'Mind the Gap': Gender Inequalities in China's Pension System

Shimeng Yin

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Abstract

This thesis analyses the gender gap in China's most prominent pension schemes: the Urban Employees' Pension Scheme (UEPS) and the New Rural Social Pension Programme (NRSPP). The author created two new datasets for the two pension schemes from data already available in the 'China Health and Retirement Longitudinal Study'. Specifically, descriptive data analysis was used to explore how large gender gaps exist in pension benefit for the UEPS and participation rates for the NRSPP. Inferential data analysis was applied to explore how impact factors on the gender pension gap change over time. In the case of the UEPS, the thesis groups empirical data based on the years of retirement to examine how the gender gap, in terms of pension benefit, develops depending on important pension reforms. Additionally, the research explores which impact factors have affected the participation rates for men and women respectively in the NRSPP.

The findings of the study are fourfold: first, the gender gap both in terms of pension benefit in the UEPS and participation rates in the NRSPP does exist and has become larger over time. Second, in the UEPS, after reflecting the results with pension policies in different time periods, it is concluded that the variables which are directly included in the pension calculation form are the most crucial impact factors, such as eligible working experience and wages. This finding refutes the statement that 'gender difference in retirement age is the most crucial factor to eliminate the gender pension gap' in most of the previous empirical studies. The thesis also analyses results for the different retirement time periods and ranks them according to the significance of their impact on the gender pension gap in the UEPS. Eligible working experience always ranks the first in all retirement groups, and wages is the other factor that always ranks the top position in all groups. Third, in the NRSPP, the effect of some selected impact factors can be exactly opposite for men and women, which suggests the conclusions of previous empirical studies may be inaccurate, since they only consider gender variable in regression models, rather than exploring the impact factors' effect on the participation rates for men and women respectively. The findings suggest that income-related variables and education level play an important role in explaining participation rates in the NRSPP for both genders. Finally, the results of this thesis reject Esping-Andersen's (1990, 1999) argument that the 'commodification' of women could be crucial to reduce gender pension gap. In practice, the 'commodification' of women to increase the female labour participation rate is not sufficient to close the gender gap in China's pension system. Traditional practices and traditional gender role expectations play important roles, in which equalization of educational opportunities, equal opportunities for high-paying jobs and promotions in the labour market, and reducing women's care responsibilities are crucial steps in closing the gender gap in China's pension system.

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Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

Chapter 1. Introduction

An aging population in China is becoming one of the main challenges for policy makers, with studies estimating that nearly 35% of China's population will be over 60 years old by 2050 (Banister, Bloom and Rosenberg, 2012). The Chinese government has made several efforts to reshape the pension system since it was first introduced in 1951. After several reforms, most of the population is now covered by a diverse set of pension schemes (Zhu and Walker, 2018). Despite this mosaic of schemes, the government intends to have a more equal pension system for all people. However, inequalities in China's pension system, and in particular inequality between generations and between regions, is well recorded (Zeng, 2014). Gender inequality is one of the inequalities which have always existed in the Chinese pension system and yet very little attention has been paid to it by the government. Simply put, gender equality in pensions has not been mentioned in the various pension system reforms in the past decades (Zhong and Chu, 2015). This is the reason why the decision was made in this current thesis to focus on gender inequality rather than other inequalities in China's pension system.

Previous studies reported in the literature which have sought to identify the reason for the gender gap in China's pension system can be divided into two groups. The first group have explored possible explanations for the gender gap in the pension system but ignored the characteristic of the segmentation inherent in the system. The second group offered a wide range of applied empirical analyses but focused solely on one specific pension scheme to explore the reasons for the gender gap. The empirical studies which focused on the Urban Employees' Pension Scheme (UEPS) usually employed a simulation model using a dataset at one point of time to analyse the reasons of gender pension gap. In their studies, the participants in the UEPS are constructed as ideal people and assumed to experience no interruption to their career or to have different ages for entering the labour market. This 'ideal person', however, does not necessarily represent a real person or the more nuanced and complex aspects of earning a livelihood. For this current study, multi-linear regression was used to test how and which impact factors can affect the gender pension gap in the UEPS in real life. Another gap in the literature is that there has been limited research into how different retirement years and pension policies in different time periods could affect the gender pension gap in the UEPS. The retirement years and pension policies in different time periods were therefore treated here as another dimension of the impact factors on the gender pension gap.

Previous empirical studies on the New Rural Social Pension Programme (NRSPP) have usually employed a simple logit model using a quite small cross-sectional dataset collected by the researchers themselves to analyse the impact factors of participation rate. The gender variable was considered as one of the independent variables, but how and which impact factors can

explain the participation rates for men and women, both separately and jointly, has never been addressed in any previous studies. This current study is therefore designed to explore how the impact factors on participation rates in the NRSPP differ for men and for women in order to fill this gap. Most of the literature focusing on the gender gap in China's pension system is comprised of empirical studies and this study will not be an exception. Nevertheless, it offers a reflection on existing theories which can explain or seek to solve the gender pension gap.

In this regard, this study explored how far there is a gender gap in terms of pension benefit in the UEPS and in terms of participation rates in the NRSPP. The principal intention was to capture whether these gaps narrow or widen over time. It is also very important to understand how factors identified in the current literature review such as education level, working experience and income before retirement affect the gender gap in China's pension systems, both the UEPS and the NRSPP. The empirical aim of this research was to explore whether the results are consistent over time or not. Finally, this study controlled for the same gender in both the UEPS and the NRSPP and explored whether there are any similarities or differences in terms of how the factors discussed above inter-relate.

To meet those aims, the two representative pension schemes were selected for examination, one in urban areas and the other in rural areas. The first was the UEPS, which covers most of the employees in urban areas (456.21 million participants in 2020[1]) and was first established in 1951. The second pension scheme was the New Rural Social Pension Programme (NRSPP), which was intended to provide pension benefits to rural peasants. The NRSPP is also the largest pension scheme and almost covers all the elderly people in rural areas. How far the gender gap exists and which impact factors can affect it in each of the two pension schemes were explored in this study. The reasons for the gender gaps in these two schemes will also be compared to see which impact factors play important roles in both schemes. The findings will be discussed in the light of previous research findings and will reflect on existing theoretical approaches, and will also offer a new dataset for future research and identify next steps and directions for narrowing the gender pension gap in the Chinese pension system. Additionally, policy suggestions will be made which could help the government in its stated mission to eliminate the gender gap.

To carry out the empirical analysis of the gender gap in China's pension systems, The 'China Health and Retirement Longitudinal Study' (CHARLS) was selected as the original dataset. CHARLS is a dataset which covers four waves of surveys (2011, 2013, 2015 and 2018) and can be merged into a panel dataset or used as four cross-sectional datasets. For the current study, the

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[1]. Data were taken from the 'Statistical Bulletin on human Resources and Social Security development in 2020' (Ministry of Human Resources and Social Security of the People's Republic of China, 2021)

researcher created two datasets under CHARLS in order to analyse the gender pension gap in the UEPS and the gender gap in participation rates in the NRSPP respectively. The dataset for UEPS is a new cross-sectional dataset in which the four waves of surveys in CHARLS were merged together. This dataset grouped respondents to CHARLS into five groups based on their retirement year and the milestones of pension reform in UEPS to determine how the gender gap existed in the different reform periods and how the impact factors on the gender pension gap changed under the different pension policies in the UEPS. In the NRSPP, as this rural pension scheme was established in 2009 and there has been no significant subsequent reform, a panel dataset was created to enlarge the sample size and control for the unobserved variables. Both descriptive data analysis and inferential data analysis were employed to explore the gender gaps in China's pension systems. For both pension schemes, the descriptive data analysis tested how the gender gap exists and how the selected pension-related variables correlate with the gender pension gap in the UEPS, and with the participation rates for the different genders in the NRSPP. Multi-linear regressions were used to analyse the impact factors on the gender pension gaps. For the NRSPP, a mixed-effects logit model was applied to test how the impact factors can affect participation rates in the NRSPP for men and women differently.

This thesis is structured as six main parts. Chapter 2 presents an introduction to pension programmes and their aims and functions. It presents key pension terms and debates on how to organise benefit provision and contributions, and also the various aims of the different schemes.

Chapter 3 presents a review of the development and history of China's labour market and the reform history of China's pension systems including key pension debates in China. Chapter 4 contains a detailed review of both empirical and theorical literature on gender gaps in China's pension system. The review explores studies which sought to analyse the causes of the gender pension gap in the UEPS and the impact factors explaining the participation rates in the NRSPP. The review also offers a contextualisation of the key debates and describes the selection of the variables for the analysis. It also gives a set of initial hypotheses about how these potential impact factors can affect the gender pension gap and the participation rates in the UEPS and the NRSPP respectively. The final section in Chapter 4 offers an in-depth theoretical discussion on the existing theories of social policy which could give explanations or even solutions to the gender gap in China's pension system.

Chapter 5 addresses the research design of the study. The sub-sections in Chapter 5 cover dataset selection and a detailed account of the data-cleaning process for constructing new datasets for the UEPS and the NRSPP. It also specifies the research questions for the study and gives a detailed explanation of the multi-linear regressions used for the UEPS and the mixed-effects logit model used for the NRSPP. Chapters 6 and 7 have the same structure. They both

first set out the results of the descriptive data analysis and then the inferential data analysis. Chapter 6 contains the detailed results and analyses for the UEPS and Chapter 7 contains the detailed results and analyses for the NRSPP. Chapter 8 is the final chapter, which discusses and concludes the key findings of the study. The findings in regard to the UEPS are discussed in the first section, followed by a discussion of the findings in regard to the NRSPP. A comparison of the impact factors on the UEPS and the NRSPP with a reflection of existing theoretical framework concludes the discussion. The final section includes a summary of the findings, a discussion of the contributions and limitations of the study, recommendations for potential future studies and policy suggestions for the Chinese government based on the findings of the study.

Chapter 2. An introduction to pensions: key terms and debates

In this chapter, I shall introduce the key issues and trends in pension debates internationally, including exploring the input of global organisations in both shaping and framing pension reform options. This chapter comprises two sections. First, the terminology used in pension systems, I shall then explain the background to pension systems. Then I shall describe the three current pension debates around the world, covering the pension debates on Pay-As-You- Go (PAYG) versus a funded pension system, a defined benefit (DB) versus a defined contribution (DC) pension system, and public pension systems versus private pension systems.

2.1 Terminology in pension systems

Barr (2002) stated that 'pensions' refer to a policy programme which enables individuals to 'exchange current production for a claim on future output'. In a few words, a pension represents a deferred payment which will be offered in retirement. There are many pension systems and schemes around the globe and there are significant differences even within countries (such as rural and urban areas in China). Eligibility for a pension ranges from people's occupation, years of work, citizenship or even in the case of China their household registration (*hukou*). There are two overall objectives of a pension system[2]:

1.   to smooth the consumption of households and individuals in order to enable people to maintain their quality of life after they retire; and

2.   to institutionalise a public programme which protects an aging population against poverty and enables income redistribution to achieve horizontal equity.

2.1.1 The three-pillars pension system

Mundial (1994) identified a three-pillared pension system as a blueprint for developing pension systems across the globe. The first pillar often focuses on poverty alleviation and providing a minimum level of income security. The government is often responsible for managing accounts and pension contributions (tax funded or not). The second pillar aims to smooth consumption and often reflects labour market participation records. Programmes in this pillar can be privately or publicly run. The third pillar reflects investment opportunities and personal plans. In China the first pillar comprises social pooling and individual accounts, the second pillar comprises

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[2] It should be noted that not all of the objectives can be achieved simultaneously.

voluntary (including enterprise annuity[3]) schemes and the third pillar which remains rather underdeveloped is personal private (individual saving) schemes.

The first pillar in China is conducted by the National Social Security Fund (NSSF) and contains two tiers: the social pooling and individual accounts. The social pooling is financed on a PAYG basis; for example, in UEPS, employers have to pay 20% of the salary of employees to fund the social pooling. The second tier is the individual account, which is financed on a funded basis. Employees have to pay 8% of their wages to make the contribution in UEPS.

The first pillar is mandatory and is intended to eliminate aging poverty. The second pillar is voluntary, financed by enterprises or employers and employees together and works on a funded basis. The second pillar pension system in China is also called an enterprise annuity: the government offers tax benefits to companies to encourage their participation in the second-pillar pension model. The third pillar is also voluntary and is based on a private savings account. People who want to maintain their quality of life after retirement can save their own money to ensure that their consumption remains smooth.

2.1.2 Pension funding

There are two main funding methods in China's pension system: the first is the PAYG funding system in which the pension benefit paid to the retired is financed from the contributions of the younger working generation (Barr and Diamond, 2010). In the case of funded pension schemes, the final pension benefit depends on the earlier investment of contributions (Barr and Diamond, 2010).

2.1.3 Pension payment

There are three options for pension payment: a defined benefits pension plan (DB), a defined contributions pension plan (DC) and a notional defined contribution pension plan (NDC).

In the case of the DB pension plan, the employee will receive a specific amount of annuity when he or she retires. The amount of the benefit is predetermined and can be adjusted based on the inflation rate. Traditionally, employers own the asset and effectively also bear the investment risk (Barr and Diamond, 2010). In the case of the DC pension plan, both employees and employers have to make a periodic contribution to either an individual or a collective account (for example, a Collective Defined Contribution). The amount of income in retirement is not guaranteed, only the amount of contributions is defined. The contributions will be invested as assets and the future value asset (including returns on these investments) will finance the

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[3] An annuity is a fixed amount of money which is paid each year (or each month) to someone, usually until they die (Barr and Diamond, 2010).

pension benefit. It is common for employees to bear the investment risk themselves. The main difference from the DB scheme is that there are many factors which can affect the amount of money which people can receive when they reach the age of retirement, such as the amount of the contributions and more importantly the performance of the fund's investment (Barr and Diamond, 2010).

The DB scheme has the same issue as PAYG funding. When the ratio of contributors to retired people is high, it is easy to pay the predetermined pension benefit (Immergut, Anderson and Schulze, 2007). As explained above, in a DB scheme, the pension benefit is predetermined using a formula. With longer life expectancy, declining fertility and a lower labour market participation rate, it could be more difficult to finance DB schemes, so in order to stabilize the financing of the pension system, many private and public schemes have tried to transfer from DB to DC. Bridgen and Meyer (2005) found that in the private sector, the pension system was rapidly transferred from DB to DC. In the private sector, the transfer from DB to DC means that employees (the future retirees) have to take more risk themselves as the pension benefit in DC is based on the revenue of the asset and thus employees have to bear a greater market risk (Ring, 2003). In the public sector, transfer from DB to DC is subject to more political conflict. If a DB scheme is a PAYG funded scheme, even when it is transferred to a DC scheme, the government is still responsible for preventing poverty if the DC scheme does not provide a good benefit. The transfer from DB to DC is the result of collective bargaining and relies on negotiations between employers and employees. In the case of the public sector, this decision can be renegotiated between trade unions and the government, but this usually has a more political character (Brown and McInnes, 2014).

Forman (1999) stated that it would be an "arduous task" to convert a pension system from DB to DC. The cost of the conversion could also be expensive because of the need to pay lawyers, actuaries and consultants. Forman (1999) suggested some reasonable approaches for transferring a DB plan to a DC plan, such as implementing a supplemental pension plan under the DB system, offering the DB and the DC systems at the same time, letting employers choose which pension system they prefer, or policy-makers can close entry to the DB plan and implement only the DC system to new employees entering the labour market. Regardless of what kind of pension system the government provides to retired people, the objectives will always be the same: first, to protect the aging population from poverty, and second, to smooth consumption and maintain their standard of living after retirement.

The more recently developed NDC pension plan is financed on PAYG basis and copies the funded DC pension plan. Effectively, this pension payment plan enables some savings to be channelled towards a PAYG scheme while allowing individual accounts to build assets which

are invested in the financial markets. This kind of pension plan aims to address the fiscal instability involved in transitioning from DB to DC (Auerbach and Lee, 2006).

The calculation of the pension benefit depends on the replacement rate: this rate equals the ratio of monthly retirement pay to pensioners' monthly salary before retirement. This rate can measure the efficiency of a pension system (Barr and Diamond, 2010): the more generous the replacement rate the more generous the pension payment will be. Its importance is also related to the provision of adequate support for pensioners and also to sustaining living standards and smoothing consumption for those who are in transition from employment to retirement.

During recent decades, there has been a growing concern internationally over the looming aging crisis (World Bank, 1994), which is a result of major demographic shifts and changes in the labour market. First, longer life expectancy at birth means that people live longer, including those who have already reached retirement age. Second, the declining fertility rate decreases the dependency ratio [4] and thus changes the demographic structure of most countries. The combination of more people in retirement due to higher longevity rates and fewer younger people to fund their pensions increases the 'Old Age Dependency Ratio'[5].

Finally, a reduced labour force, predominantly among older men, means that earlier retirement options add more pressure to the fiscal sustainability of all pension systems. Also, changes in the labour market, including pressures to lower employers' contributions and an increase in more precarious form of employment add additional pressure to pension financing.

A pension scheme will suffer serious pressure if it cannot meet these long-term needs. One of the major concerns highlighted by Barr and Diamond (2010) is that people have longer life expectancy, with younger workers often starting to work at a later age than their parents had, while their parents have access to early retirement. This combination of major demographic and labour market trends add more pressures to government and employers to continue financing DB pension plans as often the cost of the pension does not take into account the changing trends, resulting in an increase of pension commitments to an unsustainable level (Barr and Diamond, 2010). On the other hand, longer life expectancy will not affect the cost of pensions in DC pension systems as the monthly benefit will be reduced to fit the longer life expectancy. The option for governments and employers to reform the pension system from DB to DC is substantial in order to reduce their risk or commitment towards honouring future payments. To solve the high cost of pensions, policy-makers have introduced pension reforms to respond to

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[4] The dependency ratio is the ratio of the number of dependants (who are too young or too old to work) to the size of the labour force (Simon, Belyakov and Feichtinger, 2012).
[5] 'Old age dependency ratio' captures the number of aging people as a percentage of the number of people in the labour force (Barr and Diamond, 2010).

these changes, for example, by increasing contributions, reducing benefits and sharing the risk with employees. A well-designed pension should be gender neutral, able to achieve poverty relief and able to help to smooth consumption.

2.2 Pension Debates

There are three key debates about pensions systems: the first topic is about the pension funding method – PAYG versus a funded basis pension system; the second is the payment structure in the pension system – DB versus DC; and the third is about the public pension system versus the private pension system. All three of these pension debates will be discussed in detail next.

2.2.1 PAYG pension systems versus funded pension systems

2.2.1.1 The theoretical approach to financing

Immergut, Anderson and Schulze (2007) stated that one of the most hotly debated topics in the pension literature is the optimal and socially fair funding of the schemes. There are two funding methods for financing pension benefits, PAYG funding and a funded pension system. In the PAYG funding model, the pension benefit paid to retired people is financed from the contributions of younger generations who are still working (Barr and Diamond, 2010). Public pension systems usually follow the PAYG funding method, which means that contributions from the current labour force are transferred directly to the retired population (Brunner, 1996). In funded schemes, the pension benefit paid to the retired is financed from their own contributions when they had been employed.

2.2.1.2 The economic effect under PAYG and under funded schemes

From an economic perspective, PAYG can be considered from two aspects. From the point of view of the individual contributor, participation in PAYG means that they can establish a claim for pension benefit in the future if they make contributions now and for the designated contribution period. On an aggregated level, tax revenue (the pension contribution) is simply transferred from one group of people to another in the PAYG pension system (Barr and Diamond, 2006). With the looming aging problems, PAYG is believed to be vulnerable to problems of sustainability. For example, if the government does not want to reduce the benefit level and does not want to cover the deficit using other government revenue, the contribution rate has to increase. Effectively, from an aggregate point of view, the PAYG system is financed from payroll tax (the contribution) and the payroll tax would be expected to increase as the size of the aging population increases (James, 1997). Economists suggest that the implications of such an increase on the labour market will be distortional, which means that total employment costs will increase but also that workers might make less effort due to the increased payroll tax, unless the labour force is inelastic (James, 1997). If the labour force is inelastic at all, workers

will not leave their jobs due to the decreasing payment (as the payroll tax increases) and will always make the same effort no matter how much payment they can obtain.

In a funded pension system, distortions in the labour market can be minimized as the pension benefit has an actuarial relationship with contributions (Holzmann and Hinz, 2005). The labour will no longer treated contribution as taxes as they contribute for their own future (World Bank, 1994). Feldstein (1997) assumed that if the pension system changes from PAYG to a funded basis with the same level of pension benefit, the contributions to the funded pension system will be lower than the labour tax in the PAYG system, which means that workers can have more disposable income. If the consumption level stays the same, private saving will increase and the increase in national saving will equal the amount of private savings plus the net flow into the retirement account. Barr (2002), however, stated that national saving does not necessarily increase in a funded pension system and that if there is any increase in savings, it will only occur in the build-up period. Even during the period that the savings will be increased, this will necessarily lead to the investment of these savings and thus will have limited impact on economic growth. From an aggregate point of view, contributions towards a funded pension system are expected to make an indirect contribution to economic growth through deepening and widening capital markets (Barr, 2002), but at the same time this means that financial resources will be exposed to more risk. It is important to note that when the transition from PAYG to funded schemes refers to first pillar schemes, then it is important to remember that the objective for the pension system is to avoid aging poverty rather than to increase the rate of saving or to improve economic growth (Mackenzie, Gerson and Cuevas, 1997).

All these economic effects are considered from an economic point of view assuming that all workers are individuals instead of being part in a broader set of societal relations (such as a household or a family). The economic effect is also analysed under the simplified economic model which treats both workers' and employers' contributions as a labour tax which might affect working incentives and any possible repercussions that this might have for economic development from both the individual and the aggregate aspects. Workers are often part of a wider set of inter-generational relations, such as a family, where reciprocal and non-market relations cannot be determined by individualistic and incentive-based approaches.

2.2.1.3 Debates on generational accounting and long-term financial estimation

The equality between different generations is a challenge for the pension system if it wants to be sustainable and socially just. Orszag and Stiglitz (2001) used a simplified PAYG system to explain the elementary problem for inter-generational justice. They assumed that members of each generation have to pay one dollar in their entire working life as the previous contribution period and receive one dollar in their entire retirement period. There will be one generation (the

oldest generation) which does not need to make a contribution because they have already entered retirement. The rate of return for this generation is therefore infinite whereas the rate of return for other generations is zero as they would be expected to contribute and to receive one dollar. The first old generation who did not make contribution during their entire working life but can receive a more generous pension benefit is the reason why pension systems were initially established on a PAYG rather than a funded basis.

The 'golden age' of the welfare state coincided with the introduction of the PAYG system and politicians often deferred the cost (like the high labour social contribution) and promised a very generous benefit. Especially in Europe, the US and Japan, the timing of introducing a PAYG scheme coincided with the loss of a significant proportion of the population in conflicts and wars, meaning that the numbers of retirement-aged people did not pose a great threat to the financial stability of the pension system. The 'baby-boom' generation was able to continue to finance pension benefits and also to contribute towards the creation of larger assets. The social or political contract between workers and governments meant that cutbacks, even in times of increased demographic pressures, were difficult to implement. This was partly because politicians wanted to keep their promises on offering generous benefit levels but also to avoid blame for any cutbacks (Pierson, 2002).

Myles and Pierson (2001) noted that if a government chooses to transfer from a PAYG pension system to a funded pension system, then a 'double payment problem' emerges. This refers to the burden borne by one generation who have to pay the pension contribution for the current aging population benefit and also have to make enough contributions to their own account to ensure that they can eventually have enough money in their own funded pension (Myles and Pierson, 2001). This could explain why with a decreasing rate of return, each generation prefers to stay with the current pension system until they themselves retire (Ebbinghaus, 2006). The funded pension system is much fairer from an individual's point of view compared with the PAYG system as with the funded pension system workers make their own contribution to their own retirement account and the pension benefit is financed from their own pension account. The benefit which they can receive is related to how much they have contributed. There is no transaction between different generations and the government only needs to take on the responsibility for preventing aging poverty.

Long-term financial sustainability is one of the most debated topics on the aging process (Esping-Andersen and Myles, 2006). As the PAYG pension system will transfer the contributions from an active labour force to the current retirees, it will discourage people from saving money if the government promises a generous benefit level; however, with an increasing dependency ratio, if the contribution rate stays constant and the number of aging people

increases, the pension system will face a deficit which will have to be covered by government budgetary resources (Holzmann and Hinz, 2005). A funded pension system can increase economic welfare compared with a PAYG pension system. If the government tries to shift the PAYG pension system to a funded pension system, the aggregate saving might increase (as was explained in the section on the saving effect) which will lead to an increase in the capital stock. The use of this capital from the funded pension system has to meet an anticipated rate of return to pay the pension benefit in the future. The investment has to be risk-adjusted and monitored to avoid the failure of the investment and corruption (Holzmann and Hinz, 2005). However systemic risk, as witnessed in the financial crisis of 2007/8, can also seriously challenge the logic of these schemes.

2.2.2 Defined Benefit versus Defined Contribution

The DB and DC payment structures are another fiercely debated topic in the pension's literature. The DB payment structure is a pension system in which the pension benefits paid to retirees are predetermined, usually at a flat rate or related to the working history and the individual's income (McGillivray, 2006). Often, a formula is used based on the number of years of contributions and annual contributions to calculate the pension benefits (Barr and Diamond, 2010). The DC system is different from DB as DC only specifies (predetermines) the periodic contribution to the pension system but cannot guarantee the pension benefit (Barr and Diamond, 2010). The contributions to individual accounts in the DC system will be accumulated and invested and the total accumulated capital and the return from the investment will convert to the pension benefit (Whiteford and Whitehouse, 2006). The advantage of DB is that its benefit can be predictable, but even so the risk of inflation could decrease the purchasing power of the predetermined pension benefit dramatically (Munnell, 2006). NDC is a pension system which copies the DC system (Cichon, 1999). The workers who are involved in this pension system have to make contributions to a notional account and the asset and the return from the invested contribution will convert to the pension benefit, which is quite similar to DC. The difference between DC and NDC is that the return on the investment in this notional account is a notional one, which is set by the government, and the return on contributions in DC is the real one. In this section, the discussion of pension debates has focused on the PAYG DB and funded DC systems as most of the studies reported in the literature only studied these two systems.

2.2.2.1 Labour-market incentive effects

There is a common view that the labour market incentive in a funded DC scheme is better than in a DB scheme (Orszag and Stiglitz, 2001). For example, James (1997) considered a pension system as a simplified economic model and concluded that if the contribution is not highly related to the benefit, this will result in evasion and cause workers to seek to escape to the informal labour market in a PAYG DB pension scheme. In contrast, in funded DC schemes, the

benefit paid in retirement is closely linked to pension contributions, so it is expected that labour market distortions will be reduced and workers will be less likely to treat the contribution as a tax (James, 1997). Thinking of early retirement in DB schemes, James (1997) stated that DB plans give employees the option to retire early with no or hardly any reduction in their pension benefit amount. This kind of early retirement can help policy-makers to hide unemployment or for employers to employ a younger and more upskilled workforce which is substantially cheaper. Although the initial cost of approving early retirement is low, in the long run the total cost could be high as the supply of experienced workers reduces (James, 1997). McGillivray (2006) agreed that in DB plans, the real retirement age is lower than the official retirement age since participants in DB choose to retire early, unless there are measures which discourage early retirement, such early exit penalties or rewarding deferred retirement with an increase in the pension benefit.

In contrast, the early retirement problem is less in DC schemes compared with DB schemes because the decision on retirement depends on the balance of the account in the DC schemes. Employees are more likely to leave work earlier only if they are covered by an inappropriately designed pension system (McGillivray, 2006), meaning in practical terms if they have lost trust in either a DB or a DC scheme.

2.2.2.2 The redistribution function of DB and DC

Within one generation, a PAYG DB pension system can redistribute resources by giving a higher replacement rate to the people who have lower incomes and a lower replacement rate to people who earn a lot. Schwarz (1995) used an example to calculate this and concluded that although the poor people still get a lower pension benefit than richer people, those with a low income get a higher replacement rate compared with their average lifetime income. The first old generation in a DB system will get a relatively high rate of return as they did not make a life-long contribution to start collecting the pension benefit (Schwarz, 1995). The rate of return of benefit in a DB system will gradually decrease over time; one day the average rate of return of all workers in a DB system will be smaller than the interest rate, which means that there will be a redistribution from young to old (Schwarz, 1995). The pension benefit will also be adjusted in a DB system based on the inflation rate, or if a productivity increase leads to higher wages, and the pensioner in a DB system will also receive a higher pension benefit (McGillivray, 2006). In contrast, the DC system does not redistribute income. Based on the mechanism of the DC pension system, people who have similar lengths of working life and get involved in DC pension system can have same replacement rate of their final-year working wage, however, the replacement rate of their entire working life income is quite different.

2.2.2.3 Gender pension gap

There is gender gap in pension benefit which can be explained from different perspectives. The first is the traditional concept in which the husband in the family should be the breadwinner whereas women have to take responsibility for caring for children and elders. In the labour market, feminisation in employment, disproportionate numbers of women taking informal or part-time jobs, the barriers preventing women from entering the labour market (for example, the implicit gender discrimination in the labour market), the earlier retirement age and the relatively lower wages for women are all factors which lead to a lower pension benefit as the female working life is shorter than that of the male and the total contribution made by women is also lower than that of men (Foster, 2005).

In a traditional DB pension system, the length of years of contributions and the worker's earnings can determine the pension benefit (Bertranou, 2001). In this type of pension benefit arrangement, earnings and years of participation in the formal labour market along with any possible recognition for maternity breaks are important parameters for the gender gap. Bertranou (2001) stated that a traditional PAYG DB scheme is considered more gender-neutral than a funded DC scheme as the benefit formula in DB schemes relies on ungendered life tables[6] whereas women have a longer life expectancy (Barford et al., 2006). Bertranou (2001) used a formula which only considered the final few years of wage-earning to calculate the pension benefit. The earlier retirement age can benefit women because they can obtain their retirement benefit earlier than men, but this is only partly favoured by women because their earlier retirement age will decrease their pensionable income. Another factor in DB which can put women in a disadvantaged position is that the amount of pension benefit which a pensioner can receive is decided by the last few years of earning prior to retirement, which means that steeper wage-earnings profiles will offer a higher benefit. James (1997) suggested that men have a steeper wage-earnings profile than women, which means that in their earlier working life, male workers made their contributions on relatively low wages and can receive a higher lifetime benefit because the final wage for men is higher than that for women. Jefferson (2009) pointed out that if the pension benefit in a DB system is decided by years of employment, women's interrupted working life and higher labour turnover (Pesando, Gunderson and McLaren, 1991) will also prevent them from having a high-level pension benefit.

In a DC pension scheme, the disadvantages in pension benefit for women arises from a shorter working life (the years in which a woman can make contributions to her pension account) and lower contributions from women, as well as their longer life expectancy (Jefferson, 2009).

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[6] This is a calculation of how many months of payment it is estimated that you should receive as the pension benefit based on your retirement age and the general life expectancy.

Another gender gap in the DC system is that women have a higher probability of participating in a DC system than men (in the US), which means that women prefer to participate and make contributions to a DC system instead of opting to consume now (Huberman, Iyengar and Jiang, 2007). The first explanation for this is that women have more incentives to save money than men, perhaps because women have longer life expectancy than men. The second explanation is that the primary breadwinner in the household is the male, with women usually acting as secondary wage earners and their wage, if there is one, just represents a supplement to their husband's wage. If the unit on which to make a decision whether to participate in a DC system is the household, then women's behaviour perhaps could reflect the fact that typically they tend to receive a lower income than men. To protect their quality of life, women will choose to live in a household which has a higher income (in other words, to marry well) and save money for the future. According to Huberman, Iyengar and Jiang (2007), this kind of desire will cause women in the US to participate and contribute more in a DC system as they regard it as a means of saving.

2.2.3 Public pension systems versus private pension systems

The third subject of the current policy debates is the relationship between private pension systems and public pension systems and their role when they are integrated (Horlick, 1987). Both systems are intended to provide protection to the retired but there are significant differences between them; for example, public pension system are most often compulsory, whereas a private pension system can be both mandatory and voluntary. For example, the earnings-related pension system in Finland is in practice a private scheme which serves a public function as its coverage rate resembles that of a typical public pension system. Trade unions and employers' associations work together to manage the pension fund and the contribution rates (Sorsa and Roumpakis, 2012). In most cases, however, the financial flow of a public pension system is controlled by a public institution or ministry whilst the financial flow of a private pension system is governed by private companies (Queisser, Whitehouse and Whiteford, 2007).

The increasing aging population worldwide has changed the structure of the population pyramid and has brought a major challenge to the public pension systems in European countries (Queisser, Whitehouse and Whiteford, 2007). Public pension systems have been forced to reform to meet the challenge: the formula for calculating pension benefits now estimates longevity and the later retirement age and often takes into account the sustainability of the pension system (Whiteford and Whitehouse, 2006). Along with these changes, the pension benefits from a public pension system have been reduced which in turn is expected to increase people's interest in private pension systems. These changes can also be seen as an attempt to transfer the risk to pensioners rather than to public organisations, and the shift from DB to DC in private companies follows a similar logic of transferring risk to employees rather than

employers. All of these transitions are related to trust. Whether employees like these changes depends on the amount of pension benefit which they can receive in the future. However, the pension benefit from a DC model depends on the return on the fund's investment and this often depends on the situation of the financial market, interest rates and the economic environment both nationally and globally. These dimensions bring significant questions of trust in pension governance. For example, we can assume that if employees believe that a DC scheme can provide a higher pension benefit than a DB scheme, they will prefer to take the risk and transfer to DC. In the private sector, if employees trust the investment decisions of the pension fund management to provide a higher pension benefit rather than relying on final-salary schemes, they are likely to take the risk.

2.2.3.1 Public pension advantages

A public pension system has its own advantages which a private pension system cannot compete with. First, the universal coverage of a public pension system is much higher than that of a private pension system, which is less than 50% in most OECD countries (Queisser, Whitehouse and Whiteford, 2007). The universal coverage of a public pension system offers flexibility to workers as they can change their job without worrying about the gap between two jobs. Second, a public pension system provides vesting and individual workers can obtain the full credits to calculate their pension benefit (Horlick, 1987). Third, a public system has the ability to redistribute the pension benefit among the whole society instead of one firm or one industry. Fourth, a public pension system provides health care to the disabled and the elderly; it also provides disability protection before retirement and survivor's protection to widows, which private pension systems might not include (Horlick, 1987).

2.2.3.2 Public pension disadvantages

The disadvantages of public pension systems will be discussed in this section. First, if the government wants to expand the public pension system to cover more aging people, the amount of pension expenditure needs to increase. With the PAYG funding principle, this will mean that unless more younger workers join the pension system, the contribution rate will immediately become higher with the current workers having to make more contributions. With a higher contribution rate, the current generation will have less disposable income, which might lower their incentive to work (Feldstein and Siebert, 2002).

Second, the growth of the public pension system might decrease economic growth (Steindel, 2020). If the government chooses to use general taxation as a new source for financing the expansion of public pension schemes, the burden in the form of taxes has to be carried by the future generation. Additionally, the link between benefit and contribution will be weakened if the pension is tax financed and this might possibly distort economic efficiency ('deadweight

loss') and incentive structures (Feldstein and Siebert, 2002). Also, people argue that taxation to fund public services removes capital from the private economy and therefore does not enable a more effective investment of capital or financial resources (Feldstein and Siebert, 2002).

A public pension system which is PAYG funded and has attractive regulations for early retirement might lead workers to leave work earlier and thus form an implicit tax on work. This kind of pension system will decrease the size of the economically active aging population (Gruber and Wise, 1999) resulting in lower economic growth. The combination of fewer economically active people and the possible distortion of incentives for current workers could lead to slower economic growth (Feldstein and Siebert, 2002). Due to these disadvantages, the building of a large public pension system is not encouraged, even when it is not PAYG-funded (Immergut, Anderson and Schulze, 2007).

2.2.3.3 Private pension advantages and disadvantages

A private pension system has some advantages compared with a public pension system. First, a private pension system allows employers to adapt their plans and financing with a particular degree of flexibility (Horlick, 1987). Second, a private pension system can provide opportunities for people who participate to make investment decisions. There are also some issues which arise when expanding a private pension system. First, as mentioned above, the coverage of a private pension system is less than 50% and normally could not cover the entire labour force (Queisser, Whitehouse and Whiteford, 2007). For example, people on low incomes or seasonal workers might find it difficult to finance a private pension system. Second, some small companies which fail to meet the financial standard might need help to fund their small private plans. Third, the financial security of a private pension system can be a concern as it differs from a public pension system which is regulated by the government; a private pension system needs some guarantee in case the sponsor company becomes bankrupt.

Both public and private pension systems have their own advantages and disadvantages. With the development of demographic and economic growth, policy-makers should find a good mix of public and private pension systems to meet the demands of the aging population. For example, the fact that a public pension system works as a basic social security system to prevent poverty and a private pension system is implemented in order to maintain pensioners' standard of living could be a pathway to mixing public and private pension systems to increase the coverage rate of the resulting system (Rein and Turner, 2004).

2.2.3.4 Pensions and family provisions

Esping-Andersen and Myles (2006) stated that there are three welfare pillars: family, market and government. The government, which is the public pension system, can redistribute services and income whilst the market provides income and the family provides elderly care services. If

we continue to encourage the traditional family structure in which women have to take care of children and the elderly instead of entering the labour market, not only will women's total working income decrease, but the household income will also decrease, which could lead to poverty. The reliance on family might therefore be counterproductive. Privatizing pensions might reduce the pressure on the public pension system (as mentioned above, the financial pressure on the PAYG-based public pension system), but in the long-run, the transaction cost for private pensions could be very high. Esping-Andersen and Myles (2006) stated that with a basic pension guarantee financed from general revenue rather than tax, this basic public pension system can help to avoid aging poverty because of its diversified financial base. Introducing more private pension systems in the welfare pillar can also diversify the financial sources but will also induce insecurity as the private pension system probably cannot achieve the requirements of efficiency and equity.

2.2.4 Pension Reform Design: The World Bank approach versus the International Labour Organization approach

There are two international organisations which are concerned with pension reform in different countries and their influence on setting the policy debates remains influential (Holzmann and Stiglitz, 2001), namely the World Bank (WB) and the International Labour Organisation (ILO). The two organisations also represent different approaches to pension reform. They both do not focus on gender but try to make the pension system more equal across the entire population. In the next section, I shall review, compare and summarise their approaches.

2.2.4.1 The World Bank's approach to pension reform

Holzmann (2000) stated that the objective of the WB is to help client countries to enhance their economic development and reduce poverty. The WB has four major concerns about pension policy for its client countries: the first is pension financing and the financial viability (or sustainability) of schemes both in the short and the long term; the second is the effect of pension reform on economic growth; the third is the adequacy and distributive capacity of pension reform, and the fourth is the political risk and sustainability of the governance of pension reform and policy design. The reasons why these four concerns should be considered carefully if the client countries want to reform their pension system will be explained below. After considering these four concerns and the reform options, the WB prefers the multi-pillar pension system for reforming an unfunded pension system.

The first concern is short-term financial sustainability, which refers to a situation in which pension system revenues cannot cover the payments and the WB accepts that this is more likely to occur in unfunded pension systems. If the percentage of social contributions and payments towards the pension system or generosity levels remain stable, then this kind of deficit will increase with an aging demographic structure change. Not only will a pension system with a

deficit have a short-term fiscal problem, the balanced pension system is also likely to have a short-term fiscal problem. The key issue is how governments decide to pay the pension benefit. If a government decides to require a higher contribution rate to make a balanced pension system rather than to decrease the pension benefit level, workers have to pay a higher level of contribution and the income tax revenue could effectively be decreased or, in case it remains similar, individuals' purchasing power will decrease as the remaining part of their salary decreases. The funding sources for a government long-run investment, which is the government revenue including debt capacity and income tax, will be crowded out as the income tax will effectively decrease if the government decides to require a higher level of pension contribution to achieve fiscal equity for the pension system.

Compared with the short-term fiscal problem, long-term financial viability is a more important issue. Lower fertility rates and longer life expectancies are a worldwide trend and will lead to a high old-age dependency ratio in both developing and developed countries. The common solution to this situation is usually a mix of the following policy responses: to increase the contribution rate; to reduce the replacement rate; to increase the *de facto* or *de jure* retirement age or reduce other non-pension government expenditure such as education, transport and general public service; or to finance any deficit by higher taxes. All these solutions could be feasible for industrialized countries in the opinion of some fiscal economists such as Chand and Jaeger (1996), who proposed a partially capitalized central system associated with 'parametric' reforms. This kind of reformed pension system can fix the contribution rate while ignoring the political economy of pension reform and other concerns and can also provide lessons for developing countries when developing their pension policy. The second concern is the relationship between how a country finances its public-managed pension system and how this will affect aggregate savings and the capital market.

The labour tax effect and the saving effect are two dimensions which should be considered in more detail. The WB explained that these risks could have negative effects on economic development, which should be considered at the aggregate level. Holzmann (2000) stated that the younger generation will consider the contributions to pension system as a labour tax if the relationship between pension contributions and benefit payments is weak. This could result in evasion in terms of both pension benefit and contributions and in some cases the workers could have less incentive to work or could be encouraged to take early retirement (Gruber and Wise, 1999). With increased labour mobility opportunities, the weak relationship between contributions and benefit might force skilled workers to change their residence to avoid this kind of 'tax'. As for a funded pension system, explicit government interventions or inadequate regulation could lead, for example, to high administration costs and/or bad management of assets. Another effect which will lead to economic concern is the saving effect. Potentially, if

the government transfers government budgetary resources to cover the deficit in a public PAYG scheme without any compensation, the volume of national savings will decrease and the amount of money (the aggregate saving) that the government can borrow to invest in the capital market will decrease.

Distributive concern and political risk are two more concerns in the WB approach. Distributive concern expects that the whole population should receive adequate retirement benefits to avoid poverty and at the same time that workers receive a satisfactory earnings-related replacement rate after their retirement. Earnings-related pension systems often reproduce labour market inequalities with those who receive higher incomes from their labour market participation receiving better pension incomes. This is even more pronounced in countries where there is a large informal labour market or when recipients of special sector privileges (for example, civil servants, judges and CEOs) are rewarded with a generous replacement rate as part of either social or labour market contracts. The issues of gender equality and inter-generational equity are also considered in distributive concern.

Public pension schemes usually make distinctions on the basis of gender, such as the different retirement ages for men and women in a public pension scheme and the different life expectancy for men and women used when calculating the monthly pension benefit. For inter-generational equity, if the pension system increases the level of generosity repeatedly, capital formation will be reduced, as will the output level for current and future generations. In particular, when a pension system meets a demographic shock, the inequality between generations will be pressing (Holzmann, 2000). Holzmann (2000) did not consider income transfers within the family, such as older members transferring part of their retirement income (their pension) to younger members of their family. These intra-family transfers were not considered by the WB report.

The WB finally identified that political risks and in general political intervention could jeopardise the sustainability and adequacy of a pension system. Often re-election or the maintenance of power is associated with changes, or pension reforms often might not be dictated by accounting or financial rationality. Especially in countries with weak political stability, pensions could be used as a vehicle for favouritism and clientelism. In practical terms, when the pension system is not matured and politicians promise generous benefits to the existing older population, this can often mean that current generations might bear a higher contribution rate or that state finances are used to honour political promises. In a PAYG pension system, the younger generation has to pay the pension benefit to the old generation. Initially when the politicians want to win an election or to attract more people to become involved in a pension system, they will promise a generous pension benefit and at the beginning of a new

pension system being established, this promise can be achieved. With demographic change, however, if the government still wants to keep the promise with a high replacement rate and continues the PAYG pension system, the young generation and their employers have to bear a higher contribution rate, or the state budget has to transfer funds to the social security sector to cover the deficit. This is particularly the case for PAYG systems, although funded systems are not immune to these pressures especially at times of financial crisis or simply when the return on investments in funded or partly funded schemes is not enough or lower than anticipated. More importantly all these four concerns identify some of the structural risks and challenges for governments wanting to reform their pension system.

The WB identified three distinctive pillars for pension systems: in the first pillar, the WB promotes a public-run PAYG scheme; in the second pillar, the aim of the WB is to shift the pension system from an unfunded system to a fully-funded system; and the third pillar is to promote private pension savings. In a WB study in 1994, this three-pillar pension system was the most preferred option (World Bank, 1994). The multi-pillar pension system should consist of a privately-managed funded pillar, a mandatory, public-managed, unfunded pillar, and a supplementary private-funded pillar, which should be voluntary. The focus of the WB was on linking pension reform to economic growth, with the WB often promoting funded over PAYG pension systems and the expansion of private pension schemes. The WB recognises the importance of poverty alleviation but at the same time the focus on economic rationality might raise significant political challenges (such as earlier retirement ages and privatisations) to carrying out these reforms and thus affect the political capacity of pension reform.

2.2.4.2 The International Labour Organization's pension reform approach

Gillion (2000) summarised the values and issues of the ILO on pension reform. There are multiple ILO targets for reforming the pension system: first, the coverage should be extended and well-organised; second, the pension system should tackle poverty in old age; third, the pension system should not only protect the well-off but also those with below-average incomes. The ILO approach highlights the importance of redistribution and achieving security in old age through a reliable and guaranteed pension system. The fourth target is that the pension replacement rate should be adjusted based on the inflation rate to ensure that the payments offer adequate support to protect living standards. Finally, the ILO stated that people should have the right to have other voluntary provisions to increase their retirement income.

Gillion (2000) suggested that the basic pension system should be compulsory for all workers and that employers should contribute towards its financing. At the same time, the revenue collected from the general pension system should be used to prevent poverty and its compulsory element can prevent myopia and offer more guarantees for tackling poverty in old age. The

management of the pension system should be democratic, allowing employees and employers to democratically decide pension investment funds.

Gillion (2000) also advanced the ILO's views on the governance and coverage of pension systems. The ILO believed that unless a pension system can cover the whole or almost the whole population, it can be effective, whilst a mismanaged pension system will disappoint everyone and generate distrust of those responsible for its governance. There are several significant factors which can affect the coverage of a pension system, such as how long it has been established, how it is financed (by tax or contributions), how developed a country's economy is, the government's policy for extending coverage and the effectiveness of the pension system's administration.

Increasing attention has been paid to the governance of pension systems as they can only be effective if the administration is effective (Gillion, 2000). Contribution evasion is another significant challenge to operating a contributory pension system. If employers and workers do not pay the required contributions, then either the revenue of the pension system will fail to meet the required assets to pay the pension benefits, or it might simply reflect under-representation and low coverage. The latter will result in questions of its political legitimacy and could also jeopardise trust and the financial viability of the entire pension system.

The advantage of PAYG schemes is that they can provide the opportunity for the government to establish healthy pension reserves and provide current pensioners with immediate pension payments. The benefit for current pensioners can be paid from the current workers' contributions instead of waiting for their investment to accumulate a profitable return. However, a generous constant PAYG pension system can be vulnerable to demographic change or pressures from employers, employees and in some cases the government to redefine contribution rates. Gillion (2000) asked why, if there are so many problems to starting an unfunded pension system, the government cannot built up a funded pension system at the beginning instead of establishing an unfunded pension system. However, to build up a funded pension system at the beginning is not feasible in reality (Gillion, 2000). If individuals continuously make contributions, the contributions will build up a financial asset which will accumulate interest, and all the capital and interest will be the pension benefit in the future, but the investment return cannot be guaranteed, and the demands for pension benefit also depend on the replacement rate and the growth of workers' real income. A contributory pension account can become a deficit or a surplus for the individual. The investment return on the financial asset and the growth rate in real wages cannot be guaranteed and the expenditure of individuals might end up more or less than their savings. People should decide on their consumption after retirement based on comparing their previous working income and their retirement income (the

replacement rate). The unpredictable age at death is another factor which can make individuals end up saving more or less than they need. Even so, over a lifetime an individual account should be expected to be balanced.

As for the whole economy, even if a funded pension system was established in advance, the consumption goods of retirees might be impossible to carry over from one year to the next. Gillion (2000) used a highly simplified model to simulate this and concluded that this kind of balance is fragile. For the ILO, funded and unfunded pension systems display different risks. The market risk in a funded DC pension system could provide challenges insofar as lifetime savings might not be sufficient to produce a decent pension when an individual retires. The political risk in a DB system is the risk that the government or pension system might overestimate the revenue of the pension system and thus the level of the pension benefit is overpromised. Along with demographic changes and inflation rate increases, the government has to demand a politically unacceptable contribution rate. After discussing these risks, the ILO concluded that there are two options for restructuring the pension system. The first is quite similar to the WB's approach, which is to build a multi-pillar pension system which contains different tiers (the mixed DB/DC scheme) and the second is to build an NDC pension system.

Comparing these two approaches, the WB's reform approach mainly focuses on the financing method whereas the ILO focuses on the pension payment method. The WB approach prefers the multi-pillar pension system whilst the ILO approach has two options: a mixed DB/DC or an NDC scheme. Even so, both organisations accept that there is no single designed pension system which can fit all countries as all the pension reforms and schemes have to be adjusted in accordance with each country's preference and historical and social context.

2.2.4.3 European comparisons
Bonoli (2003) identified a series of challenges to the viability of pension systems in Europe and internationally, such as the integrated financial market, the increasing pressures stemming from lower fertility rates and a growing aging population, and finally a less stable labour market. The political demands and political responses to these pressures are different in European countries, depending on the model of the pension system in each specific country. One model is the multi-pillar pension system and the other is the single public pension scheme. Bonoli (2003) examined how eight western European counties faced these pressures by dividing them into two groups based on their pension model: the first group contained the countries which at the time financed their pension system on PAYG basis (France, Germany, Italy and Sweden in Bonoli's study, but Sweden is no longer operating a pure PAYG scheme) and the other group contained the countries which operated a multi-pillar pension system (the Netherlands, Denmark, Switzerland and the UK). Bonoli (2003) examined how these two different pension models dealt with three

pressures: an aging population, an integrated financial market and integrating new career profiles.

1) The biggest issue affecting the sustainability of a pension system is the rapid growth of the aging population. For PAYG systems, with changes in the demographic structure, the cost of the pension system will increase, all other things being equal. The two solutions identified were increasing the contribution rate for the current work force and reducing the pension benefit, both of which would be politically challenging to implement. The four countries which had social insurance schemes (Germany, Italy, France and Sweden) scaled back the public expenditure on their pension system. all these four counties started to introduce funded pension systems to complement the only PAYG system.

As for a multi-pillar pension system, the government has less direct responsibility for the pension benefit as it is more immediately involved in the provision of the basic public scheme. People can make their own decision to contribute more to an occupational pension scheme or a private pension scheme. Politically, the risk of financial crisis and possible investment returns and losses are often deemed to be wrong investment behaviour but at the systemic level it does raise concerns over the legitimacy of these funded schemes. It seems that the multi-pillar pension system has more room to be optimized to handle an increasing aging population if countries keep the proportion of the public pension scheme at a low level, although this could come at the cost of inadequate pension support. The multi-pillar pension system is not immune to an aging population as longer life expectancy will put pressure on annuity prices (a smaller annuity for the same capital) and the financial market can also be affected by demographic change. For the Netherlands, Denmark, Switzerland and the UK which all had a multi-pillar pension system, the demographic change did not have such big effect as their public pension schemes only occupied a small proportion of the multi-pillar pension system.

2) The second pressure on PAYG and multi-pillar pension systems comes from the integrated international financial market. The increased mobility of capital gives investors more choices of employers in whom to invest their money, which is a limit for the government to increase the domestic tax on economic activities. This kind of limitation effectively compromises the government's ability to increase social insurance contributions (seen as a tax on labour), which is the source of revenue in a social insurance pension system. It is expected that the capital outflow will increase if the international or domestic investors notice that the post-tax and contributions profit is

lower than in another country. Countries which have high contributions are more likely to have higher productivity, for example France and Germany. However, considering the aging population, if increasing contributions have to pay pension benefits to current retirees and are unable to match the higher labour productivity, the profit might be reduced because of the higher contributions and investors might choose to move to another country which can give them higher profits, and this will result in capital outflow. In contrast, the multi-pillar pension system has two resources from which to finance pension benefit: increasing general taxation or contribution rates, and the revenue from the investment of pension fund assets. The multi-pillar pension system, at least on paper, relies less on contributions compared with a social insurance pension system. In times of economic stability, it does not need to change its contribution parameters, but in times of economic crisis it is prone to lower payments and an increased risk of distrust. In contrast, a PAYG pension system would prefer to introduce a funded pension system to keep the investors and capital in the home country to finance production (Bonoli, 2003).

3) The third pressure on PAYG and multi-funded pension systems is integrating new career profiles. Social insurance pension systems and multi-pillar pension systems which were designed during the post-war period predominantly covered male workers who started in full-time jobs at an early age and had no interruption during their working life. This previously typical career profile is changing rapidly, whether because of the need for women to enter the labour market or because of the changes which have taken place in the labour market. In particular, the increase of women in the labour market, often through part-time jobs, as well as an increased risk of the precariousness of work, created a new labour market context. Many of the social insurance programmes have not taken into account new forms of work, such as zero-hour contracts, indicating the need not only to update how they should extend their coverage but also how they can achieve redistributive functions. To put it simply, these new career profiles are not covered adequately by the existing pension system.

In order to overcome these issues in a PAYG system (usually the first pillar in a social security system), contribution credit should be introduced to cover periods of inactivity such as unemployment, sickness and especially child bearing. Sweden and Italy credit the contributions for maternity leave and parental leave, in Germany if you have children younger than three years old, then you can have contribution credits equal to the average wage. As for the second pillar (or the third pillar in Denmark), things are quite different: for a company or any sector of the economy, the risk pooling is much

smaller than the basic social security, and interruptions to working life cannot be compensated as they can in a basic social security pension scheme or in the first pillar pension schemes. As contribution credits should be financed from members of an occupational pension scheme, in jobs where women are over-presented such as education and care, the credit for periods of interruption or unemployment would be difficult to implement in the private sector. The expansion of second pillar pensions will be influenced by the political demand and a different set of pressures emerging from new career profiles; for example, it should not be taken for granted that occupational pension schemes can or will be willing to offer contribution credits to compensate for maternity leave or time out of work for care. The occupational pension system, which belongs to the second pillar, should be extended to cover informal employment and part-time workers, but this raises significant questions about who should be financing this, for example, why should employers or employees who honour and contribute towards an occupational pension scheme bear the cost?

Bonoli (2003) concluded after analysing these eight European countries that the choices for dealing with issues in the two groups of countries were different. The four countries with a social insurance system run on PAYG would need to introduce a funded pension system to deal with the aging population and the integrated international financial market, and contribution credits should be used to cover the new labour force such as female workers or workers who are inactive or are in precarious jobs. The countries which have a multi-pillar pension system can use different measures to solve the problems, partly as the integrated financial market does not have a similar effect on pension finance as they rely both on social contributions and pension funds' investment returns.

Bonoli (2003) stated that an aging population does not pose a direct challenge to a multi-pillar pension system as the pressures on the first pillar are mediated by the second and third pillars. In the long term, an increasing aging population might suffer if they have experience interrupted careers or worked in precarious jobs. Whether occupational pension schemes can meet the challenges of reaching out to these groups is a serious question. From a market risk point of view, increased longevity might face the challenges of lower annuity payments and might also be prone to financial market risks.

2.3 Conclusion

After this review of the current pension debates internationally, the debates can be divided into three categories: the debate on PAYG versus funded systems; the debate on DB versus DC; and the debate on private pension systems versus public pension systems. The PAYG-based pension

system has usually been the first choice for a government at the beginning when it is trying to establish a pension system. The PAYG system can provide a generous pension benefit when the dependency ratio is relatively low, but the long-term financing of a PAYG system will be vulnerable to demographic pressures. A funded system is steadier and more generationally fair than a PAYG pension system but is also prone to systemic financial risk. DB and DC systems each have their own advantages and disadvantages. DB schemes can redistribute resources by adjusting the replacement rate for different classes of people and ensuring that all elderly people can live above the poverty line. DC systems do not have the ability to redistribute the income, and the rate of return equals the market rate. DC systems will encourage workers to work longer as the balance of their individual account is the principal factor which they will consider if they want to take early retirement. James (1997) and McGillivray (2006) stated that a DB system will encourage workers to take earlier retirement if there is no penalty for doing so. If the explicit redistributive measures are excluded, the pension benefit in the DC system will be more gender-neutral than in the DB system because the DC system removes the effect from steeper wage-earning profiles, which will be more beneficial for men than for women (Belloni and Fornero, 2008). The gender gap in pension systems not only exists at the pension benefit level; the willingness to participate in a pension system is also different between men and women in a DC pension scheme because women are more willing to participate in DC pension schemes whereas DC pension schemes are more gender-neutral than DB systems.

After reviewing the pension debates on an international scale in this chapter, I shall move on to focus on China. In the next chapter, the history of the development of China's labour market and of pension reform in China will be reviewed, and how challenges, inequalities and gaps exist in China's current pension system will also be discussed.

Chapter 3. China's pension system: history, challenges, inequalities and gaps

In the previous chapter, the pension debates internationally were reviewed. In this chapter, the focus will be on China. Since 1951, China's pension system and labour market have been reformed and refined several times. The development of China's pension system went hand-in-hand with the labour market reforms conditioned often by the Chinese household registration system known as *hukou*. I shall review the development history of China's labour market and pension systems and explain the background to the current stage of China's pension system and labour market. I shall also review debates about China's pension system at the end of this chapter.

3.1 The development of China's labour market

3.1.1 China's labour system before economic reform

Under the planned economy, China, like the former Soviet Union and Eastern European countries, had no labour market (Knight and Song, 2005). Instead a labour system was established in China based on the Soviet model in which the Chinese government directed the labour allocation and set wages. The labour policy in the 1950s was characterised by inefficiency, lack of incentives and immobility (Knight and Song, 2005). Even though the labour system was quite inefficient in that period, however, it did provide employees with security and it avoided urbanization problems through the restriction of labour mobility between local provinces by implementing strict *hukou* registration. As the government controlled wage levels, this meant that the policy of equal wages achieved the objective of egalitarianism.

Along with the establishment of the *hukou* system and a centralized labour system, the government applied unified farm products pricing regulation and unified food purchase and distribution regulation. In the 1950s and 1960s, the segmentation between urban and rural were the most distinctive characteristic in China's labour market (Yao, 2007). It was these regional segmentations in the labour system that led to economic and social inequality and the gap between urban and rural citizens. The distinctive characteristics and arrangements are often referred to as the 'big-pot system' and the 'iron rice bowl' to describe China's urban labour system before economic reform.

The big-pot system had two aspects: first, state-owned enterprises (SOEs) in China relied on central support as their total wage costs were guaranteed by the government regardless of the operating conditions of the enterprise or whether the company was experiencing profits or heavy losses. Second, in these companies, no matter how much work the workers did, they

always received the same wages if they were on the same level. The income distribution pattern in China in that period followed a strict egalitarian logic.

The iron rice bowl suggested that employees working in SOEs would spend their whole life in the same company until they reached the statutory retirement age. Workers could not change their job and the enterprise could not fire them once they were hired. It is often claimed that these two distinctive characteristics weakened people's incentive to work (Fu, 1992). The labour allocation policy therefore prevented Chinese workers who were involved in this system from ever becoming unemployed. After these employees retired, the government and the next generation, predominantly comprising family and community ties, would support them. However, this labour system only covered urban citizens, who comprised less than 20% of the population at the time. Urban workers were protected by social security and enjoyed a much higher living standard compared with rural citizens. The negative side of the urban labour system was that urban dwellers could not choose their job freely as they were limited to specific regions. These arrangements meant that couples who worked in different cities could only meet and live together when they had a vacation or after they retired.

Rural citizens were limited to local farming work: it was impossible for them to find a job in urban areas because of their restrictive *hukou* registration. Before the one-child policy was promulgated, people who lived in rural areas always had more than one child to guarantee support when they became old. As the population in rural areas increased, farmland per capita decreased gradually. As all rural citizens were under the collective production system, the grain harvest from the land did not belong to the farmers individually as the commune effectively owned all the profits. Rural citizens worked together and ate together and they were all under the control of the collective institution. They therefore lacked incentives to increase production as the land belonged to the collective institutions and not to the farmers themselves and most of them could only maintain a basic living standard (Yao, 2007). More than 30% of the surplus rural labour force was wasted as the rural citizens were isolated from the industrialization process because of the segmented labour system. From 1960 to 1978, the total output loss caused by the non-transfer of agricultural surplus labour was equivalent to 20% -60% of the entire GDP at that time (Yao, 2007).

3.1.2 Labour market reform after economic reform

Due to the urban/rural segmented labour system, the reform of China's labour market which started in 1978 had two different goals and routes: for the urban labour force, the goal of reforming the labour market was to solve the endemic 'idleness'. A competitive employment system and an incentive distribution system were introduced in SOEs in order to eliminate redundant employees and motivate the employees' enthusiasm for work. For the rural labour

force, the goal of reforming the labour market was to eliminate poverty. Agricultural land was distributed to individual farmers who were allowed to produce crops, make their own investments, choose their own jobs, transfer surplus labour and find ways to increase production and income freely. In this process, the old labour system segmented into urban and rural areas gradually broke down.

 Similar to the economic reform in China, the labour market reform process was driven as a top-down initiative with the Chinese central government promulgating documents or laws first and with local provincial governments applying the reforms. In fact, thousands of documents, rules and laws were established to reform and improve the labour market. One of the most important milestones during the reform process was the promulgation of the Labour Law (National People's Congress Standing Committee, 1994) in 1994. This law was implemented in 1995 to regulate, among other things, the employment relationship in different ownership enterprises and public institutions. It also legally stipulated the equal rights of all workers. In the next two sub-sections, I shall discuss the key measures which played significant roles for the urban and the rural labour market reforms respectively.

3.1.2.1 Reform measures for the urban labour market

After the brief introduction to the labour reforms which followed the economic reform, it is worth considering and reviewing in more detail the key reforms in the urban labour market. Yao (2007) stated that these entailed:

a) the expansion of enterprises' autonomy;
b) the establishment of labour contracts;
c) the property rights reform for SOEs; and
d) the reform of the corporate insurance system.

The expansion of enterprises' autonomy[7] enabled companies to move into the new labour market and the new economic environment, including the right to determine wages.

In turn, the labour contract system was implemented in 1983, at which point[8] the iron rice bowl system was broken, which meant that SOEs were given the power to fire employees, and workers in SOEs had the right to choose whether they wanted to leave an enterprise. Another

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[7] Enterprise autonomy was introduced with the 'Temporary Regulation on Expanding State-owned Industrial Enterprises Autonomy' (State Council, 1984) issued in 1984 by the State Council. The document gave enterprises autonomous rights which were discarded during the cultural revolution, such as the right to determine and distribute wages.

[8] A Notice regarding Tentative Implementation of the Labour Contract System was issued by the Ministry of Labour and Personnel. The Temporary Regulation on SOEs to Implement the Labour Contract System was formally promulgated by the State Council in July 1986 (State Council, 1986).

important change was that rural citizens could be accepted into the urban labour system as migrant workers regardless of their *hukou* (Ran and Brooks, 2003). Rural citizens were also provided with the opportunity to enjoy the benefits of social security, previously provided only to urban workers.

SOEs' property rights were also reformed. The State Council carried out a pilot programme to establish a modern enterprise system across the country in November 1994 to transform SOEs into stock companies (Jin, 2008). The pilot programme worked well so the transformation of SOEs spread across the whole country. As the SOEs became joint-stock companies, some of their employees became shareholders, some redundant employees lost their jobs and others continued as ordinary employees. Job availability decreased, thus enhancing competition among workers to get a job. In this way, the market-oriented allocation of the labour force in the SOEs did finally materialise. This change inevitably led to a wave of unemployment; more than 30 million SOE employees were laid off. In order to alleviate this paradox, a re-employment project was introduced by the Central Committee of the Communist Party of China and the State Council in 1998 to solve the unemployment and lay-off problems caused by the reform of SOEs.

Finally and more importantly, the corporate insurance system was reformed (Yao, 2007). The pension system before economic reform in China only covered SOE employees and this social insurance system was abolished during the cultural revolution. During the cultural revolution, the societal pension system was established with enterprises taking on the responsibility to pay pension entitlements. After the transition to a market economy, many businesses suffered losses and faced bankruptcy or merger. Along with the deepening of the reform of SOEs, the government was forced to replace the business insurance system with the social security system to protect the rights of retirees. After 1997, the 'Circular of The State Council on establishing the system of minimum Living security for urban residents in various localities' (State Council, 1997a) and the 'Decision of the State Council on to unify the Urban Employees' Pension Scheme' (State Council, 1997b), and other administrative rules were promulgated successively, the basic social insurance system was formed in China and urban retirees could benefit from social security (Yao, 2007).

3.1.2.2 Reform measures for the rural labour market
The changes not only affected urban areas, some of them also had far-reaching consequences for what became the rural labour market. The four key changes are discussed next.

First, the farmers had the right to manage their own allocated farmland. As peasants now had responsibility for their own land, farmers' production enthusiasm increased and there was

greater progress in rural economic development, laying the groundwork for the rural social pension system change (Zhang and Wang, 2019).

Second, the establishment of township enterprises and private-owned enterprises was allowed. The 'Interim Regulations of the People's Republic of China on Private Enterprises' (State Council, 1988) officially enabled rural citizens to form their own businesses and to make their own investments (Yao, 2007).

Third, rural migrant workers were permitted (Ran and Brooks, 2003) in 1981[9] to transform into non-agricultural workers and to find jobs in urban areas. The government policy soon changed as the demand for migrant workers in urban areas changed. Regulations on the Employment of Contracted Workers from Rural Areas by SOEs, which were introduced in 1991, gave workers from rural areas the same rights as urban employees.

Fourth, the *hukou* restrictions were gradually relaxed (Ran and Brooks, 2003; Yao, 2007). Rural citizens now had the right to move to small urban towns from their original villages, and although the rights of rural migrants to enter large or medium-sized cities was not officially recognized, some big cities, such as Shanghai and Beijing, introduced their own regulations for peasant immigrants. However, regulation of the *hukou* system was still quite strict for country dwellers who wanted to move to cities. In 2005, twelve provinces announced the cancellation of the *hukou*-based urban/rural domicile differences. This suggests that even workers with a rural *hukou* could find a job and live in cities freely.

The government established and reformed the Chinese labour market during these decades. From the measures described above, it can be seen that the government had made considerable efforts to get rid of the segmented labour system between urban and rural areas. The labour market gradually developed and labour equality was taken seriously in both urban and rural areas. In urban areas, there were two pension schemes: Civil Servants and Employees in Public Institution Pension Scheme (Civil Servants' Pension Scheme), and the UEPS to cover employees in urban areas. People who had an urban *hukou* but were not covered by the Civil Servants' Pension Scheme, nor by the UEPS, could participate in the urban resident pension scheme. In rural area, there was the Old Rural Social Pension Programme (ORSPP) and the NRSPP which was introduced in 2009. Peasants who had a rural *hukou* could participate in rural pension schemes but if they wanted to find a job in an urban area, they had to participate in the UEPS. The government made considerable efforts to strengthen the equality between the

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[9] 'Circular on strict control of migration of rural labour force to cities and conversion of agricultural population to non-agricultural population' (State Council, 1981)gave peasants permission to seek jobs in urban areas.

different groups of people in the labour market, but the gender difference was still one of the important inequalities which continues to exist in the current labour market.

3.1.3 The gender inequalities in current labour market

Between 1960 and 2011, the working-age population in China drastically increased. The number of people aged 15-59 reached a peak of 925 million in 2011 and then started to decrease, which was the first decline in the working-age population in China since 1978 (Li, 2016). The increasing working-age population and relatively low dependency ratio (lower than 50%) created favourable conditions for economic development, which is often called the 'demographic dividend' (Cai and Wang, 2005) . The economic environment of the entire country was characterized by high savings, high investment and high growth. In recent decades, the increasing working-age population in China provided a cheap and sufficient labour force to supply the labour-intensive requirements of industries, leading therefore to high-speed growth in China's economy. However, as the number of aging people also increased rapidly, the dependency ratio began to come under pressure and the benefit from the demographic dividend gradually began to wither.

At the heart of the demographic dividend there is another great challenge: one which highlights the importance for women to enter employment and improve China's economic growth (Su, 2016). This gender dividend refers to promoting economic growth by promoting gender equality and women's employment, increasing the participation of the female labour force, improving women's work skills and releasing the potential of female labour. The steady decline in the labour force participation rate since the mid-2000s has been a major feature of the labour market reform in China, and this applies more for women than for men (Su, 2016). Although the labour force participation rate continued to decline, the employment rate remained relatively high compared with the average international rate (Gao and Cui, 2016). By 2014, the participation rate of Chinese women in the labour force was about 14% higher than the average level of female labour force participation in the world (50.3%), although the gender gap in China's labour force participation rate was much smaller than the average gap world-wide (Gao and Cui, 2016).

According to a China Labour Market Development report in 2016 (Lai et al., 2016), the number of high-educated women had increased in recent years and the participation rate of high-educated female workers was higher than that of working women with lower qualifications. The report (Lai et al., 2016) stated that the numbers of female postgraduates and undergraduates was growing. Female graduates, who occupied 51% of the current labour market, can work as well as men and can provide the same amount and quality of work (Lai et al., 2016). Female graduate employees had increased from 12,000 (29.8%) in 1998 to 254,000 (50.9%) in 2015, with a 17%

average annual growth rate. The number of female doctor graduates had grown at an average annual rate of 20%. However, Lai et al. (2016) also pointed out that in 2015 and 2016, the average initial employment rate for female graduates was 10% lower than for male graduates.

Despite the significant growth in the numbers of women in the labour market and in higher education, the employment environment for female graduates was still challenging. For example, the report (Lai et al., 2016) stated that the average wage for female graduates (3896 yuan) was less than the average wage for male graduates (4351 yuan), with the wage gap between female and male workers increasing during the previous decade. The possible reasons for the difficulty for women to enter the labour market can be analysed from two perspectives: that of employees and that of employers. From the employees' perspective, female graduates opt to work in the public sector as it often provides more stability and security in the labour market: 38.7% of female graduates expect to be employed in SOEs or public institutions, which is 7.1% higher than male graduates. However, the expectation of employment is quite different from the actual employment for female graduates: 31.2% of male and 29.6% of female graduates entered SOEs (Ye and Liu, 2016). Additionally, the percentage of female graduates who hoped to find jobs in more developed cities was even higher than that of male graduates, with 84.2% of female postgraduates and 67.3% of female undergraduates hoping to find a job in the cities where they were educated. The percentages for male graduates were 80.1% and 63.1% respectively (Lai et al., 2016). Although these findings do not show substantial differences, it is again the case that women opt for less risky working and living environments.

From the employers' perspective, employers need to consider the benefit and the cost if they hire a new employee. A new female graduate employee who is of marriageable age, according to the Labour Law in China, can enjoy 3 days of marriage leave and at least 98 days of maternity leave (Feng, 2017). When a female employee takes leave for marriage or maternity, their work has to be divided among other employees. Companies prefer to have male employees who do not need these breaks and can contribute continuous service. The introduction of the universal two-child policy, which means that a couple has the right to have two children, further worsens the environment for female graduates to find a job (Gao and Cui, 2016). At the moment there is little protection for women working in the private sector to reverse employers' preferences, not to mention any obligation for men to assume caring responsibilities.

The gender gap in wages and in the labour force participation rate are the two main features in China's current labour market. The importance of these two gender gaps is also reproduced in pension entitlements, as women are less likely to achieve similar individual accounts or claims to those of men, and women not employed in the public sector are more exposed to lower pension entitlements.

These gender inequalities in the labour market can therefore be correlated with the gender gap in the pension system. Hao and Li (2017) suggested that in the employment market, the lower employment rate has resulted in a large number of women being unable to meet the necessary contributory years of payment required by the pension system, resulting in a significantly lower coverage rate of contributory pension schemes and a lower payment benefit.

A second issue is the wage gap between women and men. The gender wage gap existed globally, the income gap between women and men in high-income countries was even greater (Schwab et al., 2017). The contribution to a public pension is usually related to income, with women's accumulation of pensionable contributions being lower than those of men (Hao and Li, 2017). As a result, the pension benefits likely to be received by women in the future will generally be lower than those of men.

A third reason for gender inequalities in the labour market is informal employment. Bonnet, Vanek and Chen's (2019) study showed that the proportion of women engaged in informal employment (92%) in developing countries was higher than that of men (87%). The average income of informal workers is significantly lower than formally employed workers (Tian and Guo, 2021). And the gender wage gap in informal employment is greater than in formal employment. Thus, women in informal employment are usually not covered by contributory public pension systems, and even though contributions can be made, the level of the contributions is not only lower than for regular employed workers but also below the average for informal employers, which leads to very low levels of benefit.

A fourth reason is that there is a gender gap in the statutory retirement age. For example, in China, the statutory retirement age for men is 60 years old while the statutory retirement age for women is 55 or 50 years old, depending on their occupations. The statutory retirement age requirement is the basic factor affecting the decision-making about the exit age of workers. Unfair pension system design can not only exacerbate gender inequalities stemming from the conditions of the job market but also exacerbate the gender inequality of pension benefits. Hao and Li (2017) advised that it is necessary and urgent to optimize the pension system design with a gender equity objective. They made several recommendations for reforming the pension system, such as expanding the coverage of contributory old-age insurance, increasing the coverage of rural citizens and promoting the gender equalization of the legal retirement age so that more retired female workers will receive a sustainable pension.

In the current labour market in China, the urban/rural difference is gradually being eliminated as the government relaxes the *hukou* registration system. Chinese workers can make their own choice about which city or province they want to live and work in. The restrictions on rural migrant workers have also been relaxed with economic development. However, the gender

difference in the labour market is still a serious problem. As explained above, different retirement ages for men and women, the informal employment of women, the income gap between the genders and the discrimination in the labour market show that gender inequalities do exist in labour market globally as well as in China (Hao and Li, 2017). The gender inequalities in the labour market could also perpetuate the gender gap in the pension system, especially because the different retirement ages and the income gender gap can lead to different levels of contribution to the pension system. If women make fewer contributions than men, this will effectively be reflected in a lower pension for women. The gender inequalities in the labour market should therefore also be considered in any study of inequalities in the pension system.

3.2 The history of China's pension system

China has been working hard to build the largest pension system in the world while the country is in the process of undergoing unprecedented economic and demographic transition (Salditt, Whiteford and Adema, 2017). To build a pension system which can accommodate the rapid economic growth and aging process in China, Chinese government has adjusted and refined pension schemes several times over the last few decades. The reform and development of China's pension system will be reviewed in this section.

There have been many studies which have explored China's pension system which in turn have divided the process of the country's pension reform into several periods. Although the periodisation proposed by different academics varies, there are common and agreed points in time at which to capture the development of China's pension reform.

In this thesis, the reform of China's pension system will be divided into five periods summarised on the basis of Zheng and Sun's (2008), which has the most detailed division compared with other studies and was published by the People's Daily[10]. Another reason for choosing Zheng and Sun's (2008) format was that their division of China's pension reform process into five stages is a particularly clear model to show the development history and reform process of the system. It is helpful for showing that the segmentation of China's pension system occurred gradually through several reform stages, and that the inequalities existing in the segmented pension systems have not been eliminated during the numerous pension system reforms.

The five stages (Zheng and Sun, 2008) are the era of establishment (1951 to 1978); the restoration reform stage (1978 to 1991); the exploration reform stage (1991 to 2000); the pilot project stage (2001 to 2006) and the 'full coverage' reform stage (2006 to the present).

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[10] The People's Daily is one of the most credible social media platforms in China.

3.2.1 The first stage: the beginning of establishment from 1951 to 1978

The Chinese government started to establish a pension security system in 1951. At that time, only employees in SOEs were involved. Other people such as employers in private enterprises, which were a tiny minority at that time in China, were not included. The main workforce in China, peasants in rural areas, were also excluded from the pension system at that time. A contribution of 3% of total salary from workers in all SOEs was collected by the government to fund the pension provision. In 1955, Civil Servants' Pension Scheme was introduced. These workers did not need to make any contributions to fund the pension system; they were entitled to pension provision from the government when they retired.

During the period 1955 to 1978, the regulations of the pension system required male employees to be continuously contributing to the pension system for at least 25 years in order to receive their pension when they reached the age of 60. Female employees needed to serve at least 20 years before they retired at the age of 50 or 55 in order to qualify for a pension (Salditt, Whiteford and Adema, 2017). The pension replacement rate interval varied from 50% to 70% of the standard wage, depending on the length of employment. The cultural revolution which began in 1966 caused extremely serious losses to the whole system and the social insurance system was not spared. The total loss of industrial output value in the country was about one hundred billion yuan[11] with an estimated loss of fiscal revenue reaching forty billion yuan[12] and the entire national economy was almost on the verge of collapse (Chen, 2008). Millions of people died during this 'revolution' (Song, 2011) as the political turmoil had devastating consequences for social peace and cohesion.

The organisations which had been set up to organise welfare provisions were withdrawn, such as the national employment insurance fund which was managed by the labour unions. Policies from the central government were inefficient since the relevant organisations to administer them were withdrawn and data were lost. The central government's decisions were implemented ineffectively. In February 1969, the government decided to cease financing labour insurance funds from the profits of SOEs. The labour insurance costs including retirement pensions and wages for the long-term sick were transferred to non-operating expenses for the SOEs. Soon afterwards, the social insurance system was replaced with an SOE insurance with pension benefits for retirees covered by the enterprises in which they had spent their entire working life. During the ten years of chaos, the funds from pension systems were used for other purposes, such as the construction of infrastructure, and workers often retired earlier than the statutory

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[11] This number of Chinese yuan approximates to forty billion dollars in 1970s (exchange rate of RMB to US dollar is approximately 0.4 in 1970s).

[12] This number of Chinese yuan approximates to sixteen billion US dollars in 1970s (exchange rate of RMB to US dollar is approximately 0.4 in 1970s).

retirement age. As the funds were absorbed by the budgetary needs of the cultural revolution, retired workers could only rely for their pension on the particular SOE in which they had worked for their entire life.

In 1978, in an attempt to re-establish the damaged pension system, the State Council adjusted the regulations of the pension system in several respects. First, workers could obtain pension provision after ten years of work instead of twenty years. Second, the pension rate was increased to 60% of the standard wage for workers whose length of work was between ten and fifteen years, whereas workers who worked for at least twenty years could receive 75% of the standard wage after retiring. Another innovation in this adjustment was called 'Dingti', which meant that retirees from SOEs had the option of letting their child take their full time job in SOEs and then they could start to receive the pension (Davis, 1988). In this period the pension system enjoyed a favourable fiscal position as most SOE employees made contributions and only a few received any retirement income. China was therefore benefiting from a demographic dividend as there was a surplus in the pension system. The pension system during this period was more like an insurance system from the SOE than a social insurance system. During the ten years of the cultural revolution, the state and the government were dysfunctional and retired workers had to rely on SOEs to receive the pension benefit.

3.2.2 The second stage: the restoration reform stage from 1979 to 1991

The Third Plenum of the 11th Party Congress which was held in December 1978 decided to reform and refine the pension system. The lack of clear budgetary lines and transparency over pension accounts during the decade of the cultural revolution led to the challenges of rapidly growing numbers of pensioners by 1978 and consequently rapidly increasing pension expenditure (Salditt, Whiteford and Adema, 2017). All these emerging problems forced the government to adjust the regulations of the pension system. To solve these problems, the government introduced a new regulation into the pension system: by 1986 new workers employed by SOEs were required to make their individual contribution to the pension system; they were expected to pay up to 3% of their wages to their individual pension account and the SOEs had to pay 15% of employees' wages into the pension system. All these pension contributions were gathered into a collective fund and organised by a new government institution. This new regulation combined individual accounts, enterprises' accounts and government accounts as a tripartite funding model for China's pension system. The reforms helped to relieve the pressure on SOEs and expand the funding base.

The key feature of the pension system from 1979 to 1991 was that employees were still mainly protected by their own employing enterprise, which meant that retirees received their pensions directly from the SOEs. Some additional changes also took place, for example, the new

regulation published in 1986 started to transfer the protection provided by enterprises to formal social insurance. The government's main aim was to consolidate and improve the pension system during this period (Zou, 2008). These reforms also reflected the ongoing economic reforms being introduced by the government in an attempt to open up and introduce a market economy in the Chinese market, so establishing and reforming social insurance highlighted the importance of tripartite contributions. From a policy design perspective, the reform constituted a first blueprint for private enterprises and the growth of social insurance coverage.

3.2.3 The third stage: the exploration reform stage from 1991 to 2000

As the economic reforms began in the 1980s, the structure of China's economy also changed significantly. SOEs were no longer the only enterprises in the market as the numbers of individual and private enterprises began to grow. The government tried to explore and establish a new basic pension system to fit the gradually diversifying market economy system rather than the previous pension system which had been designed for the unitary planned economy system. Before 1990, the pension system only covered workers in SOEs, employees in public institutions and civil servants. This system was reformed in 1991, and a tripartite funding model by the state, enterprises and individual workers was established. Similar to SOE employees, workers in collectively owned enterprises were also included in the pension system in 1992 and shared the same pension policy with employees in SOEs. Effectively, employees in collective owned enterprises and SOEs were expected to contribute 3% of their income to the pension fund and the employers contributed 15% of the workers' wages to fund the pension system. The people who were covered by Civil Servants' Pension Scheme did not need to make any individual contribution.

The central government decentralized its power to the provincial governments for them to set the regulations of the pension system in each province. A two-tier pension system was applied for private enterprises and joint-venture enterprises at the province level. In the case of private sector workers, the funding came only from employers and employees but without the guarantee from the government. Provincial governments were able to choose whether they wanted to be part of this new system or to establish alternative arrangements. The provinces which did not apply to become part of this new pension scheme established collective funds to supply the pension provisions to retirees in private enterprises and joint-venture enterprises.

The pension scheme expanded in January 1991 to cover rural citizens, the main workforce in the country. Pension schemes for rural citizens and retirees in private enterprises and joint-venture enterprises were established on an experimental basis, with differing pension rates and regulations between provinces. The funding of the rural pension system came only from individual contributions which were sponsored by the community rather than by the rural

citizens themselves. During this stage, the contributions were deposited in banks or were used to buy treasury bonds with the interest added to the pension fund account. However, after 1997, the actual income of insured retirees decreased as returns from interest plummeted, resulting in a rapid fall in interest rates (Li, 2017), which consequently resulted in huge numbers of rural citizens dropping out of the rural pension system. In 1998, commercial insurance replaced these sponsored contributions, which resulted in a significant decline in terms of the coverage of rural dwellers (Wang, 2006). Most elderly people in rural areas were supported by their own family members instead of social security insurance (Hu, 2006). The ORSPP therefore found itself in a difficult position in terms of both coverage and sustainability.

Even in the same province, the regulations were different between cities and towns. A variety of pension programmes coexisted and the central government decided to build a uniform pension system for urban areas. A document entitled 'Circular of the State Council on deepening the reform of the Urban Employees' Pension Scheme' (State Council, 1995) was published in 1995 to set out plans for a uniform pension scheme for urban workers. This document specifically spelled out the intention to combine individual account and social pooling for urban employees, including employees in SOEs, collectively owned enterprises, private enterprises and joint-venture enterprises. In 1997, State Council Document No.26 'Decision of the State Council on to unify the Urban Employees' Pension Scheme' (State Council, 1997b) was issued to unify the pilot UEPS in different provinces into a single, nation-wide pension scheme. State Council Document No.26 set out a three-pillar pension scheme and even though the elements changed during later stages, the tripartite social insurance system has always been the heart of China's nation-wide pension scheme. The theoretical basis set out in Document No.26 took three years to become a reality. The central government chose Liaoning province as the first social security pilot province in 2000.

3.2.4 The fourth stage: the pilot project stage from 2001 to 2006

Except for Liaoning province, other provinces were also gradually included in the pilot programme and experimented with both urban and rural pension systems which best fitted China's socialist market economy. The number of provinces which took part in this pilot had extended to eleven by 2006 and covered 39% of the whole population (China Statistic Yearbook, 2006). Expanding the coverage and collection of pension contributions, adjusting the benefit formula of China's pension system, and funding individual accounts were the three objectives to be achieved through these pilot pension programmes (Zheng, 2006). Although pension replacement rates and contribution rates were different between the eleven provinces, the eleven pilot programmes still provided confidence for the central government to build a unified nation-wide pension system. Several institutions were established to manage the social security system in China during this period. The NSSF was established in 2000 as the last resort to finance

future social security expenditure by developing a national long-term strategic reserve fund. The NSSF collected available funding resources from budget allocations, shares from selling SOEs and running their own investments portfolios which comprised stock market shares and bank deposits (Salditt, Whiteford and Adema, 2017). During this stage, the government attempted to figure out the 'best-fit' pension system for China's society using these pilot programmes and thus identifying how to expand the coverage of the pension system in the next stage.

3.2.5 The current stage: the full coverage reform stage from 2006 to the present

The social insurance used for the current pension system again comprises three pillars. Pillar one is formed by social pooling and individual accounts, pillar two comprises enterprise annuities and pillar three consists of individual savings and commercial pension insurance. The first pillar is publicly run and is statutory for everyone, the second and third pillars are privately controlled and are offered on a voluntary basis. This model largely reflects Mundial's (1994) three-pillar proposals in the WB report.

In the first pillar, the public sector is run by the NSSF, with the social pooling element running on a PAYG basis and financed by employers. Employers contribute 20% of the employees' wages to the pension system. Retirees who have worked for at least fifteen years are qualified to receive basic pension from social pooling. The basic social pooling equals to 20% of last year's local average wage for people who made 15 years contribution. If they have worked for more than fifteen years when they retire, for every additional year they have worked, an extra 1% of the local average wage will be added. This first pillar also comprises individual accounts which require employees to contribute 8% of their wage, the monthly pension benefit equals to accumulated individual account divided by a life table months plus basic pension benefit.

The second and third pillars are voluntary pension insurances. Pillar two is financed by employers and employees together and is referred to as an enterprise annuity. This is a supplementary pension system which can provide retirees with a higher standard of living. In return, the amount of money which employers contribute to the enterprise annuity is tax-deductible. In the third pillar, individual savings refer to the use of bank deposits or buying property to save money for retirement. All these pension systems are mainly focused on the UEPS. At the end of 2006, a provincial-level unified urban pension system was implemented in thirteen provinces, including Beijing, Tianjin, Jilin and Heilongjiang. A city-level unified UEPS was implemented in seven provinces including Shandong, Liaoning and Henan. Other provinces were still implementing a county-level UEPS. The different administrative levels of the pension system led to different levels of burden for the enterprises which were responsible for the enterprise endowment insurance.

In rural areas, the pension system remains at an infant stage even though the government has tried to improve it. The ORSPP was the first rural pension programme introduced by the government to protect the rural population. The ORSPP was funded mainly by peasants' individual contributions, organised by county governments, and the amount of pension benefit was determined by the accumulated individual account (Zhao and Qu, 2021). The central government only provided policy support to the old scheme and the collectives provided supplementary sponsorship. In 1998, the number of contributors in the old scheme reached a peak of 80.25 million and dropped steadily to 55.95 million in 2008 (Ministry of Human Resources and Social Security of the People's Republic of China, 1999, 2009; Wang, 2006). Mismanagement and the lack of financial commitment from the central government were the two main reasons that the ORSPP could not become a universal programme for the rural population (Wang, 2006).

In 2009, the State Council announced the start of a pilot of the NRSPP, which covered 10% of the counties and was intended to cover all rural residents by 2020 (Cai and Cheng, 2014). Rural residents aged over sixteen (excluding students) who did not participate in any other first pillar pension schemes (for example, Civil Servants' Pension Scheme or the UEPS) could participate in the NRSPP voluntarily. The most important difference between the NRSPP and the ORSPP was that in the old scheme, individual contributions were the main source of funding whilst the NRSPP was funded by individual contributions as well as subsidies from collectives, economic organisations and non-government organisations, and by subsidies from other individuals, collectives and local and central government together. The government encouraged collectives, economic organisations and non-government organisations to give some financial support but the subsidies to the NRSPP from collectives were not compulsory. There were two components in the NRSPP, the first was a non-contributory social pooling element and the second was the individual account (State Council, 2009). For the non-contributory social pooling, the central government promised to provide a basic pension benefit of 55 yuan per month per person to rural residents aged over 60. The local government could raise the basic pension according to the actual situation of local economic development. For contributors who made a long-term individual contribution, the basic pension benefit could be increased by the local government as well. The increased element of the basic pension benefit had to be funded by local governments themselves.

The individual account was financed by individual contributions from rural residents, the subsidies from collectives, economic organisations, non-government organisations, and subsidies from other individuals. All these amounts were accumulated at a rate of interest which equalled one-year's interest on the deposit. Participants could choose one of five categories ranging from 100, 200, 300, 400 to 500 yuan per person per year as their own contribution. The

local government could set higher categories according to the conditions of local economic development. Local governments were required to provide financial support to participants' individual contributions of not less than 30 yuan per year. For participants who chose the higher category of individual contribution, the local government could give higher subsidies. The individual contribution categories could be adjusted by the central government according to the per capita net income of rural dwellers. The monthly pension in the NRSPP equalled the basic pension plus the pension benefit from the individual account. The monthly pension benefit from an individual account would equal the accumulated amount in the individual account divided by 139 (State Council, 2009). If a participant were to die before retirement, the existing contributions deposited in the individual account, excluding the government subsidies, could be inherited.

At the time of the NRSPP implementation, rural residents aged over 60 who were not included in any other basic pension schemes, like the UEPS, could receive the monthly basic pension benefit without making any individual contributions if their children decided to participate in the NRSPP. Rural residents aged between 45 and 60 had to pay a certain fee at first and then make an annual individual contribution and were allowed to make up the individual contribution to not exceeding fifteen contribution years. Rural residents under the age of 45 were required to make an annual contribution of not less than fifteen years in order to receive the pension benefit from the NRSPP.

The NRSPP developed rapidly after it was first introduced. In 2009, there were only 320 counties included in the pilot NRSPP. One year later, the number had expanded to 838 counties in 2010 and the number of contributors to the NRSPP had reached 102.77 million, which was more than the ORSPP had at its peak (80.25 million). By 2012, the NRSPP had achieved almost full national coverage and nearly a quarter of rural residents (326.4 million people) were covered as contributors to it (Cheng et al., 2018). However, the NRSPP was implemented at county level and as the economic development situation varied a lot across the country, the amount of pension benefit received from the NRSPP also varied greatly between different regions.

In 2014, the State Council published 'Opinions of the State Council on establishing a unified basic old-age insurance system for Urban and Rural residents' (State Council, 2014) in which it announced the decision to establish a uniform 'Residents' Pension Scheme' (RPS) by combining the pilot of the NRSPP and the pilot of Urban Residents' Pension Scheme (URPS). The RPS also stated that residents aged over 16 (excluding students) and not participating in the UEPS, no matter what their *hukou*, could participate in the RPS. There were some changes following the merger of the two schemes. The first was that there were twelve fixed grades of

individual contributions for participants to choose voluntarily: 100, 200, 300, 400, 500, 600, 700, 800, 1000, 1500 and 2000 (State Council, 2014) instead of the previous five categories in the NRSPP (State Council, 2009). The local governments still had the right to add more higher individual contribution categories based on the local economic development conditions[13]. The local governments were also required to provide financial support to participants' individual contributions just as in the NRSPP. The change was in the amount of the financial support. For participants who chose to make a 100-yuan contribution per year, the financial support from the local government should be at least 30 yuan per year. For participants who chose a higher-level individual contribution, the local government could give more financial support. For example, local governments were required to give at least 60 yuan per year per person as financial support to participants who choose the 500-yuan or higher category of individual contributions. This change gave participants more options for making contributions and the higher government subsidies for the higher contribution levels could also give incentives for residents to participate.

The second change was that in the RPS, the accumulated amount in an individual account was calculated according to national regulations rather than to the one-year deposit interest rate in the NRSPP. The other change after the merger was that when a participant died, the whole amount left in the individual account could be inherited, whereas in the NRSPP, the amount left in an individual account could also be inherited but excluding the government subsidy element.

In 'Opinions of the State Council on establishing a unified basic old-age insurance system for Urban and Rural residents' (State Council, 2014), the government made no change to the minimum standard of the basic pension benefit, which was 55 yuan per month, but the basic pension benefit did increase in accordance with economic development and price development. The basic pension benefit increased for the first time in 2015 to 70 yuan per month per person and continued to increase to 88 yuan per month per person in 2018 (Wang, Huang and Sun, 2019). The basic pension benefit could be raised by a local government according to the different local economic circumstances.

The combining of the NRSPP and the URPS into the RPS established a unified pension scheme regulated by provincial governments. Since the unified scheme was introduced in 2014, there have been no significant changes in the policy, just some minor changes such as adding more fixed grades of individual contribution and raising the minimum level of the basic pension benefit. After the introduction of the new pension scheme, more participants were protected. The total number of participants in the NRSPP and the URPS was 497.5 million in 2013. In

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[13] The highest category of individual contribution should not be more than the annual contribution of the local flexible employees in the UEPS, which was different from the NRSPP pilot. The local flexible employees were employees who have a part-time, temporary or flexible job.

2014, the number had increased to 501.07 million and then gradually increased to 542.44 million in 2020 (Ministry of Human Resources and Social Security of the People's Republic of China, 2014, 2015, 2021).

The unified pension scheme does not mean that each participant will have the same amount of pension benefit, but it gives residents, no matter where their *hukou* is, the same opportunity and right to participate in the same scheme. The amount of individual contributions will directly affect the size of the pension, which emphasizes the incentive for participants to contribute more and for a longer time. The contributions of residents who can afford the higher fixed grade of individual contribution can be accumulated more in their individual account and give them greater security in retirement. The basic pension benefit could vary in different regions as the central government only sets the unified minimum standard, reflecting differences in economic and social development across China. On the one hand, this policy could give local governments more autonomy to decide what level of basic pension benefit works best for them, and on the other hand it can increase the diversity of the benefits paid.

It can be clearly seen from this history that the composition of China's pension insurance was complex during the past decades, involving the NRSPP, the ORSPP, the URPS, the UEPS, and Civil Servants' Pension Scheme, and the RPS. These different pension schemes provide different policies and benefits to different groups of people. After these reforms in China's pension system, the residents in China can always find a proper pension scheme to participate and have at least a minimum income security when they get old.

3.3 Pension Debates in China

Twenty-five percent of China's population is expected to be over 60 years old in 2040 (World Bank, 1997). With this massive aging population and the legacy of the one-child policy (which has only recently been abolished in 2016), the rapidly aging population will force the government to face a long-running predicament. In the global context, the approach which the Chinese government chooses for transforming its pension system and making it both sustainable and relatively fair is of extreme importance, especially if we consider that the Chinese pension system will be serving the most populous country in the world. Successful experience in China can also be a guide to other countries which are seeking to reform their pension system (Whiteford, 2003). China's pension system was first established in the 1950s and as the economic system has been reformed, the pension system has also needed to be reformed to cover the growing population. After the various reforms described above, the current pension system consists of a funded DC sector and a DB PAYG sector (Feldstein, 1998). After 1997, China started to facilitate a transition from a DB system based on enterprises to a unified urban pension system. The creation of social pooling, individual accounts and a voluntary enterprise

annuity comprise the three elements in this unified pension system. Social pooling is still organised on a DB payment plan and funded on a PAYG basis. Individual accounts are organised as a funded, mandatory, DC pension. Despite the aim of building a unified pension system, China's current pension system is still highly segmented at the provincial level, or worse, county level. This multi-level pension system increases the difficulty for the government to incentivize and promote pension contributions. With limited contributions and high spending on pension payments, a deficit in the pension system exists in most provinces in China.

After several reforms, the three-pillar pension system was established in China. The first pillar was publicly run and comprised social pooling (a DB payment funded on a PAYG basis) and an individual account (a funded DC payment). The second pillar comprised enterprise annuities and the third pillar comprised individual savings and commercial pension insurance. The second and third pillars were private pensions on a voluntary basis. China's pension system is therefore comprised of a diverse set of pension schemes, including the three debates discussed above on PAYG versus funded, DB versus DC, and public versus private schemes. In part, this reflects historical continuities but also multiple attempts (and pilots) to tackle it were made as the rapidly aging population represents a severe challenge, which is the same as the pension debates internationally on the sustainability of pension systems (see Chapter 2). It is important to clarify the key concepts and debates, and I shall use pension debates on DB versus DC and on PAYG versus funded schemes to do this. I shall also show that China's pension system has exactly the same issues as the pension debate internationally.

In recent decades, China's rapid economic development has been accompanied by the rapid expansion of manufacturing, which has attracted many young people into the labour market. At the beginning of the rapid economic growth, the contributions from these younger workers could easily finance the PAYG DB pension system and pay the pensions of those who had retired; this rapid economic growth in combination with the demographic dividend made the PAYG DB scheme financially sustainable as contributions to the pension pot were higher than the payments made out of it (Immergut, Anderson and Schulze, 2007). However, along with the economic development, a service industry began to develop in China and the proportion of labour-intensive industries decreased, meaning that the transitions in the labour market could no longer be regarded as so favourable for the pension system. In the international literature, this is referred to as the 'Baumol effect' or 'Baumol disease' (Baumol, 1967). The unfavourable economic context was also matched with demographic pressures. Under the one-child policy, the supply of labour also decreased. With the increasing numbers of aging people and the decreasing numbers of young workers, the demographic dividend was slowly fading away.

China is now facing rapid aging problems with the higher dependency ratio continuing to add more challenges to the sustainability of the pension system. With the size of the aging population increasing, the ratio between contributors and pensioners decreases, becoming unfavourable for the sustainability of various schemes. One solution is to increase the contribution rate for current contributors if the government wants to maintain the level of pension benefit as they promised. The problem of using PAYG financing becomes increasingly serious as, for example, researchers have projected that some European countries must either double their contribution levels by 2050 if they want to keep their current level of pension payments, or must implement reforms to increase their financial sustainability (Feldstein and Siebert, 2002).

Policy makers are seeking to finance pensions in other forms instead of PAYG, such as a fully or partly funded system, to prevent the need either to cut pension benefits or to increase contributions. However, this shift could be difficult because the contributions from current working young people have already started to pay the pension benefits for the retired. If the policy makers decide to bring in some sort of funding scheme, the current contributors could be expected to increase their contribution rates with any increase covering existing gaps in the PAYG DB scheme, and in some cases channelled to the funded DC scheme. Higher contributions are politically undesirable and could also lead to retirees suffering a lower income (after contributions) because they will have to fund both PAYG DB scheme and their own funded pensions. This is because these additional contributions are needed to cover the sustainability of the PAYG DB scheme and the government does not have sufficient cash flow (or is unwilling to finance it), so the current contributions from the young generation would have to be used to pay the pension benefits for current pensioners. This will lead to empty individual accounts, resulting in what Pierson and Myles (2001) identified as the 'double payment problem'. To reduce the deficit in the pension system, including government-owned foreign bonds in the individual accounts (with interest included) or issuing new government bonds paying a market interest rate into individual accounts, could be one of the feasible approaches. Reflecting on China's circumstances, Barr and Diamond (2010) stated that a fully funded individual account is a mistake underlying China's economic conditions and suggested that notional accounts would be a better strategy for China. Notional accounts are meant to offer a transition from PAYG to funded schemes, with the actual contributions used for payment of current retirees, but logistically, the contributions made are monitored and there is a nominal interest rate or rate of return (in the case of funded schemes).

In this chapter, I have reviewed the main labour market and pension reforms as well as the pension debates in China. The importance of these reforms remains today, such as changes to *hukou* registration and to retirement age, but nevertheless significant changes have taken place,

such as in coverage and generosity. It is therefore important that we contextualise these reforms so that we can next consider the debates in the literature on the gender gap in China's pension system. The literature on this gender gap will be reviewed in the next chapter in order to map the potential gap in the knowledge and provide the initial hypothesis for this study.

Chapter 4. Literature Review

China is becoming an aging society as there are currently 264.02 million people (18.7% of the population) over the age of 60 (National Bureau of Statistics of China, 2021a). The negative effects of the rapidly increasing aging population on China's living standards and economic growth have been also highlighted by the National Research Council and by the Committee on Population in 2012. In an attempt to safeguard social cohesion and living standards for retired workers and the aging population, the government attempted to build the largest pension system in the world (Salditt, Whiteford and Adema, 2017). Since the introduction of the pension system in China in 1951, several different schemes have been established, often running in parallel. There have also been several refinements during recent decades to make the pension system adapt to the rapidly developing economy and the changing needs of the population. The reform history has been detailed in the previous chapters. What is important to note here is that even though the government has made many efforts over the years to reform the pension system to make it more equitable, issues of inequality still exist in China's pension system. Zeng (2014) stated that the inequalities in the current pension system can be divided into five perspectives:

- inequality between generations (Hu, 2014b);
- inequality between different pension schemes, especially between the UEPS and the Civil Servants' Pension Scheme (Huang, 2020; Li, Zhao and Gao, 2013; Wang et al., 2013; Wang and Yang, 2015; Hu, 2014b);
- gender inequality (Jia, Zhan and Li, 2021; Zhan, 2020; Su, 2014b);
- inequality between urban and rural areas (Li, Xiong and Xia, 2018; Jia, Zhan and Li, 2021; Su, 2014b; Liu, 2016); and
- inequality between regions (Jia, Zhan and Li, 2021; Li, Xiong and Xia, 2018).

As China is currently undergoing a transition from PAYG DB to a funded DC system (Zeng, 2014), the generational inequality refers to the double payment problem which the younger generations face because those of working age are expected to contribute both to their own individual account and also to the social pool to cover the cost of pension provision for existing retirees. The inequality between different pension schemes suggests that the Civil Servants' Pension Scheme always has the highest replacement rate and relative pension benefit (Wang et al., 2013; Li, Zhao and Gao, 2013; Wang and Yang, 2015). In terms of pension benefit level, retirees in the Civil Servants' Pension Scheme also have higher pension benefits than retirees in the UEPS (Wang and Xia, 2021). Wang et al. (2013) and Jia, Zhan and Li (2021) also pointed out that the pension gap between different pension schemes is mainly caused by different pension policies as institutionalised between different schemes.

Gender inequality refers to the gender difference in the coverage rate and pension benefit level in the different pension schemes. Huang (2020) argued that the gender gap in coverage rate still exists after several reforms, albeit with a decreasing trend. However, previous studies have found that the gender difference in pension benefit level increased after several reforms in the 2000s (Hu, 2009). One of the possible explanations for this gender gap is that women are more likely to participate in informal employment than men. The lack of sufficient contributions or formal years of work translates in pension policy terms into lower coverage rates and a lower pension benefit level (Wu, 2020; Wang and Yang, 2015; Chen and Huang, 2018). Informal employment typically pays less than formal employment and enterprises which employ informal workers are less likely to enrol them into the UEPS. This is beneficial to enterprises as they do not need to pay any contribution (typically 20% of employees' wages) (Wu, 2020). On the other hand, Wang et al. (2013) and Ba and Li (2017) showed that the different retirement ages are the main reason for the gender pension gap. The UEPS has the largest difference (ten years) in the legal retirement age between men and women. To add some complexity, the gender pension gap in the Civil Servants' Pension Scheme is smaller as the legal retirement age gap is five years in this scheme (Wang et al., 2013). As men and women have the same legal retirement age in the NRSPP, there are no gender differences in terms of the replacement rate and the relative pension benefit (Wang et al., 2013).

The urban/rural gap primarily reflects the gap in coverage rate (Huang, 2020) and also in the pension benefit level (Huang, 2020; Jia, Zhan and Li, 2021). It was expected that the establishment of the RPS would provide protection for women who do not have a job in an urban area and narrow the gender gap in the coverage rate in pension schemes. Huang (2020) found that the urban/rural gap in pension benefit level remains significant (Huang, 2020).

Reflecting on the pension reform history in China, it can be seen that the government has made many attempts to reduce various inequalities in the system (Li, 2021). In 2009, the government established the NRSPP to address the shortcomings of the rural social security system. In 2014, the URPS and the NRSPP were merged into a RPS, which put an end to the more than 60-year history of the segmentation of urban and rural areas in China's pension system. In 2008 and 2015, the government tried to gradually reform the Civil Servants' Pension Scheme to reduce the inequality between it and the UEPS. The overall effect of these changes was higher coverage rates and pension benefits among the different pension schemes and that the urban/rural gap in pension benefit level is decreasing as time goes by (Huang, 2020; Jia, Zhan and Li, 2021). As for the regional gap, Han and Zhao (2020) stated that regulation of the pension system in China has been devolved to the provincial level, which is a great improvement as the previous pension schemes were regulated at the municipal level (for the UEPS) and even at the county level (for the ORSPP).

In terms of the gender inequality in China's pension system, the current situation is that the total number of aging women is higher than the total number of aging men, primarily as women tend to outlive men. Combined with the gender pension gap in China, women are more likely to find themselves facing a more severe economic situation than men when they become older (Zhong and Chu, 2015). This issue has historically never been identified as a key priority for reforming the pension system despite concerns over the current and future levels of the gender gap (Pei, 2011; Chen and Turner, 2015). Given the long-held aim of the government to establish a more equitable pension system, it is concerning that this dimension has not been fully addressed or considered when pension reforms are taking place. It is for this reason that I chose to study and analyse the gender gap in China's current pension system rather than the other inequalities.

There will be four sections in this chapter. The first section contains an overview of the literature on the gender gap in China's pension system identifying the key reasons explaining it. The second section comprises the empirical literatures focusing on impact factors of gender gap in terms of pension benefit in UEPS and the third section is about the empirical literature on the impact factors of gender gap in terms of participation rate in the NRSPP.

Another gap showed in the previous literatures is that most of the previous studies focusing on gender gap in pension system have been empirical studies. None of them included the guidance of the theories of social policy pertaining to gender pension gap. The Section 4.4 contains a theoretical discussion of the existing theories of social policy that can explain or help us analyse how to analytically capture the gender gap in pension systems.

4.1 A review of the literature on the pension gender gap

The gender gap in the pension system is not unique to China neither is it unprecedented. Along with other researchers, Even and Macpherson (1994) studied the pension system and stated that a gender gap certainly existed in the coverage rates caused by gender inequalities in the labour market, and that children and marriage also have a negative effect on female pensioners' coverage rate. Studies by the International Labour Organization have identified gender pension gaps in many countries, with the Czech Republic, Hungary and Poland displaying lower gaps among EU countries (Fultz, Ruck and Steinhilber, 2003). Even and Macpherson's (1990) study gave an evidence that women's pension benefit was much lower than men's. Bonnet and Geraci (2009) tried to determine how to correct gender inequality in a pension system from the experience of five European countries and concluded that the gender inequality within the labour market was the persistent cause of the inequality in the pension system. In particular, they identified the lower level of contributions as the cause and said that it needed to be corrected in order to reduce gender inequality in a pension system. Vara (2013) used Spain as a case and concluded that the gender inequality in pension benefits there depended on the

accumulated pension contribution through people's working life, highlighting the length of (formal) employment years. Kuivalainen et al. (2020) pointed out that the relationship between working-life income and gender segregation in occupation are the two main challenges for equalizing the gender gap in pension benefit. Bonnet et al. (2006) showed that men benefit from a more homogeneous working life and a higher pre-retirement salary than women, rendering the pension system more advantageous for men. Overall, most of the relevant literature, which focuses on western countries, highlights gender inequalities in the labour market in terms of a wage gap, contribution years and occupation as the main reasons for the gender gap in the public pension system in many countries.

This gender gap in pension system is also an issue which has been studied in China (Chen and Turner, 2015) and the literatures such as Pan (2001, 2002); Wu (2002); Wang (2012); Ai (2015) and Huang (2017) have explored the reasons for the gap in China's pension system. There are at least five main reasons why older women are less secure compared with older men in China: the gender inequalities in the labour market; the gender gap in education level; the influence of culture; different life expectancy for men and women; and finally the different statutory retirement ages. These five factors will be reviewed next.

The first reason is the gender inequalities in the labour market. The gender wage gap in the labour market could lead to a lower pension benefit level for women than men when they retire (Wu, 2002; Li, 2007; Wang, 2012; Ai, 2015). Gender segregation in the labour market keeps women away from well-paid occupations or industries (Wang and Cai, 2008; Wang, 2012; Ai, 2015). The coverage of pensions (including participation rate and entitlement rate) is strongly related to the characteristics of the labour market for both men and women (Li, 2007). As women usually have lower standard of education, longer part-time working hours, lower skills, a shorter working life and less opportunity to have a formal job or opportunities for career progression, all these characteristics will place women at a disadvantage in terms of the coverage of pension system compared with men (Li, 2007; Su, 2014b).

The second reason is the gender gap in education level. Huang (2017) pointed out that the education level for women is lower than for men and the difference in education level can cause the gender gap in participation in the pension system in China. Wang (2012) and Ai (2015) showed that for men and women who have same level of education, men still have higher wages and more opportunities in the labour market. A lower wage will lead to a lower accumulated contribution and a lower pension benefit after retirement.

The third reason is the influence of the traditional Chinese concepts of 'men should work as the breadwinner' and 'adult children should take responsibility for taking care of their retired parents' (raising children for your old-age). Since 1949, women have had more equal rights in

China and they have also had opportunities to have independent work and be the breadwinner in the family. Even so, according to Chinese tradition, women have to take more responsibility for caring for the family, and some of them may choose to become housewives whereas others who have a job still have disadvantages in the labour market (Wang, 2012; Ai, 2015). These disadvantages will lead to a lower income when women become old and rely more on their husband or on support from their family whereas men can rely on their individual savings and their pension benefit (Huang, 2017; Li, 2007). Especially for rural women, their retirement life is more dependent on their family rather than the social security system (Su, 2014b). However, the stability of financial resources is inconsistent for different resources. Social security insurance is the most stable financial resource compared with financial support from the spouse, whereas income from work after retirement and financial support from children are the least stable financial resources (Wu, 2002). The aggravation of the aging population and the one-child policy changed the structure of the family while at the same time the rapid economic development increased the risk of old-age security for those depending on children and family. The stability of the 'family support' system was and remains to this day under pressure (Ai, 2015; Wang, 2012).

The fourth reason is the different life expectancy for men and women. The longer life expectancy for women requires more money to maintain their standard of life as the average life expectancy for Chinese women is 79.24 but for men is 74.76 (World Bank, 2019a, 2019b). The amount of monthly pension benefit is also related to which life tables are chosen in China's pension system. As women have longer life expectancy in general, ungendered life tables will give more advantages to women than gender-based life tables (Li, 2007). Currently, the monthly pension benefit will equal the basic pension benefit plus the total individual account divided by the life-table months. For men who retired at 60 in the UEPS, the life-table length is 139 months whilst for women who retired at 55(50), it is 170(195) months. Pan (2002) held a different opinion about life expectancy, she pointed out that even though women have a lower monthly pension benefit, they have a much longer life expectancy. So taking into consideration the age of earlier retirement than men, the total lifetime pension benefit for women is higher than that for men.

The last and the most important reason is the different retirement ages for men and women. In China's pension system, even though the policy has changed several times, the retirement age is still the same as it was in the 1950s: 60 for male cadres and workers, 55 for female cadres and 50 for female workers, with additional provisions for special jobs. The difference between men's and women's statutory retirement age is the only gender-specific provision in China's pension system. In 1950s, this difference was considered to be in women's favour as women were supposed to have had fewer social obligations and enjoyed the right to retire earlier (Liu,

2010). After more than half a century of such regulations, the situation has changed considerably.

Pan (2002) and Ma (2016) both pointed out that different retirement ages could affect the gender difference in monthly pension benefit in two ways. The beneficial effect is that, as women have a lower retirement age, as described above, it is easier for them to meet the qualification to receive a pension benefit (Pan, 2002; Ma, 2016). Wang (2012) and Ai (2015) held the opposite opinion and stated that because women have an earlier retirement age, it will be more difficult for them to qualify to receive a pension as the pension policy in China requires at least fifteen years of contributions by retirement age in order to be eligible to receive a pension. The disadvantage is that the early retirement age could result in a lower pre-retirement salary and fewer contribution years (which can also be considered as eligible work experience). Before 1995, China's pension benefit was related to eligible working experience, and after 1995, the pension was related to accumulated individual contributions and eligible working experience, and as a result employees who retire early will have a lower monthly pension (Pan, 2002; Li, 2007; Ai, 2015).

None of these studies considered the segmentation in China's pension system, but the pension policies in different pension schemes are quite different. The characteristics of participants in different schemes can vary considerably. That could be the reason why most previous researchers only focused on one pension scheme to analyse the gender issue rather than take into consideration how the segmentation of the pension system interacts with the gender pension gap.

As will be shown next, even when the same programme is analysed, the benefits which public pension programmes provide to men and to women are quite unjust. The relevant empirical literature can be divided into two sections based on the different pension schemes which were studied. The 4.2 contains empirical studies which focused on the impact factors of gender gap in the UEPS and the 4.3 comprises the empirical literature which studied the impact factors of the gender gap in the NRSPP.

4.2 The literature on the gender difference in the Urban Employees' Pension Scheme

In the previous section, I reviewed previous attempts to explain the pension gender gap in China and beyond. This section moves on to explore gender inequalities in the UEPS.

The studies reported in the literature used both macro- and micro-level datasets to study the gender gap in China's UEPS. The macro-level datasets included China Statistical Abstract, China Statistical Yearbook, China Labour Statistical Yearbook, Survey of the Status of Chinese

Women, the Price Yearbook of China and the Population Census, etc. The micro-level datasets included the CHARLS and the Chinese Household Income Project, etc. The macro-level datasets were used in descriptive data analysis (Li, 2004; Pei, 2011) and in simulation models performing actuarial analysis (Ding and Zhang, 2006; Mi, 2016; Zheng, Xu and Liang, 2017). There were additional simulation models which focused not on macro-level data but instead on meso-level and in particular the UEPS (Chen and Li, 2004; Li, 2008; Gao and Pan, 2007; Hu, 2009; Wang, 2010; Wang and Li, 2013; Guo and Yue, 2017; Zhao and Zhao, 2018; Wu, 2020; Chen and Huang, 2018; Wang et al., 2013). The micro-level datasets focused their descriptive analyses on how the gender pension gap exists for different groups of people[14] (Zhang, 2010; Chen and Turner, 2015) and multi-linear regressions were applied to explore the impact of the gender gap in the UEPS (Zhang, 2010; Zhao and Zhao, 2018), including counter-factual techniques such as Oaxaca-blinder decomposition (Zhan, 2020) and Neumark decomposition (Wang and Xia, 2021).

Zhang (2010) used data from 'the status of the old in Shanghai and follow-up survey on old people's desire in 2003' to analyse the gender gap in the UEPS in Shanghai, and the descriptive data analysis in that study showed that female retirees in urban areas have disadvantages in education level, legal retirement age and occupation compared with male retirees. Pei (2011) showed that the average pension benefits for men and women are organised in different groups by retirement age, education level, occupation and city. The descriptive data analysis showed that no matter in which group, the average pension for women was always lower than that for men. Chen and Turner (2015) controlled average pre-retirement salary and average pension benefit by gender and retirement period[15] and found that the gender pension gap and gender wage gap were both decreasing.

In a study which used a simulation model to analyse the gender gap in the UEPS, Gao and Pan (2007) compared the gender gaps in the average monthly pension benefit, total pension benefit and replacement rate. They assumed that both men and women participate the labour market at the age of 20, men retire at 60 and women retire at 50. For both men and women, it was assumed that they did not leave the labour market during these years, so men would have 40 contribution years and women 30 contribution years. There was therefore a ten-year gap in the contribution years, the same as the gap in retirement ages. The ratio of the total monthly pension benefit between men and women was identified as 1:0.8.

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[14] For example: how pension benefit differs for men and women with different education levels.
[15] There were three retirement periods in Chen and Turner's (2015) study: before 1997, 1997-2005 and after 2005.

The literature shows that there is a gender pension gap in the UEPS with the actual pension payments for men being 1.9 times higher than those for women (Zhan, 2020). The variables used to analyse the gender pension gap in different papers are different because the scholars might have compiled different datasets, but there still are some commonalities in selecting impact factors for analysis. The impact factors of the gender gap in the UEPS can be summarised in two dimensions; the first is the labour-market-related variables and the second is the pension-policy-related variables. The variables related to the labour market includes income, education level and occupation type and those related to pension policy include retirement age, contribution years (always known as eligible working experience in China) and life tables. The results of how these variables can affect the gender pension gap in the UEPS are discussed next.

4.2.1 A reflection on variables related to the labour market

Chen and Huang (2018) and Zhan (2020) cited the discrimination of women in the labour market as the direct reason for the gender pension gap. They found that in particular, labour market participation rate, occupation, income level and working experience[16] (Chen and Huang, 2018; Zhang, 2013) play crucial roles. The current pension payment method is closely related to the amount of contributions whilst the total amount of contributions is highly related to the eligible working years and wage levels. As women have such a disadvantaged position in the labour market, they are more likely to experience lower average wage levels than men. Additionally, women are eligible for an earlier retirement age thus resulting in a shorter working life. These conditions means that existing labour market inequalities will continue to be at play and will disadvantage women during their retirement (Zhang, 2013). Guo and Yue (2017) compared the income before retirement and pension income after retirement and found that the gender gap in pension income was larger than the gender gap in working income.

4.2.1.1 Wage gender gap

The wage gap between women and men is one of the reasons why women receive less pension benefit than men. The gender gap in wages means that women contribute less during their working life and this leads to a lower pension benefit after retirement (Wu, 2020). Li (2004) showed that if women could have the same wages as men, the gender gap in pension benefit will decrease. However, even if men and women can have the same wage, the gender pension gap will only decrease by 21% to 25% and there would still exist a significant gender pension gap. Zhan (2020) also pointed out that 19% of the gender pension gap was caused by the gender different in pre-retirement wage. Mi (2016) and Wu (2020) pointed out that the gender difference in the pension system is a continuation of the gender differences in the labour market, which means that the gender difference in wages is one of the main causes of the gender

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[16] The variable 'working experience' will be discussed as contribution years in the policy-related variables section.

difference in pension benefit. The effect of discrimination in the labour market, especially on wage levels, is having an increasingly significant effect on the gender pension gap as time goes by (Wang and Xia, 2021).

As men retire at 60 and women at 50, if men and women have the average wage, when men and women reach the same age (for example, 60), the gender pension gap will increase as the wage level increase (Li, 2008). If men have a lower working wage than the average wage, the relative pension benefit level will be higher than the relative wage level. However, for women, a higher relative wage level will result in a lower relative pension benefit level, the relative loss on pension benefit for women is increasing as their relative wage increase (Li, 2008).

Pei (2011), however, showed that wages can significantly affect the gender pension gap but not as significantly as education and retirement age. Ding and Zhang (2006) offered contrasting evidence by showing that when the wage gender gap is considered, and even if women and men have the same retirement age of 60, men will always have a much higher total pension benefit (around 25% -30% more) than women.

Wang and Li (2013) used replacement rate rather than monthly pension benefit to analyse the gender gap in the pension system. They first assumed that men and women have different wage levels. In the social pooling section, the replacement rate will decrease as the contribution rate decreases. As women can usually earn 70% of men's wage, and there are ten years difference in the retirement age between men and female workers, the gender gap in the replacement rate in the social pooling sector varies by 13% or so (female workers 23.61%, males 37.04%). The gap is more than 50% of female workers' replacement rate in the social pooling sector. As for the replacement rate in the individual account, women, especially female workers, have a significant disadvantage in the replacement rate in their individual account. Women have a lower replacement rate (7.59% for female workers and 9.27% for female cadres) than men (11.89%) (Wang and Li, 2013). For the total replacement rate in the basic pension system, at the same increase rate of wage (for example, 8%), for female workers who have an average wage level and work for 30 years, the total replacement rate is only 35%. In the same condition, the replacement rate for female cadres is 42% and the replacement rate for males is 49%. If women cannot earn an average level wage, the situation will become worse during retirement.

4.2.1.2 Occupation

Although wage inequalities seem to overwhelmingly dominate explanations for the gender pension gap, occupation is more contested. For example, some writers (Zhang, 2010; Pei, 2011) have claimed that occupation does not have a significant effect on the gender pension gap. Wang and Li (2013) had the opposite opinion that occupation is one of the significant causes of the gender difference in the replacement rate as men always have the highest replacement rate,

female cadres have the second highest and female workers have the lowest. Guo and Yue (2017) focused on the individual accounts in the UEPS for men and women and similarly found that it is men who benefit the most from government subsidies, followed by female cadres and then workers. Li (2008) stated that the gender gap between female and male workers is larger than the gender pension gap between female cadres and men even there is no gender gap in wage level during their working life. Li's study showed that when men and women reach 60, a female worker can only receive around 64% of the monthly pension of male workers and female cadres can receive around 80% of the monthly pension of male workers. More recently, Wang and Xia (2021) stated that the effect of occupation on the gender pension gap is reducing over time, with factors such as education and age becoming more important. There is therefore evidence showing a mixed picture depending often on the time frame of the analysis and which additional variables are considered.

4.2.1.3 Education

Education is a variable which can not affect the gender pension gap directly but the wage level in the labour market is highly correlated with education level (Bettio, Tinios and Betti, 2013). Li (2004) pointed out that both male and female workers who have a higher education level will have a higher salary level, a higher increase rate of salary and more years of employment. Zhang (2010) and Pei (2011) showed that education level has a significant effect on the gender pension gap. Pei (2011) identified a cultural aspect of this unequal treatment based on education, in that Chinese families prefer to invest in boys rather than girls.

Zheng, Xu and Liang (2017) calculated the present value of the total pension contribution to individual accounts and the present value of total pension benefit which pensioners can receive after retirement at the current legal retirement age of 60 for men and 50 for women. The results showed that with the increase in life expectancy and a higher level of education, the total pension benefit received will be much more than the contribution for both men and women. Female workers have the largest gap between pension contributions paid and payments received as they retire at 50 and their contribution is lower than that of men, and they have the longest expected life after retirement during which to receive the pension. Wang and Xia (2021) pointed out that education does have an effect on the gender pension gap but that the size of the gap has been decreasing significantly during recent decades.

4.2.2 A reflection on variables related to pension policy

After exploring labour market policies, I shall next review the literature on the importance of variables related to pension policy such as the calculation form of pension benefit, retirement age, contribution years and life tables.

4.2.2.1 Retirement age

The gender difference in retirement age is the most significant variable which leads to insufficient protection for women who are covered by the basic pension system and causes the gender gap in pension benefit (Wang and Li, 2013; Li, 2004). Chen and Li (2004) tested how much the gender difference in retirement can solely affect the gender pension gap. They assumed that women and men can have the same wage level before retirement. Their findings showed that women can only have 80% of men's pension benefit when they are both at the age of 60 even though there is no wage gender gap. Zhang (2010) and Pei (2011) stated that the effect of retirement age is more significant than that of other variables (including income, working experience and occupation) on the gender pension gap. As the individual account and social pooling pension are all related to the retirement age, the gender difference in retirement age could make women disadvantaged in their monthly pension benefit (Wu, 2020). Hu (2009) pointed out that the reform of 2005 made the social pooling sectors correlated to a higher level of contribution. Male workers who participated in the pension system at an early age were able to make more contributions and considering that they retire ten years later than women, they are more likely to benefit more from the social pooling system than women.

Wang et al. (2013) also stated that the ten-year gap in retirement age is the main reason for the gender difference in pension benefit. The earlier retirement age for women results in fewer contribution years and the income gender gap in labour market mean that female retirees will be more likely to receive a lower monthly pension payment than men. To paraphrase Zhang (2013), women are entering a form of 'retirement trap' as they are expected to retire at a younger (statutory) age without accumulating the necessary contribution for a higher pension income. Wang's (2010) findings showed that even if men and women have exactly same wage during their working life, when they reach the age of 60, women's pension benefit is still lower than that of men. Chen and Li (2004) also showed that the 20% gap between men's and women's pension benefits was caused by the different retirement ages, with the assumption that there is no wage gap between men and women during their working lives. Li (2008) similarly suggested that the different retirement ages will result in a significant disadvantage for female retirees in pension benefit even though they can enjoy all the other conditions of retirement just as men can.

Rather than pension benefit level, Guo and Peng (2017) used replacement rate to measure the gender gap in UEPS and they stated that postponing the retirement age could increase the replacement level for women. Ba and Li (2017) also used replacement rate and relative level in pension benefit to analyse the gender difference and found that the gender difference in replacement rate and relative level in pension benefit is mainly caused by the different retirement ages. The higher retirement age and longer contribution period combined with the

DC pension scheme mean that men in the UEPS will have a higher pension benefit in terms of the relative perspective and higher replacement rate.

Chen and Turner (2015) stated that the most major step towards equalising women's and men's benefits in the pension system would be to raise the retirement age for women. If women have a longer working life, they will make a greater contribution to their individual account, which could give them a higher pension benefit when they retire. Similarly, Li (2004) showed that if men and women could have the same retirement age and the same number of contribution years, the gender gap in pension benefit would decrease. Zheng, Xu and Liang (2017) also predicted what would happen if there is a change in retirement age for both men and women. If men were to retire at 65 and women at 60, the gap between contribution and pension benefit would narrow significantly, especially for women as they would make a greater contribution and work for longer to receive a pension benefit. Zheng, Xu and Liang (2017), however, predicted that women would still receive a greater total pension benefit than men as they have longer life expectancy. If both men and women retire at 65, the gap between contribution and pension benefit will narrow even further because men and women would make almost the same contribution but women would still receive a higher total pension benefit because of their longer life expectancy. However, the replacement rate in the individual accounts told a different story in that study. The results showed that postponing the retirement age would have a greater influence on the replacement rate for men than for women. Zheng, Xu and Liang (2017) stated that in the current situation of low pension yield and increasing life expectancy, postponing retirement can help to improve the overall pension replacement rate and effectively improve the pension security level in China to some extent. Guo and Yue's (2017) simulation showed that if the retirement age for women is increased to 60, the advantage in net expected present value and relative replacement rate in the individual account for men will decrease and therefore the gender gap in pension income will be reduced.

4.2.2.2 Contribution years

The number of contribution years is the second variable related to pension policy. Contribution years in China are directly related to the length of the working life but women's average working life is usually shorter than men's (Dewilde, 2012). Ding and Zhang (2006) found that the total contribution is positively related to the contribution years meaning that the higher legal retirement age for men will increase the total amount of contributions. However, when Ding and Zhang (2006) explored the implications of postponing the retirement age, they found no significant effect on total pension benefit for either men or women. The years of contribution have a more significant effect on the gender gap in total pension benefit if men and women can have same wage, and female workers who retire at 50 can have 8% more total pension benefit

than men who retire at 60. Pei (2011) showed a different result that the number of contribution years has a significant effect on the gender pension gap.

Wu (2020) and Wang and Yang (2015) pointed out as women have more responsibilities in the family in terms of giving birth to children, nursing them and caring for children and the older members of the family. Women's careers are more likely to be interrupted during their working life because of these family duties, so it will be more difficult for them to reach the fifteen years required to receive a pension benefit (Chen and Huang, 2018). The interruption of their career could also lead to an interruption in pension contributions and reduce the years of contribution.

Excluding the gender difference in retirement age, the eligible working years of women are also lower than those of men. Working for a shorter time equals fewer contribution years, so even if men and women have the same wage, the accumulated individual account for women will be less than men's (Chen and Huang, 2018). Wang and Li (2013) compared the replacement rate for men and women (workers and cadres) if they have different contribution years. The number of contribution years also affects the replacement rate (which is why the retirement age matters, as Wang and Li (2013) assumed that people would enter the labour market at 20 and make continuous contributions until they retire), more contribution years will result in a higher replacement rate. But even with the same number of contribution years, men always have the highest replacement rate, female cadres have the second highest and female workers have the lowest.

4.2.2.3 Life tables

Life tables are the last variable in this section. Ge and Yue (2017) showed that women have a higher expected accumulated rate because they live longer. As women have a longer life expectancy and retire earlier than men, they will have a longer time in which to receive a pension to support their life. However, the monthly pension benefit is not only related to the total contribution, it also relates to the number of months of receiving the pension. The calculation formula takes expected life years into consideration, so the longer the retirement a retiree has, the lower the average monthly pension will be. As women have a longer life expectancy and earlier retirement age, the proportion of monthly pension from the individual account for women will be less than for men even if they have same total amount in the individual account (Zhang, 2013). Gao and Zhao (2020) found that longer life expectancy is likely to increase the optimal retirement age for both genders. In the current economic system, to achieve the goal of maximising personal utility, the optimal retirement ages for men and women would be 58.54 and 60.16 respectively.

After reviewing the empirical literature, we can see that the different retirement age is the variable which has attracted the greatest attention from researchers, and the different retirement

ages could increase the gender pension gap in the UEPS. As for other variables, different scholars have reached different conclusion about which variables have a significant effect on the gender pension gap, for example, Pei (2011) and Zhang (2010) pointed out that retirement age and education are the main reasons for the gender pension gap whereas Ding and Zhang (2006) found that the difference in pension benefit between men and women of the same age is mainly due to the influence of pension policies, followed by the gender gap in wages, and finally the impact of retirement age. These studies have shown that when the causes of the gender gap in the pension scheme are considered, multiple variables should be considered together rather than just a single variable.

4.3 The literature on the gender difference in the New Rural Social Pension Programme

Since the NRSPP was introduced in 2009, many researchers started to explore the transition from the old rural pension scheme to the NRSPP (see Li, 2012), the effect of the NRSPP on labour supply (see Qin and Guo, 2021), the substitution effect of the NRSPP on the traditional family support to rural aging people (see Wang and Hetzler, 2015; Wang, Zhou and Zhu, 2013) and the impact factors which can affect peasants' decisions on whether to participate in the NRSPP (for example, Zhong and Nie, 2013; Liu, 2017). The study of the gender gap in rural areas is usually associated with the importance of family support in rural households and how far family traditions are in transition (Fan, 2009)On the one hand, elderly parents enjoyed financial support from their son but on the other hand they preferred to live with their daughter, regardless of whether the daughter was married. Fan (2009) showed that the values and the ethical basis of family support for the rural elderly have been changing.

The NRSPP is a voluntary pension scheme which no longer relies on the contributions of the individuals alone. The central government and local government promise a basic pension benefit to participants in NRSPP from social pooling. The government expected the NRSPP to deliver a universal social programme to protect the rural population by its generosity in terms of both funding and payments. Whether rural dwellers are willing to participate and what factors will affect their willingness should be analysed and discussed carefully. Studies of the impact factors on rural people's participation intention and behaviour in the NRSPP will be reviewed in the next section.

The literature contains analyses of micro-level survey data to identify how NRSPP participations rates can be explained. The datasets used in previous studies include both national datasets and data collected in a specific area. For example, some scholars collected their data from developed counties in East China, such as Shi, Fan and Wang (2009); Wu (2009); Lin (2010); Jiang (2011); Mu and Yan (2012); Li (2013); Zhao, Li and Huang (2013); Hu (2014a);

Tu and Hei (2015) whereas others used data collected from undeveloped counties in West China (Feng and Dai, 2010). There have also been studies focusing on minority areas in the central and western regions (Huang and Xie, 2012; Su, 2014). Several authors (see, Yang, 2011; Liang and Wang, 2016; Wang, 2011; Wu, 2014; Zhao et al., 2016; Bian et al., 2018; Zhang and Wu, 2014; Xu, 2011; Chang et al., 2014) used data collected from several provinces with the aim of exploring regional differences as well as other factors explaining motivation to join the NRSPP. Most of these researchers collected their data by themselves with their datasets containing data for one year only, putting together a cross-sectional dataset, with most of them applying the simple logit or simple probit model for their analysis. Only Zhao et al. (2016) and Bian et al. (2018) used panel data, which means that their datasets contained information about the same subjects for two or more times. Bian et al. (2018) applied a fixed effect logit model whilst Zhao et al. (2016) used a simple logit model. The fixed-effect logit model controlled the effects from time-invariant variables, for example, gender and race, but the effect of these time-invariant variables can not be estimated in fixed-effect models. Fixed models can help to control the omitted variable bias unless the omitted variables change over time (Allison, 2012).

As most of the authors used their own questionnaire design to collect the data in different time spots and different regions, the variable lists used based on the questionnaire in each paper were different, but there still were some commonalities in the selection of variables. The independent variables used in previous studies can be divided into three dimensions. The first is personal characteristics, which includes variables such as gender, age, education level, health condition, marriage status and *hukou*. The second dimension comprises variables which can provide information about the family, including the land space available to the family, the number of children, the number of sons, total family income, and family expenditure. The third dimension consists of the variables which can provide information about the community, such as the location of the data collection area, how many neighbours participate in the NRSPP, the degree of satisfaction with the government's policies, and the level of understanding of the NRSPP. As the independent variables and datasets are quite different in the studies in the literature, it is perhaps not surprising that the authors reach different conclusions about the impact factors of the rural residents' willingness to participate in the NRSPP. The results of coefficients from different papers' regression models are summarised in the next section.

4.3.1 A reflection on individual dimensions

For the variables in the first dimension (the individual dimension), gender is one of the most highlighted factors in previous quantitative studies when scholars tried to determine the impact factors which can affect rural dwellers' decisions on whether to participate in the NRSPP. There are four results regarding gender coefficients in the logit regression model: the significant positive gender coefficient (Liang and Wang, 2016; Wu, 2009; Jiang, 2011; Yue, 2004; Tu and

Hei, 2015; Chen, 2015; Deng and Liu, 2013; Wang, 2011), the insignificant positive coefficient (Huang and Xie, 2012; Li, 2013; Hu and Shen, 2016; Zhong and Nie, 2013), the significant negative coefficient (Mu and Yan, 2012; Chen and Luo, 2016; Lin and Wang, 2012; Yao, 2015) and the insignificant negative coefficient (Chang et al., 2014; Zhao et al., 2016; Shi, Fan and Wang, 2009; Zhang and Wu, 2014; Liu and Xu, 2014; Hu, 2014a; Wu, 2014; Liu, 2017; Zhao, Li and Huang, 2013; Li and Cui, 2014; Xu, Liu and Chen, 2014). The positive coefficient in these studies suggests that women are more likely to participate in the NRSPP than men; the possible reason for this could be that Chinese women have a longer life expectancy then men. One of the explanations provided is that as income from non-retirement schemes after retirement cannot be guaranteed and as women are more likely to be exposed to social risks, they opt to participate in the NRSPP to reduce the risk of retiring without any income (Tu and Hei, 2015; Deng and Liu, 2013). Studies which had negative coefficients for the gender variable show that men have a greater incentive to participate in the NRSPP than women with the possible explanation for the negative coefficient that male peasants are more likely to be engaged in manual labour and they favour social insurance to protect themselves when they become old. Additionally, female peasants are influenced by the traditional notions of male superiority and family-centred values suggesting that female peasants would be more likely to rely on family support when they get old than make sufficient contributions during their working life (Mu and Yan, 2012).

Age is the second most frequently mentioned variable in the literature as a significant factor influencing willingness to participate. However, the findings about the effect of the age variable in deciding whether rural residents will participate in the NRSPP are ambiguous. Some scholars found that age has a significant positive effect on making the decision to participate in the NRSPP (Liang and Wang, 2016; Wu, 2009; Hu, 2014a; Mu and Yan, 2012; Luo and Shu, 2011; Huang and Xie, 2012; Li and Cui, 2014; Hu and Shen, 2016; Xu, Liu and Chen, 2014; Liu, 2017; Zhao, Li and Huang, 2013; Zhong and Nie, 2013). In other studies, such as Shi, Fan and Wang, (2009); Lin, (2010); Jiang, (2011); Deng and Liu, (2013); Li, (2013); Liu and Xu, (2014); Wu, (2014); Zhang and Wu, (2014) and Chen, (2015), the researchers stated that the age variable still has a positive coefficient but the coefficients of age in their studies were not significant. Studies with positive coefficients for age stated the obvious fact that older people will face the pension issue sooner. As the NRSPP requires fifteen years of contributions to be eligible for the pension, people who are aged over 45 are usually the most active participants in the NRSPP (Huang and Xie, 2012; Liang and Wang, 2016; Hu, 2014a). It is important to mention here that prior to the NRSPP, there was little or no effective incentive mechanism to encourage rural dwellers to participate in the old rural pension scheme. Although the NRSPP is more generous and receives additional funding than ORSPP, the generosity levels in comparison with the UEPS are still much lower with the rate of accrual remaining overall low.

Lei, Zhang and Zhao (2013) stated that young adults in rural areas display myopic behaviour as they regard it as too early for them to think about life after retirement age. Young adults could participate when they reach the age of 45 and they would rather save the money than contribute to the NRSPP for the future while they are still in their 20s or 30s (Luo and Shu, 2011; Mu and Yan, 2012). This could also indicate that the fifteen-year contribution policy might induce adverse incentives for participation rates (Zhao et al., 2016).

In contrast, Yue (2004), Feng and Dai (2010), Yang (2011) and Wang (2011) stated that age has a significant negative coefficient whereas Lin and Wang (2012), Yao and Jun (2015) Tu and Hei (2015) and Chen and Luo (2016) stated that age has an insignificant negative coefficient. Other studies (Zhao et al., 2016; Bian et al., 2018; Chang et al., 2014; Su, 2014a) found that age has a reversed U-curve effect, signifying that preference to participate is low in early and late adult years but higher during people's 40s and 50s, with evidence showing that the turning age point is 56 in Change et al. (2014)'s study. As age increases, the probability of participating in the NRSPP will increase to an age point after which there will be lower willingness to participate in the NRSPP. The possible reason of the reversed U-curve effect of age is that rural people who aged over the turning point were less likely to participate in the NRSPP as they might opt to make a supplementary lump sum payment at the legal retirement age of 60 to qualify for the basic pension benefit from the NRSPP (Chang et al., 2014).

Education level is the third variable in the first dimension, which also has four results when analysing the effect of education level on the decision to participate in the NRSPP, the significant positive coefficient (Wu, 2009; Yang and Wang, 2012; Chen and Luo, 2016; Lin and Wang, 2012; Huang and Zhan, 2012; Liu, 2017), the insignificant positive coefficient (Wang, 2011; Li, 2013; Zhang and Wu, 2014; Lin, 2010; Jiang, 2011; Huang and Xie, 2012; Yue, 2004; Chang et al., 2014; Chen, 2015; Deng and Liu, 2013; Yao, 2015), the significant negative coefficient (Tu and Hei, 2015; Su, 2014a; Wu, 2008; Liang and Wang, 2016; Liu and Xu, 2014; Mu and Yan, 2012; Li and Cui, 2014; Hu and Shen, 2016) and the insignificant negative coefficient (Hu, 2014a; Bian et al., 2018; Shi, Fan and Wang, 2009; Zhao, 2017b; Xu, Liu and Chen, 2014; Zhao, Li and Huang, 2013; Zhong and Nie, 2013). The studies which had a positive coefficient for education level stated that people living in rural areas will be more likely to participate in the NRSPP if they have a higher level of education on the basis that peasants with a higher level of education would be more able to understand the policy and be more aware of the risk after retirement (Yang and Wang, 2012; Li, 2013). Studies which had a negative coefficient for education levels stated that younger people usually have a higher level of education but at the same time are less likely to participate in the NRSPP compared with people aged over 45 (Zhao et al., 2016). Another possible explanation is that peasants with a higher level of education usually have the ability to earn more money and have more revenue streams

so they do not have to worry about their life after retirement (Liu and Xu, 2014; Liang and Wang, 2016; Wu, 2008). The low level of contribution and low-level pension benefit in the NRSPP is another reason why the NRSPP cannot attract rural dwellers who are well-educated as peasants with a higher level of education do not need to rely on such a low-level pension benefit when they retire (Mu and Yan, 2012; Su, 2014a).

The health condition of the rural population is another variable in the individual dimension. Some scholars found that rural dwellers with better health had less incentive to participate in the NRSPP (Yang, 2011; Liu and Xu, 2014; Mu and Yan, 2012; Su, 2014a; Deng and Liu, 2013; Chen and Luo, 2016; Liu, 2017; Hu and Shen, 2016; Jiang, 2011; Lin, 2010; Wang, 2011). As rural elderly people are usually engaged in farming and rely on their own manual labour as their source of income, their health will directly affect their ability to farm. Those with poor health therefore have more incentive to participate in the NRSPP to reduce their dependence on family support and reduce the financial burden on families when they get old (Mu and Yan, 2012). Those with better health do not have a strong need for a basic pension benefit compared with peasants who are in poor health (Yang, 2011; Liu and Xu, 2014; Su, 2014a). Some scholars have presented opposite findings that rural peasants with better health are more likely to participate in the NRSPP than those in worse health (Yue, 2004; Shi, Fan and Wang, 2009; Zhang and Wu, 2014; Wu, 2014; Chang et al., 2014; Liang and Wang, 2016; Zhao et al., 2016). This could be explained as that rural people with good health usually have a stronger awareness of risk prevention and a longer life expectancy, so they are more likely to make some preparations for their life after retirement, such as saving more money and participating in the NRSPP (Shi, Fan and Wang, 2009).

Marriage status is a variable which has been included in some studies but is less common. The findings in regard to marriage status are quite consistent in the literature: rural peasants who get married are more likely to participate in the NRSPP than other marital status groups (single, divorced or widowed) and some of the coefficients are significant (Liang and Wang, 2016; Su, 2014a; Xu, Liu and Chen, 2014; Lin and Wang, 2012) whereas others are insignificant (Bian et al., 2018; Li, 2013; Deng and Liu, 2013; Zhong and Nie, 2013). Peasants who are married have more awareness of family responsibilities and they prefer to participate in the NRSPP in order to avoid financial risk after their retirement and ease the financial burden on their children (Su, 2014a; Deng and Liu, 2013). Lin and Wang (2012), however, found that divorced people had the greatest incentive to participate in the NRSPP, followed by married people, and peasants who are single have the least incentive to participate in the NRSPP.

There are some variables which have been included in several studies, such as *hukou*, minority nationalities and religion. The literature suggests that people in agricultural households are more

willing to participate in the NRSPP than those in non-agricultural households as the latter have more options, such as the UEPS (Mu and Yan, 2012). Ethnicity and religion did not have significant coefficients in those papers which included them in the logit model.

4.3.2 A reflection on family-related variables

The second dimension contains variables at the family level, such as the family income, family expenditure, the number of children, family size and family land space. Family income has been one of the most popular research topics in the second dimension and the results of the coefficient in the logit model are also ambiguous. The literature suggests that family income is positively correlated with the probability of participating in the NRSPP (for example, Yue, 2004; Liang and Wang, 2016; Liu and Xu, 2014; Hu, 2014a; Mu and Yan, 2012; Zhao et al., 2016; Wu, 2008; Zhang and Wu, 2014; Ling, 2013; Wu, 2009; Xu, 2011; Chang et al., 2014; Deng and Liu, 2013; Zhao, 2017a; Chen and Luo, 2016; Lin and Wang, 2012; Zhao, Li and Huang, 2013; Zhong and Nie, 2013). The positive coefficient has shown that as the amount of pension benefit is related to the amount of contribution, people with a low income are less likely to be part of the pension programme (Deng and Liu, 2013). A family with more money will be more likely to make a long-term contribution to the NRSPP in order to have an extra layer of security for their life after retirement. Often, a low monthly contribution will not affect their current standard of life (Wu, 2009; Hu, 2014a; Wu, 2008; Xu, 2011; Chen, 2015; Zhao, 2017a). Yang and Wang (2012), Li (2013), Li and Cui (2014), Su (2014a), Huang and Zhan (2012), Tu and Hei (2015), Hu and Shen (2016) and Liu (2017) all found that family income is negative correlated with the probability of participating in the NRSPP. This shows that even if a high-income family has the ability to contribute to the NRSPP, they also have more and alternative sources of funding to support their life after retirement, which explains the negative correlation (Su, 2014a; Yang and Wang, 2012). Luo and Shu (2011) made a different finding on the effect of family income on deciding whether to participate in the NRSPP; they found that the relationship between income and the probability of participating in the NRSPP is more like an inversed U-curve. Rural peasants with a high income or an extremely low income are less likely to participate in the NRSPP. People with an extremely low income cannot afford the long-term contributions whereas peasants with a high income think that the pension benefit level is too low for them to participate and because it cannot support their standard of life during their retirement, they have little incentive to join the NRSPP (Luo and Shu, 2011; Jiang, 2011).

Studies in the literature identified only negative coefficients on family expenditure. This suggests that families with higher levels of expenditure are less likely to participate in the NRSPP. Higher expenditure might suggest that a family has more spare money with older members of a wealthy family feeling more secure and not having to rely on the basic pension

programme (Feng and Dai, 2010; Liang and Wang, 2016) and might instead prefer to use a commercial insurance company than the NRSPP (Liu and Xu, 2014).

Land space in the family has had positive coefficient in all previous studies except those of Chen and Luo (2016), Liu (2017) and Bian et al. (2018). There are two explanations for this: the first is that having more land space might suggest that this family might have more spare money and greater ability to make a long-term contribution to the NRSPP (Yang, 2011), the other explanation is that more land space suggests that the family members have less opportunity to find a non-agricultural job (Wu, 2009) and are more likely to be exposed to agricultural risks such as natural disasters and market risks such as decreasing prices for their produce because of the long cycle of agricultural activities. Rural families with more land are more likely to participate in the NRSPP when they want to have in place an extra layer of security (Wu, 2008; Yue, 2004; Wu, 2009; Liu and Xu, 2014). As for the negative coefficient for land space, Liu (2017) explained that rural dwellers with more land might prefer the traditional way to retire: to rely on their family savings and the land rather than to participate in a 'new' pension scheme.

The variable 'number of children' has shown both positive (Liu and Xu, 2014; Shi, Fan and Wang, 2009; Chen, 2015; Chen and Luo, 2016; Lin and Wang, 2012; Liu, 2017) and negative coefficients (Liang and Wang, 2016; Hu, 2014a; Wang, 2011; Su, 2014a; Hu and Shen, 2016; Xu, Liu and Chen, 2014; Yao, 2015) in different studies. The positive correlation suggests that the concept of family support and 'raising children for your old age' is gradually being replaced by social support with the development of the economy (Chen, 2015; Shi, Fan and Wang, 2009; Liu and Xu, 2014). On the other hand, the NRSPP requires participants to make contributions if they would like to receive a pension after retiring. If a participant is quite close to 60 and has adult children, the adult children would usually pay the contribution for their parents. If the family has more adult children (or adult sons), these children can share the responsibility of making the contribution and the average contribution which each child should pay for their parents will be relatively low. Families with more children are therefore more likely to participate in the NRSPP (Shi, Fan and Wang, 2009). As for the negative coefficient for number of children, scholars have stated this is a result of the concept of raising children for old age being still deeply rooted in rural areas. People with more children have the more confidence in family support and believe that their children will guarantee the standard of their life in retirement, so they have less incentive to participate in the NRSPP (Su, 2014a; Wang, 2011). In some studies even though the number of children is positively correlated with whether to participate in the NRSPP, the number of sons in the family also has negative effect on the probability of participating in the NRSPP (Liu and Xu, 2014; Zhao, Li and Huang, 2013). If there are two families with the same number of children and all other conditions are the same, the more sons there are in the family, the less probability there will be of the parents

participating in the NRSPP. The probable reason for this is that the traditional concept of raising children for your old age translates into older parents relying on their sons. Daughters who have married into another family usually do not undertake the main responsibility for caring for their parents but concentrate with their husband on the needs of their parents-in-law (Su, 2014a).

4.3.3 A reflection on other variables

The third dimension is the community, such as the location. Previous studies reported in the literature usually collected data in one city and only few of them compared differences between regions. Studies which did mention different regions all concluded that peasants in the more developed rural areas are more open to the new policy and also have more spare money to make the long-term contributions (Wu, 2009; Wang, 2011; Shi, Fan and Wang, 2009; Yue, 2004; Xu, 2011; Huang and Xie, 2012; Chen and Luo, 2016). It is because in developed areas, the local government can provide more subsidies to collectives, which also encourages people to participate in the NRSPP (Xu, 2011; Wu, 2009). Huang and Zhan (2012) and Yao (2015), however, found that rural peasants in less developed areas in middle and western China are more likely to participate in the NRSPP than rural peasants in developed areas (eastern China).

After reflecting on the influencing variables in the participation rate of the NRSPP, there are some studies which have focused on the impact factors of the level of contribution to the NRSPP. The ordered probit model has been used to test the impact factors of contribution options in the NRSPP (Zhao, Li and Huang, 2013; Deng and Li, 2014; Yang and Tang, 2018). Zhao, Li and Huang (2013) and Deng and Li (2014) pointed out that women are more likely to choose the higher contribution grade than men whereas Yang and Tang (2018) found the opposite result that men are more likely to choose a higher contribution grade than women. Nie and Zhong (2014) used a logistic model to test the impact factor of choosing the higher contribution grade and reached the same conclusion as Yang and Tang (2018) that men are more likely to choose a higher grade. Huang and Zhan (2012) used the OLS model to test the influencing factors of contribution options in the NRSPP and found that peasants in eastern areas preferred to make higher contributions than peasants from central and western areas, whereas peasants in central areas had the lowest contribution amount. Yang and Tang (2018) similarly found that peasants in the more developed areas had a higher probability of making a larger contribution.

4.4 Gender inequalities and pensions: the theoretical review

It is nevertheless important to critically reflect on how far existing theories of social policy can explain or even try to solve the gender pension gap problem. However, most of the previous studies exploring the issue of gender pension gaps have been empirical and data driven, without the guidance of theories pertaining to gender differences in the pension system. Often, policy

problems and challenges dominate the aims of the research seeking to explain, compare and identify the causes and/or policy solutions for the gender pension gap. Studies of the Chinese pension system and the gender pension gap are no exception in terms of their empirical focus (see Section 4.1, 4.2 and 4.3 for a detailed overview). This thesis is an empirical study that attempts to examine the impact factors of gender gap in China's segmented pension system, yet I will try to reflect upon the theories based on my findings to examine their feasibility. In the section of discussion, I will reflect the empirical results with these theories to explain and even provide a solution to the gender gap problem in China's pension system. Given the absence of theories that are directly tied to gender differences in China's pension system, the existing theories of social policy should be reviewed and reflected in China's situation.

The most prominent theoretical approach in comparative social policy stems from the work of Esping-Andersen (1990, 1999). Esping-Andersen (1990) put forth three types of welfare regimes and systems which in combination produced three forms of welfare states: 'social democratic', 'conservative-corporatist' and 'liberal'. In the liberal welfare state, people are encouraged to reply on market provision and public provision is provided only to 'poor' citizens. By contrast, in the other two welfare states, a more well-developed and full-coverage provision can be provided. The difference could be attributable to the fact that social democratic welfare state favours social equality while the conservative-corporatist welfare state stresses classification and disparity of social status. Even though this classification of welfare state is well accepted in the research community, this typology developed by Esping-Andersen has quickly become the focus of debate (de Frel, 2009). Burlacu (2007) stated that the classification was designed for Western countries, especially European countries, and is not applicable in the Eastern-European countries. Lee and Ku (2007) noted that eastern Asian countries may not technically fit in any one of the categories of welfare state. Lee and Ku (2007) suggested the type of welfare state in East Asia should be considered as a combination of liberal and conservative models. Although Esping-Andersen's work has raised significant debates, it remains of great help to develop and to test the new hypotheses for explaining the development and effects of social policy (Arts and Gelissen, 2002).

Esping-Andersen (1990) identified the ability to maintain living standards and to have rightful access to public services as essential aspects of welfare protection. The concept of 'decommodification', which reflects the extent to which a person's normal way of life is independent of the labour market, was used to explore comparatively how similar and different welfare systems are in their provision of welfare services and payments, including pensions. Esping-Andersen (1990) identified that for someone to receive access to welfare, they would have to rely on basic or minimum pensions (often based on the criterion of citizenship), earnings-related or occupational schemes (based on work) or private options (such as private

plans with insurance companies). Esping-Andersen referred to the basic pension being based on the criterion of citizenship, but actually in many countries, including China, the basic pension is linked to an earnings-related pension scheme. For example, the public pension scheme for urban employees in China has two elements: social pooling and an individual account. The social pooling is considered as providing the basic or minimum pension whilst the individual account is earnings-related. Employees have to make at least fifteen years of contributions to their individual account in order to receive the basic pension from the social pooling. Otherwise, they can only receive the accumulated amount from their individual account.

For women, this has meant that they could rely on the basic or minimum pensions but also on the second and third main pillars if they are working. This last point was not well developed in his earlier work (Esping-Andersen, 1990) and as a result attracted much criticism from scholars adopting a feminist critical view. Many feminist scholars criticised the notion of gender-blindness in the scheme of Esping-Andersen (Orloff, 1996): the citizens are set to be male, and the gender difference in the relationship between states and families is dismissed in the three types of welfare state. Moreover, women's invisible works (like housework, unpaid care to children and elderly) on behalf of social welfare are not discussed (Sainsbury, 1994a, 1994b, 1994c; O'Connor, 1993). As a matter of fact, Esping-Andersen (1990) does not entirely ignore the gender issues, instead the gender relations within employment were examined in his other studies (especially from 1999 onwards). However, a growing number of feminist researchers have used or modified his ideal-typical scheme to incorporate gender inequalities on the investigation of the differences between regimes (Orloff, 1996). They argued first that women are more likely to rely on basic and minimum pensions because their careers are often interrupted due to care responsibilities. Additionally, for someone to be decommodified (that is, to maintain their living standards), they have to be employed first, that is, they have to be commodified (Knijn and Kremer, 1997). In the conservative-corporatist welfare state, subsidiarity is highlighted for women and the women would be dependent more on their family to get access to the welfare. In the social-democratic welfare state, the services that could allow people in charge of childcare -- most often married mothers -- are provided so that they can join the labour market. In the liberal welfare state, the gender relation is somewhat ignored and is at the mercy of the market. For Esping-Andersen (1990, 1999), women are more likely to be 'commodified' in the social democratic and liberal welfare states and less so in the conservative-corporatist welfare state. In the latter women rely on family and marriage to access benefits, a condition that remains however valid for the other welfare states too (but often for tax or means-testing purposes).

One of the key arguments developed by the feminist critique of Esping-Andersen was that the welfare system provisions were built around the principle that men were participating in the

labour market ('male breadwinners') and women had to 'reconcile' work and family obligations (Lewis, 1992, 1997, 2002; Liu, 2003). This typical household form of male-breadwinner-female-housewife excludes married women from the labour market and reduces wives to become complete subordination to their husband in terms of tax and social security rights, owing to the lack of public support (Lewis, 1992). Women are mostly engaged in the unpaid caring work for elderly and children in the family. Nancy Fraser criticized the male-breadwinner-female-housewife household form in the American welfare system as "gendered" and "dualistic": the employment-based social insurance system targets male breadwinners, whereas the relief programme, including food stamps, targets women with low level of protection and come up with hardship (Dai, 2014). Therefore, in most of the cases, a woman's entitlement to welfare benefits is not based on her independent personality and identity, but on her role in the family. In Esping-Andersen's welfare system provisions, women were more likely to have interrupted careers and take time out of the labour market for tending to their care responsibilities. This exposed two issues – first that women are not entering the labour market in the same numbers as men and second, neither do they have the same opportunities as men to build their careers. This is consistent with China's situation that the female labour force participation rate is always lower than the male labour force participation rate (World Bank, 2021a, 2021b). The importance of these approaches was that they highlighted the limitations of the original Esping-Andersen (1990) theorisation, with Esping-Andersen later (1999) identifying that one possible solution to these issues was to encourage women either through labour market activation schemes or the extension of public or affordable provision. Following the logic of Esping-Andersen's argument, the commodification of women can be seen as a crucial step for equalising labour market participation rates between men and women, a step which would also allow women to build their own pension pots based on their 'enhanced' employment and possible career progression. Frericks, Knijn and Maier (2009) disagreed with Esping-Andersen and suggested that the concept of 'commodification' capture the gender difference by ignoring it rather than overcome it. In China, the female participation in the labour force is lower than that of men, despite the fact that on a global comparative level their participation is higher (68.8% in China and 53.9% as the world average in 2017[17]) and thus more commodified (Xiao and Asadullah, 2020). This current study explored whether the commodification of women in China, especially female employees in urban areas, can decrease the gender discrimination in the labour market or allow women to build their own pension pot, so the gender gap is still significant in China's pension system.

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[17] The data is taken from the World Bank's 'Labor Force Participation Rate, Female (% of Female Population Ages 15–64) (Modeled ILO Estimate)'. https://data.worldbank.org/indicator/SL.TLF.ACTI.FE.ZS?locations=CN

Reflecting on Esping-Andersen's framework, Sainsbury (1994c) proposed another household form known as the individual model, in which both men and women can become breadwinner and care giver. In this model, women can also get access to the social security entitlement individually rather than being subordinated to their husband. The caring work is no longer unpaid, and the help to the care giver can be provided by the state. As more women become able to enter the labour market, their individual contributions will also be more likely to increase. Similarly, a higher percentage of women in the labour market is likely to push reforms for offloading care responsibilities outside the family, which scholars often refer to as 'defamilialisation' (Eithne and Glendinning, 1994). This feminist concept 'defamilialisation' which was developed by Lister (Lister, 1994, 1995) is probably the most widest used feminist concept in comparative welfare studies (Kröger, 2011). Lister (1997) defined 'defamilialisation' as 'the degree to which individual adults can uphold a socially acceptable standard of living, independently of family relationships, either through paid work or through social security provisions' (p.137). However, some researchers, such as Esping-Andersen (1999) and Korpi (2000), inaccurately defined the 'defamilialisation' as how far the welfare states decommodify family rather than women in the family. These researchers only stress the freedom of family, and yet ignore gender difference and women's actual situation. Taylor-Gooby (1996) defined 'defamilialisation' as how far the welfare states support women and enable women to live as an individual person rather than a man's wife. In view of this definition, women's freedom is subject to the length that the welfare states will go to help them participate in the society (Bambra, 2004, 2007). Daly and Saraceno (2002) stated that all works of both genders should be commodified and the care jobs need to be marketized to defamilialise the welfare regime.

The challenge to achieve 'defamilialisation' in the case of China is that women have to take care of family and also work in the labour market. The care responsibilities still remain domesticated within the family (or extended family) unit as the increase of female labour market participation is not accompanied by the growth of public caring institutions (Sung, 2013). Esping-Andersen's (1999) approach would effectively suggest that the commodification of women could undermine labour market inequalities and allow women to build their own individual pension contribution records but the lack of public and affordable childcare might render this approach limited in explaining how the gender pension gap can be dealt with. Additionally, the fact that caring is not recognised as paid labour could mean that women are more likely to have an interrupted career and contributions record. Peng (2012) argued that the significant growth of women's participation rates in the labour market has not led to a substantially increased share of care responsibilities for men. The situation in China remains that even if women also work as one of the breadwinners in the family, the responsibility to take care of the family remains gendered.

An important weakness of Esping-Andersen's approach is that it takes into consideration the fact that many countries, especially those with extensive informal welfare regimes (Gough et al., 2004), are exposed to a cultural embeddedness which genderises the responsibility for care (Saxonberg, 2013), often imposing care responsibilities onto women rather than men (Roumpakis, 2020). This is what happens in China – in fact, China has a strong cultural expectation of gender and caring roles, burdening women, daughters and wives, with these care responsibilities, often at the expense of their working careers (Sung and Pascall, 2014). Cultural aspirations in terms of how gender roles are assigned suggest that these are embedded, not just in the labour market but also in other aspects of social life, including relationships of care and education. In the framework of traditional culture, different task priorities are assigned to men and women: work is for men, while domestic works and family responsibility are for women (Gutek, Nakamura and Nieva, 1981; Gutek, Searle and Klepa, 1991). Such expectation of gender role also applies in China (Guo, 2020).

The role of family has been identified as playing a key role in East Asian countries, including China. This often means that family plays a pivotal role both as a welfare and economic actor (Papadopoulos and Roumpakis, 2017, 2019). These relationships engrain gender inequalities and hierarchies of power which are long-established and often difficult to change (Walker and Wong, 2005). It could be hypothesised here that women in rural China are less likely to participate in a pension system which is highly related to their employment history, not only because they are likely to have lower rates of labour market participation but also as they would be more likely to be expected to deliver care and serve the household economy by staying at home or being involved in agricultural duties. The latter roles, along with informal work, are often responsible for not enabling women to establish or accumulate sufficient savings in their own individual pension pot. Additionally, it could mean that women in rural areas would be culturally expected to honour family traditions and assigned roles and have less opportunity to develop their own skills and expertise through education.

In urban China, as women are also commodified, they need to spend time on their career and not be able to concentrate as much on their family as before. In that case, the longer time they spend on their work, the higher probability of harbouring work-family conflicts, considering that traditional culture has specific gender role expectations for women, which is to spend time more on their family (Duxbury and Higgins, 1991). However, the changes of employment structure and family structure in the industrial era have collided with the traditional culture gender role (Zhai, 2019). Women are no longer restrained in the role of mother and wife, they can also be the breadwinner. Hence, this tradition male-breadwinner-female housewife household form could not meet the demand of modern family (Jin, 2018).

Esping-Andersen's (1999) approach found 'defamilialisation' to be the prerequisite to decommodification, through which women are able to commodify their labour (Jin, 2018). Esping-Andersen (1999) stated that in the conservative-corporatist welfare state, family is the provider of the welfare and that 'defamilialisation' is not the aim of their welfare. The liberal welfare state can achieve 'defamilialisation' by marketizing the care services, yet it is social democratic welfare state that can prompt 'defamilialisation' in a real sense as often child (and elderly) care remains within the realm of public, affordable and good quality services.

The concept of 'defamilialisation' used by Esping-Andersen stresses how the family can undo the heavy yoke of traditional welfare provision responsibilities through marketization or social policy. How individuals gain sufficient autonomy in family-related decisions requires additional discussion. 'Defamilialisation' in Esping-Andersen's framework can not meet the demand of feminist researchers for the 'gender sensitive' typology of welfare regimes (Jin, 2018). Mathieu (2016) put forth the concept 'demotherization' for the 'gender sensitive' typology of welfare regimes. 'Demotherization' refers to how far mothers can be freed from family responsibilities especially in terms of taking care of children. For instance, children could be attended to through a new division of labour among family members. The different notions of 'defamilialisation' only emphasises the role of state or the market, while 'demotherization' features the distribution of care responsibilities between family members. Furthermore, this concept places "care work" as the central topic of analysis, highlighting that mothers usually take up the care task rather than the families (Mathieu, 2016). The traditional gender role expectation of labour is no longer consistent with the concept of 'demotherization'. As women can be freed, at least in part, from the caregiving job, they now have - in principle - more opportunities to get employed and to participate in the labour market. Women can also develop their own career without having to worry about the work-family conflicts. In so doing, women could make sufficient contribution to the occupational pension. However, the weakness of 'demotherization' concept relates to the social value of care work and in particular how caring responsibilities are shared. This relates not just how care is shared between parents but also in relation to accessing good quality and affordable childcare via the market or the state. The latter however does not necessarily mean a direct questioning of cultural stereotypes and gender role expectations for women.

The fourth theoretical approach is the logic of industrialisation. Wilensky (1975) showed that there was a positive correlation between the level of industrialization and aggregate social spending among selected OECD countries. The rationale for this argument was that with economic development, governments would be able to spend more resources on their welfare provisions. The welfare state model in East Asia focuses on economic development rather than social welfare. Therefore, the development of welfare in East Asian countries is mostly

attributed to the needs of economic growth (Ju, 2017) with less attention being paid to cultural or social value of care and its importance for sustaining economic growth. Although these correlations have been questioned when it comes to Global South countries (Gough et al., 2004), economic growth remains one of the key variables for explaining income inequality. In the case of pensions, this could relate to the development of fiscally sustainable and financially adequate pension systems. The expectation therefore would be that the more advanced the economy, the more likely it would be that gender inequalities would be lower. Crucially, China offers an interesting testing ground for this theory in the NRSPP as local governments have been able to run their own pension schemes but crucially are able to incentivise participants with different levels of pension payment, often based on their different levels of economic development and wealth. A local government in a more developed area usually offers higher subsidies to the individual account if the participants choose a higher level of pension contribution. Based on the results of quantitative analysis, the logic of industrialisation will be examined to explain the gender gap in the NRSPP in China.

The fifth theoretical approach is the role of institutions and pension legacies. The work of Esping-Andersen (1990) and also the work of American scholars (Skocpol, 1984; Pierson, 1994) highlighted the importance of policy and institutional legacies for creating and reproducing inequalities within a welfare system. Historical institutionalist research often highlights the long-term impact of early or earlier decisions on contemporary life. In the case of the gender inequalities in the pension system, the research can explore how far different pension settings and schemes can really matter in reproducing or ameliorating gender inequalities. Frericks, Knijn and Maier (2009) argued that the more a pension system relies on earnings-related (second pillar) schemes to offer income protection in retirement, the more exposed women are during retirement. The same applies to pension schemes which are based on individualised contributions and schemes, with weak redistribution of any social (risk) pooling. Additionally, the same logic would apply to private funded schemes, as these tend to favour a steady flow of contributions, often without offering any redistribution. In contrast, pension systems in which public schemes and collective redistribution have an important role for pension provision, women would be less likely to be exposed to pension inequalities during retirement.

One of the defining choices of this thesis was to explore the extent to which the multiple pension reforms over the years have had an impact on the gender pension gap. The Chinese government has run several pilots (see Chapter 3 for more details) and has often tested the ground for policy solutions. The aim has been to amalgamate the differences among the various pensions schemes in place and offer a unified scheme both across all China's regions and also across rural and urban areas. It is worth considering therefore how far the existing gender gaps

across and within the urban and rural pension schemes fare, and how far more recent reforms have managed to address these inequalities.

The final theoretical approach developed an East Asia regional focus. Holliday (2000) identified that social policy often becomes subordinated to the needs of the economy. Essentially, social policies acquire a functionalist role of enhancing efficiency and productivity rates. Partly this can be accommodated through investment in skills and training. The focus on education and on nurturing skills is therefore essential to achieve a greater level of productivity and hence economic growth. As part of this argument, when women have access to better education, they will be able to have better-paid jobs and more opportunities for promotion. Since ancient times, China's educational resources have been skewed in favour of men, with men studying to achieve success and women staying at home to raise their children. Over the past thousands of years, family is the main provider of the welfare in China. Chinese women are expected and educated to be 'good wife and good mother', rather than skilled workers. This situation has improved in modern China, especially since the introduction of the one-child policy, both boys and girls have more opportunity to be educated but the educational resources is still skewed to men, especially in families with many children. The argument here echoes the logic of commodification, as discussed earlier, but the focus is not simply on pushing women into the labour market but also encouraging their educational development and hence their chance for a better-paid job and working conditions. Papadopoulos and Roumpakis (2017) exposed the limits of this argument when one takes into consideration the minimal role of the state and employers in funding or absorbing social risks, thus transferring most care responsibilities to families and predominantly to women (see Roumpakis, 2020). The hypothesis developed from this argument is that education could play a crucial role in improving women's ability to enter the labour market and achieve better wages. This is expected to narrow any pension gender gap. The opportunity to have a higher level of education will be tested between genders in this thesis to see whether educational opportunities favour men rather than women in China. How the gender gap in educational opportunity exists in urban and rural areas and how it could affect gender gap in the pension system will also be tested in this thesis.

4.5 Conclusion

This review of the relevant literatures has shown that studies of the gender gap in China's current pension system have hardly considered the segmentation of China's pension system at all. Each pension scheme has its own regulations and policies and the situation of aging men and aging women in different pension schemes could vary considerably. Some researchers have tended to focus on a particular pension scheme, mainly the UEPS.

In the studies which focused on the gender gap in the UEPS, most of the researchers used a simulation model or actuarial analysis to determine which factor(s) will affect the gender gap, such as Chen and Li (2004), Ding and Zhang (2006), Li (2008) and Mi (2016). Few scholars, however, have paid attention to explaining the gender pension gap, with the exception of Pei (2011) and Zhang (2010). Additionally, many of the studies focused on a particular point of time. For example, Zhang (2010) used data from 2003 and concentrated the research on Shanghai only.

For pension schemes in rural areas, the logit model has been most popular model for analysing the impact factors on willingness to participate in NRSPP. The effects of the selected variables on whether peasants decide to participate in NRSPP are quite ambiguous, and the results for common variables such as gender, age, health and education level are quite different. Most of the studies used datasets collected by authors themselves with quite small sample sizes, and the questions in their questionnaires contained different variables, with the majority of studies collecting data for one year only and in a specific area.

In this thesis, I selected CHARLS as my dataset. This is a dataset covering most of China's provinces and contains four waves of surveys (2011, 2013, 2015 and 2018), so the sample size would be much larger in order to provide more significant results when analysing the effect of each variable on the gender gap in China's pension system. I shall explore the gender gap in China's pension system by considering the segmentation in urban and rural areas. In urban area, the UEPS will be analysed as more employees are covered by this scheme than by the Civil Servants' Pension Scheme. In rural areas, the NRSPP will be analysed because it replaced the ORSPP.

For the UEPS, multi-linear regression and descriptive data analysis will be used. In the previous studies, especially in those which used a simulation model to carry out the actuarial analysis, the researcher(s) consistently assumed people to be ideal, which means that their working life will not be interrupted, they will build up uninterrupted contribution years until they retire and they can be assumed always to have the average income. However, these things might not all be achieved in real life. To see how these impact factors can have an effect on the gender pension gap in the UEPS in real life, it would be ideal to explore how far the retirement year and policies in place at the time impact the gender pension gap. However, there is no such dataset available yet. For that reason, I decided to create a new dataset under CHARLS which divides participants into five groups based on their retirement years and the milestones of reform in UEPS to fill this gap and also to explore the effects of the policy reforms over time and how these changes are reflected by the milestones of reform history. In this way, my intention in this study is to contribute to the knowledge in two ways: first, by creating a new dataset and second,

by analysing the gender pension gap based on retirement years, which has never been considered in the previous studies.

In regard to the pension system in rural areas, it is easy to see that the logit model has been the most popular model for analysing the impact factors on the willingness to participate in the NRSPP. The effects of the selected variables on whether peasants decide to participate in the NRSPP are quite ambiguous. In this thesis, I merge the four waves of surveys (2011, 2013, 2015 and 2018) in CHARLS to create a completely new panel dataset, and the sample size will be much larger in order to provide more significant results after analysing the effect of each variable on willingness to participate in the NRSPP. A mixed-effect logit model is used instead of a simple logit model, and 'region' will be added as an independent variable in order to capture any regional differences. Also, the gender variable has usually been used as one of the independent variables in previous studies, but how these impact factors will affect the participation behaviour in the NRSPP for men and women separately has hardly been studied. I used the mixed-effect logit model separately for men and for women in order to see how the impact factors in participation behaviour in the NRSPP will be different between the genders.

In the literature, researchers who wanted to analyse the impact factors on the gender gap in pension provision usually focused on one single pension scheme. How the gender gap exists differently in urban and rural areas and whether there are any differences and commonalities in the impact factors on the gender gap in urban and rural pension schemes are issues which have only rarely been addressed in previous studies. As the Chinese government would like to unify the pension schemes in the future, a comparison between the impact factors on the gender gap in urban and rural pension schemes need to be carried out. After studying these two schemes separately, the current study will be able to explore how the gender gap compares in urban and rural areas and whether the impact factors identified separately in urban and rural pension schemes show any commonalities; these are issues which have never been considered in previous studies.

It is noted in section 4.4 that the previous literatures on study gender gap in pension system are mostly empirical-driven and data-driven, the research results are somewhat detached from the theories of social policy. The review found six theories of social policy that could be used to explain the gender gap in pension system in China, including the most prominent theorical framework from Esping-Andersen, the concept of 'decommodification' and 'defamilialisation' by Esping-Andersen (1990, 1999), the concept of 'demotherization' by Mathieu (2016), the logic of industrialisation, the role of institutions and pension legacies and the east Asia focus. When these theories or concepts were proposed for the first time, they were not intended to explain gender differences in the pension system per se. Reflecting on these theories however

allow us to appreciate how gender is approached in welfare regime and state theory and more importantly consider the key reasons for explaining, reproducing and possibly tackling the gender gap among pension systems. The focus of this thesis remains firmly located in China and we will revisit these approaches in light of the empirical findings.

The ultimate aim of this research is to identify which aspects of pension policy should be given the most attention should the Chinese government seek to reduce the gender gaps in the UEPS and the NRSPP respectively. This thesis also provides theorical reflections by examining the link between these theories with the empirical results of gender gap in pension system. As the Chinese government would like to form a uniform pension system in the future which ignores the existing segmentation, this study could also provide some suggestions after comparing these two pension schemes for any commonalities explaining the gender gap. In the next chapter, I shall present the research questions and the research design.

Chapter 5. Research design

5.1 Introduction

In the previous chapters, a clear explanation of the structure of China's current pension system was presented, dealing the development history of China's labour market and the various attempts to reform the pension system. After reviewing the literature investigating the inequalities in China's pension system, I shall move on a step further in this thesis to investigate the importance of the segmentation of China's pension system for the gender gap. The segmentation of the system is shown in Figure 5.1. Because the Chinese government wants to establish a more equitable, sustainable pension system with full coverage on a national scale, a study of the impact factors on the gender gap within the urban/rural divide in the system is necessary. The UEPS was selected in urban areas because more employees covered by the UEPS than by the Civil Servants' Pension Scheme. The NRSPP was selected to represent the pension scheme in rural areas as the ORSPP was more like an individual savings programme than a social security system.

To investigate the gender gap in the segmented pension system, a quantitative approach will be applied using a secondary dataset. For this study, the 'China Health and Retirement Longitudinal Study' (CHARLS) was chosen as an appropriate means of analysing the gender gap in China's pension system. The reason for choosing CHARLS rather than other secondary datasets will be explained later. There were two reasons for using a secondary dataset rather than collecting the primary data myself. First, China is an extremely big country and there would therefore have been significant challenges to acquiring a sufficient sample which could represent the whole population. The challenge would have been the lack of resources in terms of both money and time needed to collect primary data to guarantee that the sample size is big enough. The second reason is that, if I were to carry out research into the variation tendency in regard to the gender gap in China's pension system, that would require panel data rather than cross-sectional data or time-series data, and I would have had to track the same group of people for several years, or at least part of the same group of people for several years, to track the change and research the variation tendency. Again, this would not be possible or realistic within the parameters of a PhD study. Instead, I decided to use the CHARLS secondary dataset which satisfies the main requirements of containing relatively sufficient samples and the fact that interviewees can be grouped based on the pension schemes in which they are involved. The data in CHARLS can also be combined with cross-sectional data and panel data as they use consistent ID numbers to mark the same interviewees in different years. The methods used to address the research questions, dataset selection and the data cleaning process are set out in this chapter.

Figure 5.1 China's segmented pension system
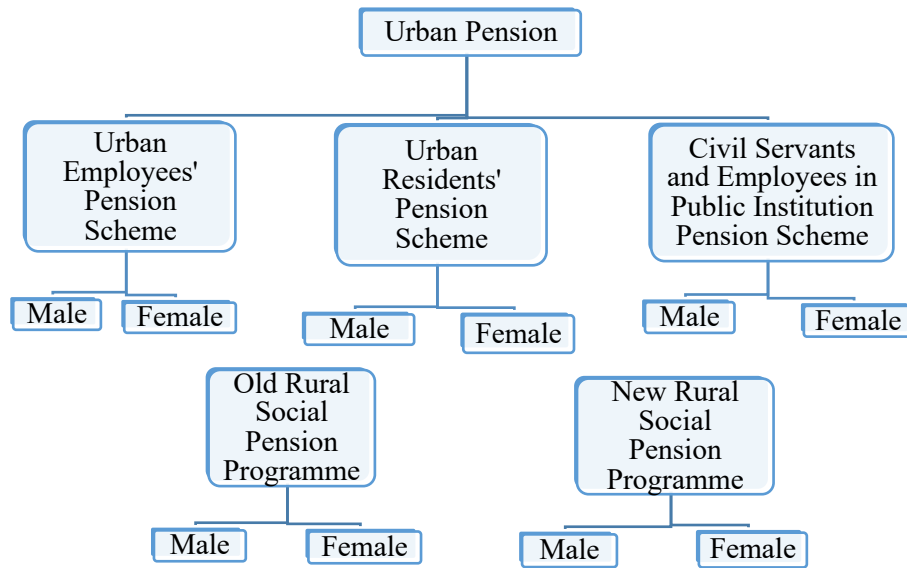
Source: Summarised by the author

5.2 Research Questions

For this study, a multi-level analysis comprising descriptive analysis and inferential analysis was carried out using data from CHARLS to address the following five research questions:

1.   Is there a gender gap, in terms of pension benefit, in the Urban Employees' Pension Scheme (UEPS)? Is the gap narrowing or widening over time?

2.   Is there a gender gap, in terms of participation rate, in the New Rural Social Pension Programme (NRSPP)? Is this gap narrowing or widening over time?

3.   How do factors such as education, working experience and income before retirement affect the gender gap in China's pension systems including both the UEPS and the NRSPP?

4.   How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?

5.   When controlling for the same gender in both the UEPS and the NRSPP, are there similarities or differences in terms of how the abovementioned factors inter-relate?

5.3 Dataset selection

In the literature reviewed in the previous chapter, researchers usually used macro-level data to form a simulation model and carry out an actuarial analysis, which usually assumed that participants in the pension system are ideal persons. In real life, however, participants are usually not ideal; there will be income gap between different people and the length of their working life can vary considerably. The micro-level dataset was chosen for this study to analyse how the gender gap exists and then analyse the impact factors. Three datasets have been used in previous studies to carry out inferential analyses when studying the issue of gender inequality in China's pension system: the 'Chinese Household Income Project' (CHIP), the 'China Family Panel Studies' (CFPS) and the 'China Health and Retirement Longitudinal Study' (CHARLS). I shall compare these three datasets next and explain why I chose CHARLS as the micro-level dataset for this study.

CHIP is an institution which seeks to track the dynamic of China's household income distribution. Five survey waves which covered the income and expenditure information for urban residents and rural residents respectively (surveys of migrants were added to the survey in 2002) were conducted in 1988, 1995, 2002, 2007 and 2013. The samples in CHIPS were selected using a systematic sampling method and data were collected by personal interview and coded on-site observation. However, the sample was not consistent in these five surveys and CHIPS did not follow up the interviewees, which means that it is not possible to combine the five datasets as a panel data. For example, the dataset in 1988 covered 28 provinces and cities, which contained 9009 urban households and 31,827 individuals, and 10,258 rural households and 51,3252 individuals. In 2013, however, only fifteen provinces (126 cities, 234 counties, 18,948 households and 64,777 individuals) were covered, and the sample was collected from a larger sample of the annual integration household survey carried out by the National Bureau of Statistics in 2013. The first three datasets (1988, 1995 and 2002) consisted of four parts: urban individual-level data, urban household-level data, rural individual-level data and rural household-level data. The individual-level data and household-level data for migrants were included in the CHIPS dataset in 2007 and 2013. The data in CHIPS reported interviewees' employment status, level of education, type of employer, occupation, retirement status, monthly pension, monthly wage and basic demographic variables including gender, age and relationship to the householder. These individual-level data are quite similar compared with CHARLS and the interviewees are already divided into an urban group and a rural group, however, CHIPS is a cross-section dataset rather than panel data and it might be more suitable for carrying out a simulation of pension benefits and analysing the levels of income and expenditure under the different pension policies. This was how Mi (2016) explored the gender gap in China's basic pension insurance system. If we want to track the change in individuals' pension benefit during these years, the data from CHIPS can not meet the requirement.

The CFPS is a dataset which contains data about China's development in different aspects, such as economic development, social change, demographic change at the individual, family and community levels. The sample in CFPS covers 25 provinces with the full memberships of 16,000 households, which is a significant sample. Two pilot surveys were conducted in 2008 and 2009 in Beijing, Shanghai and Guangdong. The baseline survey was then launched in 2010 and all the memberships in the baseline survey and children (natural or adopted) were permanent members of CFPS. The sample was tracked every two years and the data for 2010, 2012, 2014, 2016 and 2018 are available on the website which can be combined as panel data in contemporary China. Four types of questionnaires formed CFPS: a community questionnaire, a family questionnaire, an adult questionnaire and a children's questionnaire. Some of data that need to be considered when studying the gender gap and the urban/rural gap in the pension system are included in the CFPS dataset, such as age, gender, *hukou*, education background, marital status, working history, and individual income. However, no information about the pension benefit or the contribution to the pension system was covered by CFPS. Information about which pension system these interviewees were involved in is not given, nor how much benefit can be received when someone first retires, whereas all this information can be found in CHARLS.

The objective of CHARLS is to provide high-quality data from Chinese residents aged over 45 to meet the requirements of scientific research on the living conditions of the elderly. The first pilot survey was conducted in 2008 but only covered Zhejiang and Gansu provinces. Using the Probability Proportionate to Size sampling method, data on 2685 individuals from 1570 households were collected. In 2012, the research team tracked these individuals with a second wave pilot questionnaire. The national baseline survey was conducted in 2011 and covered 17,708 individuals in 150 counties/districts and 450 villages from 28 provinces. CHARLS data include different aspects of information related to the elderly, such as demographic background, health status, health care and insurance; work, retirement and pension; and income, expenditure and assets. These data can provide a high-quality national sample of Chinese elders for scientific research. After removing the private information, data from CHARLS can be used without charge. All these samples were tracked every two years and the data were available to all researchers one year later. Now, therefore, we have a panel data which contains a national sample of 17,708 individuals for four years (2011, 2013, 2015 and 2018). Data from 'work, retirement and pension' and 'income, expenditure and assets' can provide information such as the pension benefit and which pension group the sample is involved in. The data about the factors which might affect the pension benefit such as education background, retirement age and pre-retirement salary can also be found in this dataset. Based on the information from 'demographic background', we can divide the sample into different groups such as urban and rural, men and women, or different pension schemes to compare the pension benefits in the

different groups. By comparing data from different groups, we can then analyse the inequality problem existing in China's segmented pension system. After comparing these three datasets, it was decided that CHARLS was the most appropriate dataset to provide the secondary data at micro-level to answer the five research questions of this study.

5.4 Data-cleaning process

5.4.1 Urban Employees' Pension Scheme

In CHARLS, every interviewee has three ID numbers; the first is a community ID, the second is a household ID and the third is the respondent's individual ID number. Respondents from the same community are therefore assigned the same community ID and the same applied to household ID, with the individual ID number for each interviewee being unique. The ID numbers will be consistent for an interviewee if the interviewee repeatedly participates in different waves of CHARLS surveys. The datasets from four waves of the CHARLS survey were used in this study to create a unique cross-section dataset comprising new interviewees, and a second dataset, a panel dataset, was also put together comprising interviewees who participated in 2011 as well as in 2013, 2015 and 2018. This was possible using the consistent ID numbers. In this section, I shall describe the cleaning process of the CHARLS data for the UEPS as an example to explain how I put together a revised cross-sectional dataset for a pension scheme.

The data-cleaning preparation needed to review the CHARLS questionnaires for each year involved identifying key questions and the answers given. After reviewing these questionnaire responses, it became obvious that the dataset included different types of retired people in the UEPS. The sample was selected based on people who had already completed 'receding position' procedures and also those who had completed retirement procedures.

There are four pathways of retirement in the UEPS, receding position procedures, legal retirement (normal retirement), early retirement and internal retirement. The receding position covers a specific category of people who have a serious illness or disability rendering them unable to work but who have not yet reached the statutory age for retirement. There is not limit on age to have receding position procedures. These people can follow the receding position procedure and receive compensation and material assistance from the government.

The second pathway is the legal retirement route and is probably the most straightforward route as recipients have met the legal retirement age of 60 for men and 50 for women with female cadres retiring at 55. The third pathway is early retirement in which people need to satisfy one

of the following conditions to receive it[18]: first, workers who have 30 years of eligible working experience. Second, workers who have been engaged in a high-risk or high-intensity industry for a while can, as a compensation, apply for early retirement. For example, workers in high-risk occupations such as working at heights or in particularly heavy manual work, are eligible for early retirement once they reach ten years of high-risk employment, and they are allowed to retire five years early (that is, at 55 for men and 45 for women). Third, employees of a company which has become bankrupt or has been restructured can receive early retirement at 50 for men and 45 for women. Workers who satisfy one of these conditions have to receive approval from the employer to complete the early retirement procedure. The fourth route for early retirement mirrors what OECD countries refer to as a 'disability pension'. Male workers reaching the age of 55 and female workers reaching 45 with a continuous length of eligible working experience of ten years can apply for early retirement if they have been appraised by a hospital and it has been confirmed that they are completely incapable of working.

All other things being equal, the amount of pension benefit for retirees who take early retirement for one of the reasons set out above could be relatively low as the contribution time was shorter and the accumulated amount of their individual contributions was smaller compared with retirees who completed the legal retirement. The relatively low pension benefit also applies to retirees who have been engaged in a high-risk or high-intensity industry, but they have usually received a post-related allowance while they were working. Women who take early retirement because they have thirty years of eligible working experience can usually receive the full pension as the contribution period is similar to a normal retirement (working from 20 to 50). For men, early retirement could mean a comparatively lower pension than for normal retirement as the anticipated contribution time for a normal pension is longer than thirty years.

The fourth retirement pathway is internal retirement, which is an effective policy tool for refreshing the labour force. It refers to a situation in which an employee has not reached the legal retirement age and is typically five years younger than the legal retirement age requirement. In this case, employees can sign an internal retirement agreement with the employer, with whom they then retain the labour relationship but are no longer in post. The purpose of the state's internal retirement policy is to reduce the number of older employees and increase efficiency through investment in a younger and better trained work force able to boost production. For example, this policy option is aimed at employees in a company which has surplus personnel and who were not suitable to carry on working at the required intensity due to

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[18] All these conditions were taken from the government document 'State Council's Provisional Measures for Taking Care of the Aged, Physically Weak, Sick and Disabled Cadres' (State Council, 1978b) and the 'State Council's Provisional Measures Concerning the Retirement and Resignation of Workers' (State Council, 1978a).

age, frailty or sickness. The scheme is voluntary and recipients can enjoy retirement benefits in advance of their statutory pension. When the state introduced the policy, it emphasised that it is strictly forbidden for enterprises to conduct inward withdrawal in excess of the provisions set by the State Council. During the internal retirement period, the employees will be paid relatively lower than their normal wage, but they do not need to work. They will continue to make contributions to their individual account in the basic pension system, but the monthly contribution amount will also decrease compared with their working days as the amount is paid in proportion to the wage received. Once these employees reach the legal retirement age, they must complete the legal retirement procedures and then start receiving their pension benefit (both from the first and second pillar pensions for which they qualify) with the company ceasing to provide them any further payment in the form of a salary. The differences between the four retirement routes in the UEPS are summarised in Table 5.1. For the current research, I only selected respondents by identifying those who had started to receive the pension benefit from the pension system, which means that people who have completed internal retirement but have not completed the legal retirement procedures were excluded from the research. The other four groups of respondents who have started to receive the pension benefit from the UEPS are all included in the research.

Table 5.1 The differences between the four pathways to retirement

	Did they reach the legal retirement age?	Did they receive any retirement income from the pension system at the time?	Did they receive a salary from their employer?
Receding position procedures	No	Yes	No
Legal retirement	Yes	Yes	No
Early retirement	No	Yes (reduced if their contribution period and accumulative individual account are lower than the normal retirees under the same conditions)	No
Internal retirement first, then completed legal retirement procedures	Yes	Yes	No
Internal retirement, but have not yet completed legal retirement procedures	No	No	Yes

Source: Summarised by the author

After reviewing the profiles selected for analysis and explaining which respondents were selected, it is important to explain the challenges encountered in putting together the four waves of data (CHARLS 2011, 2013, 2015 and 2018). First, the four respective questionnaires required interviewees to provide answers based on the retirement type in the UEPS. For example, in the 2011 wave, one person might have worked until the legal retirement age and another might have received an internal retirement salary first and then eventually reached the legal retirement age. The questionnaires asked for details about when and at which point this decision was made. In fact, the questionnaires explored each of the retirement options in order to identify 'when did you formally retire?', 'how much was your pre-retirement salary?', 'how many eligible work years were counted for the pension?' and 'how much did you receive when you started receiving the pension benefit?' These questions were asked for each 'profile' or 'type' of retiree in the sample. The challenge was that in the questionnaires for 2013, 2015 and 2018, the coding of the questions and answers was numbered differently from the baseline questionnaire (2011) which was used to create the cross-sectional dataset. Another challenge was that a proportion of the respondents had participated in more than one wave of questionnaires, but they did not answer the question in all of the waves in which they participated. All these issues needed to be addressed before using these four datasets to form the new cross-sectional dataset.

In order to put together a sufficient sample for regression analysis, I merged each of the sub-questions. For example, in the 2011 survey, the data for the pre-retirement monthly salary of retirees who had reached retirement age and those who had taken early retirement were grouped together under variable 'fm016'. The same applied to the question asking about disability[19] and for people who took internal retirement first and then at a later age became eligible for the formal retirement, which were captured by the variables 'fm007' and 'fm028' respectively. To reduce the complexity of the questionnaire and for the purposes of the analysis, the data for those with a disability (fm007) and those who took internal retirement first (fm028) were copied into the fm016 variable. After merging these values in fm016, I was able to conduct a descriptive analysis of pre-retirement salary using only fm016. After completing this process, the variable was focusing on the key set of questions such as when did you formally retire, how much was your pre-retirement salary, how many eligible work years could be counted for your pension and finally how much did you receive when you started receiving the pension benefit and less so on the different types of retirement pathway available within the UEPS. The same process had to be applied to the CHARLS questionnaires and samples for 2013, 2015 and 2018.

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[19] Or for people who have completed receding position procedures, as it is officially described in the questionnaire.

This process produced a larger sample for analysis and sought to overcome the shortcomings of the CHARLS questionnaire which effectively offered limited respondents to analyse the impact of the different pathways within the UEPS. This does not mean that these pathways are not important for the analysis but the research here primarily seeks to capture how the categories discussed above differ between pension systems and gender. Future research and statistical analysis of the differences within the UEPS would be possible as the sample of CHARLS will increase through the next waves.

To make it more complicated, the 2013, 2015 and 2018 waves used the same questions but they were numbered differently in the dataset. As mentioned above, the second problem was once more that the coding of the questions and answers in the questionnaires for 2013, 2015 and 2018 waves were numbered differently from the baseline questionnaire (2011) which was used to create the cross-sectional dataset. For the purposes of merging the datasets into one cross-sectional dataset, I had to follow a similar process by embedding the data and the answers available in the 2013, 2015 and 2018 waves into the new cross-sectional dataset by transferring the responses from 2013, 2015 and 2018 into the variables designated in the cross-sectional dataset (which was originally based on the 2011 wave). For example, the question for people who had started to receive a pension from the UEPS 'Are you currently receiving a pension as follows' was differently numbered in the different waves. In the 2011 questionnaire, the question number was fm019, but in 2013 and 2015, the number of the same question changes to fn002w2, as in the 2018 questionnaire it changes again to fn002w4_a. More information on the actual transfer of variables and answers is available in Appendix A.

A further challenge which CHARLS posed was that there are many missing values in the responses in all four waves examined here. As CHARLS is effectively a panel data, there are multiple time-points at which interviewees responded. For the purposes of increasing the sample available, I took into account respondents (based on their unique Personal Identifying number) who participated in all four waves and cross-examined any missing values which might apply to all of their responses. It is often the case in CHARLS that the respondents do not answer the questionnaire in full for a given wave. By cross-checking the different waves in this way, I was able to 'migrate' answers to questions which were not subject to changes in time, such as gender[20], retirement year, pre-retirement salary and the first pension benefit. This applied for all four waves. This effectively sought to increase the sample size for the cross-sectional data as well to produce a better-quality panel dataset.

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[20] Of these categories, only gender can change, but this is deemed too personal for CHARLS to capture.

After finishing the data-cleaning data process, the shortcoming of the CHARLS dataset had been resolved: the respondents with missing values had been removed, the inconsistent numbering of question and variables had been unified (for different pathways of retirement and different waves of questionnaires) and the sample size for the new cross-sectional dataset had been enlarged after merging and migrating the data from the different waves.

The new cross-sectional dataset comprised all of the interviewees in the 2011 survey and new interviewees in the 2013, 2015 and 2018 surveys. A variable denominated 'xrtype' was used to distinguish the new interviewees from re-interviewed participants: if xrtype was 1 in 2013 and 2015 or 2 in the 2018 wave, it means that the interviewees were new participants and would be kept in the cross-sectional dataset. After merging the new cross-sectional dataset, respondents who had any missing value for any variable, or whose value for the variables seemed unreasonable (such as the pension benefit recorded as zero) were discarded, after which I grouped the respondents using retirement years before I started the descriptive analysis and the regression analysis.

One more challenge evident in CHARLS and the creation of the cross-sectional data was that interviewees' retirement year differed. For example, the 2013 wave might include someone who retired in 2009 and subsequently the 2011 wave might also include someone who retired in 2009. It was important therefore to assess the impact of the public provisions in place at the time of retirement. Pension reform does not happen each year and its effect might take longer to capture. I therefore opted to group the years of retirement based on important pension reforms (at the regime level, rather than minute detail). There were two important milestones when China tried to reform the UEPS: 1995-97 and 2005. The first milestone refers to the plan to build a unified pension system for urban workers in 1995[21] whereas in 1997 another State Council Document[22] sought to unify the pilot pension programmes in different provinces into a nation-wide pension system and at the same time institutionalise a three-pillar pension system. One of the key reforms introduced in 1997 was that the responsibility to protect retirees' financial resources was shared between employees, employers and the government. The other milestone happened in 2005 as the state council document[23] in that year indicated that the pension benefit was related to the span of time of employees' contributions and individual contributions by employees were reduced from 11% to 8%. The life table was also included in the pension calculation form after 2005's reform.

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[21] State Council Document No.6, ''Circular of the State Council on Deepening the Reform of the Urban Employees' Pension Scheme' (State Council, 1995).
[22] State Council Document No.26, 'Decision of the State Council on the Reform of the Urban Employees' Pension Scheme' (State Council, 1997b).
[23] State Council Document No. 38, 'Decision of the State Council on the Improvement of the Urban Employees' Pension Scheme'(State Council, 2005).

With the consideration of the time points of these two milestone documents in the reform of the UEPS and China's rapid economic development and inflation, I grouped the respondents into five groups with a span of five years between them using the variable 'the year of retirement'. The first group consisted of respondents who retired in or before 1995, the second contained those who retired between 1996 and 2000, the third group contained those who retired between 2001 and 2005, the fourth group contained those who retired between 2006 and 2010, and the final group comprised those who retired between 2011 and 2018. After finishing the data-cleaning process, the total number of respondents by gender and groups is shown in Table 5.2, which shows that there were 1452 respondents in total, 740 of them men and 712 women, so the ratio of male to female was quite close to 1. The sample size in each group is also relatively close, except for the final group 2011-2018, which had only 60 respondents. The percentages of men and women retirees in the first three groups are slightly in favour of women, whilst the percentages are slightly in favour of men in the last two groups, but the number of respondents remained quite balanced at around 45-55%. The total number of respondents in the groups was significantly lower than in the full CHARLS dataset but the sample sizes are still large enough to generate meaningful results. This revised cross-sectional dataset was generated after merging the four waves of the CHARLS datasets into the one dataset, which could be an open source for other researchers after the current study has been completed. Although the respondents are grouped on the basis of their retirement year, this revised dataset was used to carry out the descriptive data analysis and multi-regression analysis to address the research questions.

Table 5.2 Sample sizes for the UEPS by gender and groups

Gender	Group					
	Before 1995	1996-2000	2001-2005	2006-2010	2011-2018	Total
Male	194	140	160	213	33	740
Percentage	48.62%	49.47%	49.08%	55.47%	55.00%	50.96%
Female	205	143	166	171	27	712
Percentage	51.38%	50.53%	50.92%	44.53%	45.00%	49.04%
Total	399	283	326	384	60	1452

Source: Author's own table based on CHARLS, 2011, 2013, 2015 and 2018

In the literature review chapter, income, occupation, education, retirement age, contribution years and life table were found to be the six impact factors that can affect the gender gap in the UEPS. The selection of the key factors to be explored in this study was constrained by the available data, but a rich set of variables was nevertheless selected for this multi-linear regression model set. The selected dependent variable was the monthly pension benefit, and gender, education (years of schooling), working experience (years of participation in the labour market and eligible working years), pre-retirement monthly salary, retirement age and

occupation were chosen as the six independent variables for the UEPS. I shall next give a detailed explanation of the variables I used for the descriptive data analysis and multi-linear regressions. The definitions of the dependent variable and independent variables are summarised in Table 5.3. Instead of the actual values of monthly pension benefit, the dependent variable in multi-linear regression models was the logarithm of the monthly pension benefit received at retirement, which can make the dependent variable close to a logarithmic normal distribution. The independent variables are continuous and categorical variables. Specifically, continuous variables are the variables that can have any values within a given interval, while categorical variables (also known as discrete variables) can only be a fixed number of values. In this multi-linear regression model, the continuous independent variables are retirement age, pre-retirement salary and working experience. Of the categorical independent variables, gender and occupation are dummy variables, whereas education is an ordinal variable. If the respondents are women, 'gender' equals 1 and if they are men, the gender variable equals 0. The 'occupation' equals 0 if the individual is retired as a worker, and 1 if the individual is retired as a cadre. Following Zhang (2010), the education level was transferred to the years of schooling according to the highest education level achieved.

Table 5.3 Definitions of dependent and independent variables for the UEPS

Variables	Description
Y	log (monthly pension benefit at retirement)
Gender	0 = male; 1 = female
Retirement Age	age (in years)
Working Experience	eligible working experience (in years)
Pre-retirement salary	monthly wage before retirement (in yuan)
Education	education = 0 if respondents choose no formal education education = 6 if respondents choose primary school education = 9 if respondents choose junior school education = 12 if respondents choose high school education = 15 if respondents choose 3-year college education = 16 if respondents choose bachelor's degree education = 20 if respondents choose master's degree or above
Occupation	0 = worker; 1 = cadre

Source: Summarised by the author

5.4.2 New Rural Social Pension Programme

The data-cleaning process for the NRSPP was slightly different from the process for the UEPS. For the UEPS, I had divided the respondents into five different groups based on their retirement year, and after that the programme was a cross-sectional dataset, which means that it only contained information for one observation at one time point. The data were collected in 2011, 2013, 2015 and 2018, but I divided them based on their retirement year to form the new cross-sectional data for the UEPS. For the NRSPP, I merged the data in the different waves of CHARLS to form a panel data which dealt with the respondents on the same subjects in different times.

There were two challenges to form the panel data using the different dataset waves. The first challenge was that some of the respondents has participated in more than one wave of the survey but they did not answer the same questions in all waves. By cross-checking the different waves, I was able to 'migrate' answers to questions which had the same coding and were not subject to change in time, such as gender, birth year and region. After the data migration, the time-invariant variables still had constant values in all waves. For example, gender and region are time-invariant variables in this study and do not change in all four waves. The data on education for most of the respondents were time-invariant but for some of the respondents they were time-variant[24]. For the questions which could be time-variant, the answers were not migrated to different waves, even when there were missing values in some waves for the same question. The time-variant variables were age, marital status, health, number of children, total income and the land space.

The second challenge was that in the coding of the questions, the answers were numbered differently from the baseline questionnaire (2011) in the subsequent waves to create the panel data. For example, the question 'Are you participating in the NRSPP?' was numbered 'fn071' in the baseline questionnaire, and in the following questionnaires it was numbered 'fn069_w2' in 2013, 'fn057_w3 in 2015 and 'fn058_w4' in 2018. More information about the transfer of the variables and questions is given in Appendix B. After the cleaning process for this revised panel dataset, the sample size by gender and waves is shown in Table 5.4. Table 5.4 shows that the total sample size for NRSPP participants was 19,446, which is quite a large sample. The numbers of the respondents were different in the different waves which effectively means that this panel dataset is unbalanced[25]. The numbers of male and female respondents were quite

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[24] There is a question in CHARLS which asks people whether their education level has changed since the last wave, and although most of them reported no change, a small number of participants stated that their highest level of education had changed but did not give a reason for the change.

[25] A balanced panel data means that all variables should be observed for all respondents and all years. I carried out a test to see if the panel dataset could be cleaned to a balanced dataset. However, after running the command to make

similar in all four waves with the numbers of male respondents being slightly larger than that of females. It is easy to see that the sample size is much smaller than the full CHALRS but is nevertheless still large enough for a panel dataset to analyse the gender difference in the impact factor of the probability of participating in the NRSPP.

Table 5.4 Sample sizes by gender and time for the NRSPP

Gender	Year				
	2011	2013	2015	2018	Total
Male	3206	2756	1707	2465	10134
Female	2992	2604	1271	2445	9312
Total	6198	5360	2978	4910	19446

Source: Author's own table based on CHARLS, 2011, 2013, 2015 and 2018

I shall now explain the variables which I used in the logit model. The definition and descriptive statistics of dependent variable 'participation in the NRSPP' and the independent variables which I used in the mixed-effects logit model are summarised in Table 5.5. The table shows that the dependent variable asking about participation in the NRSPP was a dummy variable: if the respondent did participate in the NRSPP in that specific wave of the survey, the value equalled 1, otherwise the value was 0. If the respondents did not answer this question, they were discarded. There were different types of independent variable, including categorical variables (gender, *hukou*, education, health, marital status and region) and continuous variables (number of children, total income and land space). The gender variable and *hukou* were both dummy variables: gender equalled 1 if the respondents were female and 0 if male, whilst *hukou* equalled 1 for respondents with an agricultural *hukou* and 0 for those had a non-agricultural *hukou*. Health, marital status and region were categorical variables. The ranges of the categorical variables are presented in Table 5.5 and information about the continuous variables is also presented in the table, below the categorical independent variables. To make it clear, the mean for the gender variable in Table 5.5 is always smaller than 0.5 which means that the number of men who are included in the sample is slightly larger than the number of women[26].

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the dataset a strong balanced panel data, there will be nothing left, and all the respondents must be dropped if I made the dataset a strong balanced panel data.

[26]. A careful reader will notice that in the total income variable in Table 5.5, the value changes from 174,703 in 2011 to 2,164 in 2013. I double checked the data and found that there were 77 respondents in 2011 who stated their total income was over 5,000,000 yuan a year, which is hardly possible, but I do not think that the value could have been mis-recorded for 78 times, so I kept these 78 respondents in the 2011 wave.

Table 5.5 Definitions and descriptive statistics of dependent and independent variables by gender in different waves for the NRSPP

Variables	Description	2011		2013		2015		2018	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
NRSPP	0 = not participating; 1= participating	0.278	0.448	0.685	0.465	0.716	0.451	0.618	0.486
Gender	0 = male; 1 = female	0.483	0.5	0.486	0.5	0.427	0.495	0.498	0.5
Age	age in years	59.582	9.881	60.059	9.535	60.612	8.915	63.548	8.747
Education	education years	3.935	4.281	4.293	4.402	4.61	4.406	4.055	4.372
Health (self-reported)	1= excellent; 2 = very good; 3 = good; 4 = fair; 5 = poor; 6 = very poor	4.06	0.912	4.024	0.94	4.026	0.968	4.072	1.024
Marital status	1= married; 2 = single; 3 = divorced; 4 = widowed	1.547	1.128	1.502	1.109	1.489	1.096	1.59	1.174
Hukou	1= agricultural *hukou*; 0 = non-agricultural *hukou*	0.955	0.206	0.939	0.24	0.936	0.246	0.932	0.252
Child	Number of children	0.836	0.869	1	0	2.869	1.361	2.803	1.363
Total income	Total family income (in 10,000 yuan units)	174.703	1690.66	2.165	4.682	1.855	11.725	3.421	56.45
Land space	Land space owned within the family (Units: Mu)	15.113	87.329	16.994	200.522	14.638	98.828	8.329	47.626
Region	1 = East; 2 = Middle; 3 = West	2.016	0.834	2.037	0.831	2.065	0.83	2.016	0.83

Source: Author's own table based on CHARLS, 2011, 2013, 2015 and 2018

5.5 Method for analysing the Urban Employees' Pension Scheme

In this section, descriptive statistical analysis and multiple regression analysis will be used to examine the impact factors of the gender gap in the UEPS. Before running the multiple regression models, the descriptive analysis of the dependent and independent variables in the regression model were applied to explain the first research questions 'Is there a gender gap, in terms of pension benefit, in the Urban Employees' Pension Scheme (UEPS)? Is the gap narrowing or widening over time?' For example, to study the UEPS, the average pre-retirement salary by gender in the different retirement groups, the average pension benefits by gender in the different retirement groups and the average education and a summary of occupation information by gender in the different retirement groups were analysed. Tables showing means and standard deviations, line charts and bar charts were used with micro-level data to carry out the descriptive analysis of the selected explanatory variables.

For the UEPS, the dependent variable of the logarithm of monthly pension benefit is a continuous variable, with more than one selected independent variables. Multiple regression model was applied to examine how these explanatory variables predict the outcome of the dependent variable. However, the results of one multiple regression model can be used to estimate how the logarithm of monthly pension benefit changes along with changed independent variable. Nevertheless, how these independent variables affect the gender gap in terms of pension benefit in the UEPS can not be figured out based on the results of one multiple regression model alone.

In this thesis, I followed Zhang (2010) and Pei (2011)'s idea of applying a set of multi-linear regression models, including a standard model, a complete model and a set of nested models, to analyse how the impact factors affect gender difference in pension benefit. The mechanism that underlies the combination of three models to answer the research question will be clarified in the following section.

The first model was the standard model, which has the logarithm of the monthly pension benefit as the dependent variable, and gender as the independent variable. In the standard model, the coefficient $\beta_{\text{gender}}^{\text{standard}}$ of gender was used to represent the total effect of the gender variable on the monthly pension benefit in the scheme as gender is the only independent variable in the standard model. The second model was the complete multiple regression which contained the logarithm of the monthly pension benefit as the dependent variable, the gender variable and all the other selected pension-related variables as the independent variables was established after the standard model. The coefficient of gender $\beta_{\text{gender}}^{\text{complete}}$ in the complete model was the gender variable's direct effect on monthly pension benefit as all the other pension-related variables were included. The difference between the gender coefficients of the standard model and the

complete model was the indirect effect of the gender variable on pension benefit. The indirect effect sought to capture how the gender variable influences the pension benefit by taking into account other pension-related factors such as education. The third model was the set of nested models. In the nested models, I ruled out one independent variable at a time from the complete model to obtain one nested model, but the gender variable was always kept. For example, 'retirement age' was excluded from the first nested mode, whereas gender, working experience, pre-retirement salary, education and occupation were included as the independent variables. In the second nested model, working experience was excluded, while gender, retirement age, pre-retirement salary, education and occupation were included as the independent variables. As there were five independent variables excluding gender, there would be five nested models after ruling out one independent variable after another. These five nested models will have gender coefficients for each nested model β_{gender}^{nested}. The following formulas show the three models used in this study.

Standard model:

$$Y_{it} = \beta_{gender}^{standard} Gender + \text{ error}$$

Complete model:

$$Y_{it} = \sum_{i=1}^{k} \beta_i X_i + \beta_{gender}^{complete} Gender + \text{ error}$$

Nested models:

$$Y_{it} = \sum_{i=1}^{k-1} \beta_i X_i + \beta_{gender}^{nested} Gender + \text{ error}$$

The specification of each variable is explained in Table 5.3. The dependent variable and gender variable below will be used to measure how these independent variables affect the gender gap in pension benefit in the UEPS:

Dependent variable: Y = log (monthly pension benefit on retirement).

The gender variable in the regression model is a dummy variable.

Gender =1 if the respondent is female and 0 if male.

The letter 'Y' in the formulas above is the monthly pension benefit, and as explained above, the dependent variable is the logarithm of monthly pension benefit, which is ln(Y). So the standard model can be written as:

$$\ln(Y) = \alpha + \beta_{gender} * X_{gender}$$

$$e^{\ln(Y)} = e^{\alpha + \beta_{gender} * X_{gender}}$$

$$Y = e^{\alpha} * (e^{\beta_{gender}})^{X_{gender}}$$

Because gender =1 if the respondent is female and 0 if male, the equation becomes

$$Y_{female} = e^{\alpha} * (e^{\beta_{gender}})^1$$

$$Y_{male} = e^{\alpha} * (e^{\beta_{gender}})^0$$

$$\frac{Y_{female}}{Y_{male}} = \frac{e^{\alpha} * (e^{\beta_{gender}})^1}{e^{\alpha} * (e^{\beta_{gender}})^0}$$

$$\frac{Y_{female}}{Y_{male}} = \frac{(e^{\beta_{gender}})^1}{1}$$

$$\frac{Y_{female}}{Y_{male}} = \text{EXP}(\beta_{gender})$$

On the basis of mathematical transformations, the equation shows that the exponential function of gender coefficients EXP(β_{gender}) presents the female to male average pension benefit ratio. The value of EXP(β_{gender}) represents the gender gap in pension benefit level. As the three models have different explanatory variables, the gender coefficients from the different models could be different and therefore the exponential functions of the gender coefficient are also likely to be different. The exponential function of gender coefficients EXP($\beta_{gender}^{standard}$) in the standard model represents the absolute value of female to male average pension benefit ratio as the coefficient $\beta_{gender}^{standard}$ of gender variable represents the total effect of the gender variable on pension benefit. For the complete model, the regression contains not only gender, but also other pension-related variables, which were included as the independent variables. The coefficient of gender variable $\beta_{gender}^{complete}$ in the complete model indicates its direct effect on pension benefit.

The exponential function of gender coefficients EXP($\beta_{gender}^{complete}$) in the complete model stands for the relative value of female-to-male average pension benefit ratio. As for the set of nested models, one independent variable was ruled out from the complete model at one time, leaving the independent variables for the estimation of various gender coefficients in each nested model.

The coefficient of gender variable β_{gender}^{nested} in each nested model varied. The $EXP(\beta_{gender}^{nested})$ of these gender coefficients β_{gender}^{nested} in each nested models were also disparate. The difference between the exponential function of gender coefficients in standard model, complete model and the set of nested models were used to analyse how the selected independent variables affect the gender gap in pension benefit level in the UEPS. The deviation between the complete model's $EXP(\beta_{gender}^{complete})$ and $EXP(\beta_{gender}^{standard})$ from the standard model shows what percentage of the gender gap in pension benefit can be explained by all other independent variables in totality. The remaining gender gap is caused by the gender variable and other factors which could be related to the gender pension gap but was not included in the complete model due to the limited data availability. The deviation between $EXP(\beta_{gender}^{nested})$ from each nested model and $EXP(\beta_{gender}^{complete})$ from the complete model shows what percentage of the gender gap in pension benefit can be explained by excluding the explanatory variables.

$$\text{Deviation} = EXP(\beta_{gender}^{complete}) - EXP(\beta_{gender}^{standard})$$

$$\text{Deviation} = EXP(\beta_{gender}^{complete}) - EXP(\beta_{gender}^{nested})$$

The deviation between $EXP(\beta_{gender}^{nested})$ from each nested model and $EXP(\beta_{gender}^{complete})$ from the complete model was compared to identify the factor with the most significant effect on gender gap at the pension benefit level. The larger the deviation between the $EXP(\beta_{gender}^{nested})$ from nested model and $EXP(\beta_{gender}^{complete})$ from the complete model could justify the enlarged gender gap in pension benefit level when independent variable was excluded. The comparison of the deviations between the exponential function of the gender coefficients in the complete model and the nested models could help rank the magnitude of deviation, in the order of the pension-relative factors in terms of the greatest effect on the gender gap. After carrying out this process for all the pension schemes, it can be concluded whether the order of the pension relative factors is the same in the different pension schemes. Then I will reflect the results of order with pension policies in different time period and can try to explain why the order is same or different for different pension schemes. The research questions for the UEPS can be answered after carrying out both descriptive data analysis and inferential analysis using the data from CHARLS.

5.6 Method for analysing the New Rural Social Pension Programme

In this section, as in the discussion of the UEPS, both descriptive statistical analysis and inferential analysis will be used to exam the gender difference on the impact factors of participating in the NRSPP. The difference is that in the UEPS, the dependent variable is monthly pension benefit, which is a continuous variable for the test of how impact factors affect the gender gap in terms of pension benefit level. For the NRSPP, since the goal of this pension scheme was to cover as much rural population as possible, the behaviour of participation, was

deemed as the dependent variable, instead of pension benefit level, to analyse the gender gap. As the dependent variable in the NRSPP was a dummy variable which contains merely two categories: participation in the NRSPP or not, the logit regression model should be used for the estimation of how each independent variables affect the probability of participating in the NRSPP.

Previous studies primarily used the simple logit model to analyse the impact factors which can affect the probability of participating in the NRSPP. The dependent variable in the logit regression model applied in previous studies mostly related to whether participants had joined the NRSPP. Many independent variables have been used to analyse their effect on the probability of participating in the NRSPP in previous studies, limited by the available data, and the questions asked by CHARLS on gender, age, education (years spent in school), marital status, health, *hukou*, number of children, family total income, amount of land space and region were selected as the independent variables for this current study. The respondents were divided into two groups based on genders. The results from descriptive analysis and inferential analysis should be compared to examine the plausible existence of the gender gap in terms of participation rate in the NRSPP and how the impact factors affect the rate of participation in the NRSPP between men and women.

The descriptive analysis contains the cross tables of these independent variables and displays the number of people who chose to participate or not in the NRSPP divided by gender. An initial attempt to answer the research question '2. Is there a gender gap, in terms of participation rate, in the New Rural Social Pension Programme (NRSPP)? Is this gap narrowing or widening over time?' was addressed through the use of descriptive data presented by line and bar charts. Answers to the third research question 'How do factors such as education, working experience and income before retirement affect the gender gap the NRSPP?' was subjected to inferential analysis.

The research question 'How do factors such as education, working experience and income before retirement affect the gender gap in the NRSPP?' was broken down to three sub-research questions which were 'How does the gender variable affect the probability of participating in the NRSPP', 'How do other independent variables affect the probability of participating in the NRSPP for men and women respectively' and 'What is the difference between the independent variables which have a significant effect on the probability of participating in the NRSPP between genders'.

In the previous studies that investigated the impact factors on the probability of participating in the NRSPP, 'whether the respondents participated in the NRSPP' were used as the dependent variable. As the dependent variable was a dummy variable which only contained two values: it

equalled 1 if the respondent did participate in the NRSPP and 0 if not, the simple logit model was applied as the data derived from a cross-sectional dataset were collected by authors themselves. In the current research, 'whether the respondents participated in the NRSPP' was also used as the dependent variable. However, for this study the dataset which was used to analyse the impact factors on the probability of participating in the NRSPP was a panel dataset which contained the same subjects at several time points in time.

With a panel dataset, fixed-effects and random-effects models are the most frequently used models for estimations. In a fixed-effects model, the effect from time-invariant variables, for example, gender and birth year, were controlled but their effects were not estimated. Fixed-effects models are less vulnerable to omitted variables bias as the effect from the omitted variables is also controlled unless they contain time-variant variables. In the present research, the time fixed effects were needed when running a fixed-effects model as a joint test suggested the dummies for all years were not equal to zero. However, the effect from time-invariant variables, such as gender, should not be dismissed in this research. The fixed-effects model can not be applied to answer the question convincingly. In a random-effects model, the effects from time-invariant variables can be estimated but the model requires the unobserved variables to be uncorrelated with the observed variables. However, this requirement is often invalid and a random-effects model can still be desirable when, for example, the effect of time-invariant variables needs to be estimated. Another possible estimated model in panel data is the mixed-effects model, which contains both fixed effects and random effects. The mixed-effects model could not only estimate the effect from time-invariant variables but can also obviate the limitation of random-effects model. For instance, the mixed-effects model allows for the correlation between unobserved variables with the observed variables. The comparison of these three models found that a set of mixed-effect logistic models was used in this thesis to carry out the inferential analysis as the dependent variable was a dummy variable.

The first model was the mixed-effects logit model which contained all the independent variables including the gender variable. In the first model, the mixed-effects logit regression could tell, when all the independent variables were included, how these variables can affect the probability of participating in the NRSPP and how the gender variable can affect the probability, in other words, whether the gender variable has a significant effect on whether or not people decide to participate in the NRSPP.

The second and the third models were also mixed-effects logit models. In these two models, all other independent variables are the same but the gender variable has been withdrawn. The second model estimated for female respondents and the third model for males. Comparing the results of the coefficients in the second and third models could answer the research question '3.

How do factors such as education, working experience and income before retirement affect the gender gap in the NRSPP?'. In these three mixed-effects logit models, the dependent variable was a binary outcome variable: whether to participate or not. In the formula, let Y_{it} be the dependent variable: whether the respondent is participating in NRSPP or not. Y_{it} only has two values in this model: the dependent variable Y_{it} is 1 if an individual i participates in the NRSPP at time t and is 0 if not. Let p_{it} be the probability that Y_{it} is 1 and (1- p_{it}) will be the probability that Y_{it} is 0. The set of logit regressions of Y_{it} on a set of X_{it} is shown below:

The first model:

$$logit(p_{it}) = \log\left(\frac{p_{it}}{1 - p_{it}}\right) = \beta_0 + \sum_{i=1}^{k} \beta_i X_{it} + \beta_{gender} Gender + error \ (1)$$

The second model only includes female respondents (i can only be a woman):

$$logit(p_{it}) = \log\left(\frac{p_{it}}{1 - p_{it}}\right) = \beta_0 + \sum_{i=1}^{k} \beta_i X_{it} + error \ (2)$$

The third model only includes male respondents (i can only be a man):

$$logit(p_{it}) = \log\left(\frac{p_{it}}{1 - p_{it}}\right) = \beta_0 + \sum_{i=1}^{k} \beta_i X_{it} + error \ (3)$$

To exponentiate both sides, the logit model will transform to:

$$\frac{1 - p_{it}}{p_{it}} = \frac{1}{\exp\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_{it}\right)}$$

$$\frac{1}{p_{it}} = 1 + \frac{1}{\exp\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_{it}\right)}$$

$$\frac{1}{p_{it}} = \frac{\exp\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_{it}\right) + 1}{\exp\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_{it}\right)}$$

$$p_{it} = \frac{\exp\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_{it}\right)}{\exp\left(\beta_0 + \sum_{i=1}^{k} \beta_i X_{it}\right) + 1}$$

$\frac{p_{it}}{1 - p_{it}}$ is the odds ratio, which is a measure of association between an exposure and an outcome. β_i in the logit model explains the marginal change of the log odds ratio if X_{it} changes one unit, and the exponential function of β_i (EXP(βi)) can tell us how many times the new odds ratio will be compared with the old odds ratio if a unit of X_{it} changes. More detailed examples explaining

the results of the mixed-effects model will be given in the results analysis section.

Chapter 6. Urban Employees' Pension Scheme

This chapter contains the descriptive data analysis and regression results analysis of the gender gap in the Urban Employees' Pension Scheme (UEPS). Previous empirical studies reported in the literature have shown that a gender gap does exist in pension benefits in the UEPS (Zhong and Chu, 2015; Chen and Turner, 2015; Pei, 2011). The pension policy-related variables affecting the gap include retirement age and eligible working experience. The earlier retirement age for women could result in a reduction in pension benefit for them and the difference in retirement ages has consistently widened the gender difference in pension benefits (Li, 2004; Zhang, 2010; Pei, 2011; Wang and Li, 2013; Wang et al., 2013; Wu, 2020). The number of contribution years is positively correlated with pension benefit (Hu, 2009) and the gender gap in the number of contribution years could also enlarge the gender pension gap in the UEPS (Chen and Huang, 2018; Wang and Li, 2013). Discrimination in employment opportunities and wage rates is also unfavourable for women (Wang and Cai, 2008), and the gender inequalities in the labour market could result in a larger gender gap in pension benefit (Wang and Li, 2013; Zhang, 2013). Lower wages for women mean that they contribute less to their individual accounts than men and this will result in a lower pension benefit level (Wu, 2020), and the income gap has an even more significant effect on the gender pension gap over time (Wang and Xia, 2021). As for occupation type, male retirees usually have a higher replacement rate than female cadres, whilst female workers have the lowest replacement rate (Wang and Li, 2013). The gender inequalities in the labour market will therefore continue to affect the gender gap in the pension system (Mi, 2016; Wu, 2020). Education is another factor which has a significant effect on the gender difference (Pei, 2011; Zhang, 2010; Zheng, Xu and Liang, 2017). These previous empirical studies provided the initial hypothesis for this current study about the selected independent variables: retirement age, pre-retirement salary, eligible working experience, occupation type and education level should all have a positive relationship with the average pension benefit, and the gender gap existing in these independent variables could widen the gender gap in pension benefit. In this section, the results of the descriptive data analysis and inferential analysis will be presented and the initial hypothesis about the impact factors of the gender gap in the UEPS will be tested using five different retirement groups of data from CHARLS as described in Chapter 5.

6.1 Results of the descriptive data analysis

Before running the set of multiple regression models, the descriptive statistics of pension-related independent variables and the average monthly pension benefit will be discussed together. Because the CHARLS interviewees were grouped on the basis of their retirement year, the descriptive data analysis can answer the first research question 'Is there a gender gap, in terms of pension benefit, in the Urban Employees' Pension Scheme (UEPS)? Is the gap narrowing or widening over time?'.

Table 6.1 shows a series of descriptive statistics for the means, standard deviations and differences in mean of the three continuous independent variables and the monthly pension benefit broken down by gender and group, including retirement age, working experience and pre-retirement salary. Table 6.1 shows the average value of the variable, and the standard deviation from the mean. A smaller standard deviation means that the data are more concentrated, while a larger standard deviation indicates that the data are more dispersed. The difference in mean in Table 6.1 is calculated using the average for men minus the average for women to measure how large the gender gap in the variables. The positive difference in mean suggests that men have an advantage over women in the specific aspect in the same retirement group, and vice versa. Different types of charts are used in this section to help to demonstrate the variation trends of variables over time. Descriptive analysis could be applied to put forth an initial hypothesis about how these impact variables affect the pension benefit level.

Figure 6.1 to 6.4 present the contents of Table 6.1 as line charts, which more clearly depict the changes in average values and gender difference over the years. Comparing the data among the five retirement groups, the average monthly pension benefit increased for both genders but the growth trend for men was much larger than that for women, as shown in Figure 6.1. From the 'Before 1995' group to the '2011-2018' group, the average monthly pension benefit increased from 378.59 yuan to 1950.18 yuan for men whereas for women over the same time period the increase was from 322.51 yuan to 1040.15 yuan. Interestingly, the highest average monthly pension benefit for women was not in the fifth group but instead in the 2006-2010 group (1109.71 yuan)[27]. This could be due to the low sample size in the last retirement group because only 27 female interviewees were included based on their retirement year. The growth rate for men and women was also different. It is clear in Figure 6.1 that the line for men has a much steeper slope than that for women, which means that the average pension benefit for men was rising much faster than that for women and the difference in the mean increased during these years. Both the mean and the difference in mean of the average pension benefit suggest that the gender gap did and does exist in the average monthly pension benefit and that the gender difference increased during these years.

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[27] An outlier can make a significant decrease in the average value for this group. One participant in the 2011-2018 group stated that her monthly pension was 40 yuan, which is bit unreasonable to have such a low pension for a woman who retired after 2011. However, this response contained all the information on the selected independent variables, so she was kept in the dataset for the analysis.

Figure 6.1 Monthly pension benefit by gender in the different groups

Monthly pension benefit (RMB)
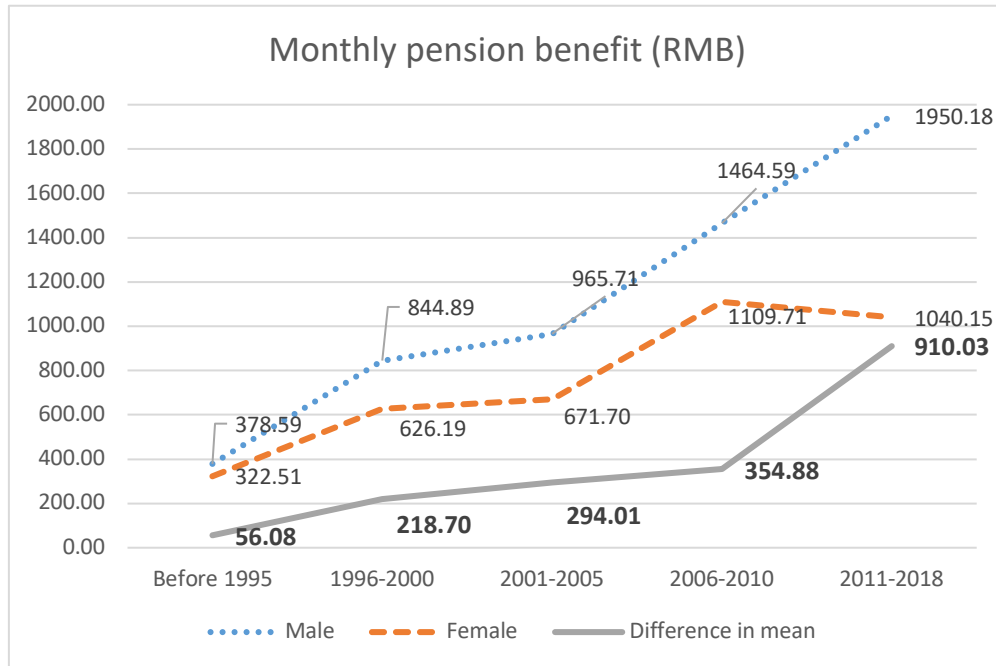
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

The average retirement age for both men and women also rose during that period but the growth trends were quite different for men and women (see Figure 6.2). The average retirement age for men increased steadily from 54.47 in the 'Before 1995' group to 59.61 in the '2011-2018' group, whereas the average retirement age for female retirees in the different years underwent a gradual increase: the average for women retiring in the 'Before 1995' group was 50.06 and increased to 50.96 in the '2011-2018' group. Figure 6.2 and information in Table 6.1 show that men's average retirement age increased faster with the difference in retirement age increasing over time. The difference in the mean of retirement age continued to increase from 4.42 in the 'Before 1995' group to 8.64 in the '2011-2018' group because the average retirement age for men rose from 54.47 to 59.61 whilst the average retirement age for women stayed around 50. As shown in Table 6.1, the gender gap between the average retirement age increased during these decades with the most recent years forming the largest gap.

Figure 6.2 Retirement age by gender in the different groups

Retirement age

| | Before 1995 | 1996-2000 | 2001-2005 | 2006-2010 | 2011-2018 |
Male: 54.47, 57.01, 57.32, 58.15, 59.61
Female: 50.06, 50.26, 50.12, 50.90, 50.96
Difference in mean: 4.42, 6.75, 7.20, 7.25, 8.64
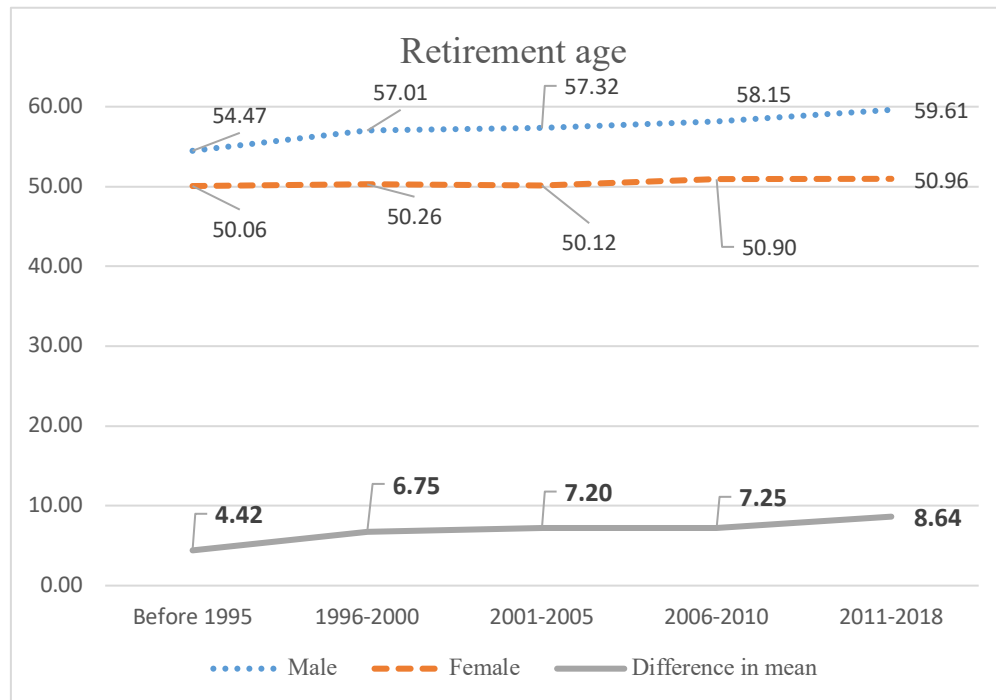
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Additionally, the CHARLS data as depicted in Table 6.1 suggests that the actual (*de facto*) average retirement age gap between men and women was shorter than the ten-year gap in statutory (*de jure*) retirement age[28]. It is important to repeat that the statutory retirement age was 60 for men and 50 for women. This means that women are more likely to work until the statutory retirement age (if not a bit more) whereas for men in this sample, on average, the actual retirement age in the total group (56.85 years) was earlier than the statutory one (60 years for men). As shown in Figure 6.3 and Table 6.1, a gender difference did exist in working experience over time. The gender difference in working experience was also increasing and the increase remained a fairly stable trend. The gender gap in working experience increased from 6.89 in the 'Before 1995' group to 11.84 in the '2011-2018' group. This rising gap can be explained by the fact that there was sustainable growth in men's average working experience, which continuously increased from 32.18 in the 'Before 1995' group to 36.55 in the '2011-2018' group. At the same time, the distribution of average working experience for women was slightly bell-shaped, with the first 'Before 1995' group (25.29) and the fifth group '2011-2018' (24.70) having much shorter working experience than those in the other groups. The average working experience for women rose to 28.25 in the second group '1996-2000', and then there was a

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[28] The statutory retirement age was decided by the 'State Council's Interim Measures on the Placement of Old, Weak, Sick and Disabled Cadres' (State Council, 1978b), and the 'State Council's Provisional Measures Concerning the Retirement and Resignation of Workers' (State Council, 1978a) in 1978 and set the retirement age for men at 60, for women cadres at 55 and for women workers at 50.

small decrease in the '2001-2005' group to 27.66 and in the '2006-2010' group it was 27.84. It is of interest to note that in the '2011-2018' group, the difference in mean increased to 11.84, which was the highest value of all of the groups. Although the average for men decreased a little to 36.55 in the '2011-2018' group compared with 36.75 in the '2006-2010' group, the '2011-2018' group also had the lowest value of the average working experience for women, which resulted in the largest gender gap in average working experience.

The difference in the mean of work experience is also related to the gender difference in the statutory retirement age. If there is no significant difference in the ages at which men and women enter the labour market, men will have more opportunities to have longer working careers than women, given the fact that the statutory retirement age for men is ten years longer than for women. It can be seen that the gender difference in the actual average retirement age was usually less than the gender difference in working experience as shown in Table 6.1, and the possible reason for that could be that women's working life could be interrupted because they have to take maternity leave and had more responsibility for caring for the family whereas men were usually the main breadwinner and were therefore less likely to leave their job to offer care provision.

Figure 6.3 Eligible working experience by gender in the different groups
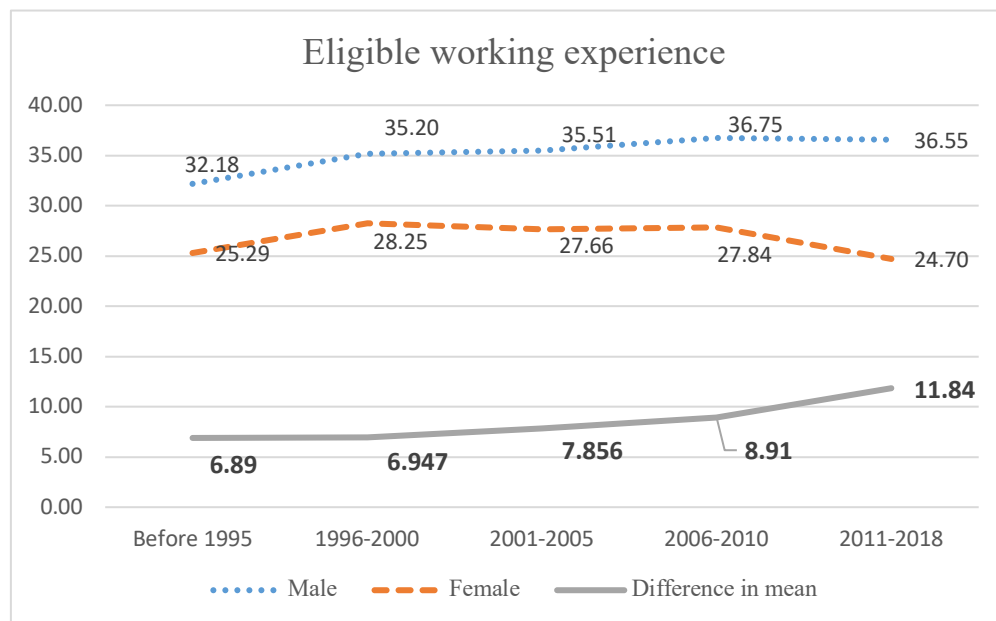
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

The third continuous independent variable was the monthly pre-retirement salary and the pre-retirement salaries for men and women were significantly different in all groups, as shown in Figure 6.4 and Table 6.1. The difference in pre-retirement salary growth for men and women can partly reflect the income gender gap in China's labour market. The standard deviation of

this variable is quite large (as shown in Table 6.1), and the value of standard deviation is quite similar to the value of the mean in each group, which means that the range in pre-retirement salary was quite extensive for all retirees. Also, Table 6.1 shows that men had higher pre-retirement salaries than women in all the year groups, with the standard deviation also demonstrating that income inequality was more likely for men in their pre-retirement salary. As Figure 6.4 shows, the pre-retirement salary increased continuously for both genders over time, and the difference in mean was always positive, which means that the average pre-retirement salary for men was always higher than that for women in all groups. The difference in mean was almost zero (0.64) in the first group, which shows that men and women could have the same level of income before they retired and that there was almost no income gender gap in the first group. This was because the government strongly advocated gender equality and implemented 'equal pay for equal work between men and women' during the planned economy period and there was a centrally controlled wage distribution system (Li and Ma, 2006). However, when China started to develop a market economy in the 1990s, wage distribution was decided by the enterprises themselves, and labour productivity could have a more significant effect on the income gender gap. When women are on maternity or parental leave, they need the help of colleagues to share the workload, let alone their physical strength difference can lead to disparity in earnings. That is certainly because earning is closely associated with labour productivity. After the economic reform, the employment structure also changed; more female workers lost their job than male workers during the restructuring of SOEs and collective enterprises, and the labour participation rate decreased more for women (Li and Gustafsson, 2008). From 1990 onwards, the gap between women and men widened in terms of labour market participation, as well as income. Even though men and women could have the same initial wage level when they entered the labour market and the same income growth rate, there was nevertheless a gender difference in pre-retirement salary when they retired as women usually had less eligible working experience than men. As shown in Figure 6.4, the gender gap in pre-retirement salary increased steadily over the different groups as the growth rate in men's pre-retirement salary was much faster than women's. The gender difference decreased a little in the final group but it is not clear whether this is a statistically significant result given that the fifth retirement group had the smallest sample.

Figure 6.4 Pre-retirement salary by gender in the different groups

Pre-retirement salary (RMB)
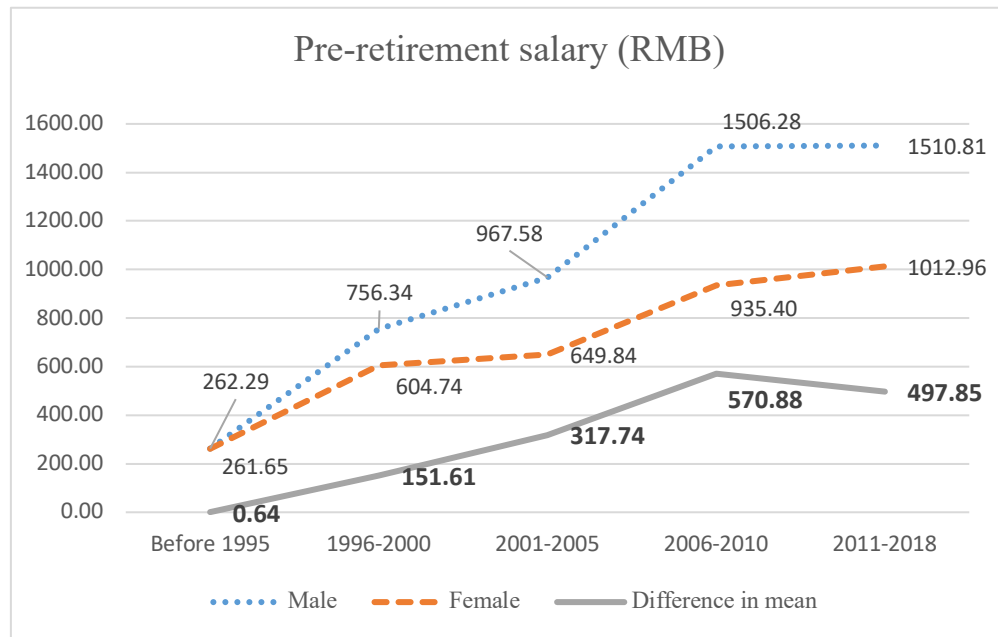
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.1 Summarised descriptive statistics of the continuous variables by gender in the five groups

	Before 1995				
	Male		Female		Difference in mean
Variable	Mean	Std.Dev.	Mean	Std.Dev.	
Monthly pension benefit	378.59	521.58	322.51	434.58	56.08
Retirement age	54.47	6.02	50.06	3.96	4.42
Working experience	32.18	7.42	25.29	7.50	6.89
Pre-retirement salary	262.29	392.33	261.65	507.12	0.64

	1996-2000				
	Male		Female		Difference in mean
Variable	Mean	Std.Dev.	Mean	Std.Dev.	
Monthly pension benefit	844.89	736.16	626.19	495.66	218.70
Retirement age	57.01	4.40	50.26	4.80	6.75
Working experience	35.20	5.90	28.25	6.23	6.95
Pre-retirement salary	756.34	680.12	604.74	930.01	151.61

	2001-2005				
	Male		Female		Difference in mean
Variable	Mean	Std.Dev.	Mean	Std.Dev.	
Monthly pension benefit	965.71	647.08	671.70	493.98	294.01
Retirement age	57.32	4.21	50.12	3.51	7.20
Working experience	35.51	5.50	27.66	6.20	7.86

Variable	Mean	Std.Dev.	Mean	Std.Dev.	Difference in mean
Pre-retirement salary	967.58	1153.74	649.84	930.15	317.74

2006-2010					
	Male		Female		Difference in mean
Variable	Mean	Std.Dev.	Mean	Std.Dev.	
Monthly pension benefit	1464.59	923.18	1109.71	648.12	354.88
Retirement age	58.15	3.36	50.90	3.58	7.25
Working experience	36.75	5.98	27.84	6.83	8.91
Pre-retirement salary	1506.28	2320.33	935.40	794.59	570.88

2011-2018					
	Male		Female		Difference in mean
Variable	Mean	Std.Dev.	Mean	Std.Dev.	
Monthly pension benefit	1950.18	1046.82	1040.15	461.55	910.03
Retirement age	59.61	1.58	50.96	6.09	8.64
Working experience	36.55	9.61	24.70	7.11	11.84
Pre-retirement salary	1510.81	1403.89	1012.96	679.64	497.85

Total					
	Male		Female		Difference in mean
Variable	Mean	Std.Dev.	Mean	Std.Dev.	
Monthly pension benefit	976.43	873.60	681.19	595.73	295.24
Retirement age	56.85	4.76	50.35	4.06	6.50
Working experience	34.98	6.69	27.03	6.89	7.96

Pre-retirement salary	922.00	1509.05	611.37	825.93	310.63

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.2 Education shown in percentages by gender in the five groups

Education	Before 1995			1996-2000			2001-2005		
	Male	Female	Difference in %	Male	Female	Difference in %	Male	Female	Difference in %
No formal education	33.51%	36.59%	-3.08%	18.57%	10.49%	8.08%	12.50%	11.45%	1.05%
Primary school	25.77%	28.29%	-2.52%	18.57%	20.28%	-1.71%	25.00%	15.06%	9.94%
Junior school	21.13%	18.05%	3.09%	22.86%	42.66%	-19.80%	26.88%	39.16%	-12.28%
High school	12.37%	14.15%	-1.78%	26.43%	17.48%	8.95%	25.63%	30.12%	-4.50%
Three-year college course	4.12%	1.46%	2.66%	5.71%	3.50%	2.22%	6.25%	3.61%	2.64%
Bachelor's degree	3.09%	1.46%	1.63%	7.86%	4.90%	2.96%	3.75%	0.60%	3.15%
Master's and above					0.70%	-0.70%			
Total	100.00%	100.00%		100.00%	100.00%		100.00%	100.00%	

Education	2006-2010			2011-2018			Total		
	Male	Female	Difference in %	Male	Female	Difference in %	Male	Female	Difference in %
No formal education	8.45%	8.19%	0.26%	9.09%	3.70%	5.39%	17.84%	17.42%	0.42%
Primary school	17.84%	9.36%	8.48%	6.06%	11.11%	-5.05%	21.08%	18.40%	2.68%
Junior school	38.50%	29.82%	8.67%	54.55%	25.93%	28.62%	29.19%	31.04%	-1.85%

High school	18.78%	45.03%	-26.25%	24.24%	55.56%	-31.31%	20.27%	27.53%	-7.26%
Three-year college course	12.68%	5.26%	7.41%	6.06%	3.70%	2.36%	7.43%	3.37%	4.06%
Bachelor's degree	3.29%	2.34%	0.95%				4.05%	2.11%	1.95%
Master's and above	0.47%	0.00%	0.47%				0.14%	0.14%	-0.01%
Total	100.00%	100.00%		100.00%	100.00%		100.00%	100.00%	

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.3 Occupation by gender and group

Retired as Worker or Cadre	Before 1995			1996-2000			2001-2005		
	Male	Female	Difference	Male	Female	Difference	Male	Female	Difference
Worker	64.95%	85.85%	-20.91%	50.00%	79.02%	-29.02%	64.38%	85.54%	-21.17%
Cadre	35.05%	14.15%	20.91%	50.00%	20.98%	29.02%	35.63%	14.46%	21.17%
Total	100.00%	100.00%		100.00%	100.00%		100.00%	100.00%	
Retired as Worker or Cadre	2006-2010			2011-2018			Total		
	Male	Female	Difference	Male	Female	Difference	Male	Female	Difference
Worker	71.83%	88.30%	-16.47%	75.76%	100.00%	-24.24%	64.46%	85.53%	-21.07%
Cadre	28.17%	11.70%	16.47%	24.24%	0.00%	24.24%	35.54%	14.47%	21.07%
Total	100.00%	100.00%		100.00%	100.00%		100.00%	100.00%	

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.4 Average pre-retirement salary in (yuan) by gender in different retirement groups for different occupation types

Retired as Worker or Cadre	Before 1995			1996-2000			2001-2005		
	Male	Female	Difference	Male	Female	Difference	Male	Female	Difference
Worker	217.90	193.31	24.60	548.51	460.82	87.70	723.97	596.45	127.52
Cadre	344.54	676.41	-331.88	964.17	1146.83	-182.66	1407.79	965.75	442.04

Retired as Worker or Cadre	2006-2010			2011-2018			Total		
	Male	Female	Difference	Male	Female	Difference	Male	Female	Difference
Worker	1268.14	801.02	467.12	1481.88	1012.96	468.91	778.81	523.96	254.85
Cadre	2113.53	1949.95	163.58	1601.25		1601.25	1181.70	1128.14	53.56

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Information on the discrete variables of education and occupation type is presented in Tables 6.2 and 6.3 respectively. Education and occupation are categorical variables, with education containing seven sub-categories. For the purpose of the analysis, the different education levels stated in the questionnaire responses were converted into school years, as was done by Zhang (2010). In the questionnaire, education level was an ordinal level variable with seven sub-categories and I transferred these ordinal categories into a list of ordinal numbers using Zhang's (2010) method rather than create a list of dummy variables for education level.

The other discrete variable, occupation type, contains two categories: worker and cadre. Occupation was kept as dummy variables in the regression models as it had only two categories, one of which needed to be excluded as a reference group when running a regression. The means of discrete variables like education and occupation could not be calculated like the continuous variables to compare gender differences. Due to the disparate number of respondents in the different groups, gender differences in each education level could not be accurately reflected. Therefore, the respondents in each sub-category were subdivided to calculate a percentage. Later on, the difference between the percentages, rather than difference in numbers, were used to express gender difference in each education level and occupation sub-category. The difference in the means of discrete variables could be calculated by using percentage for men minus percentage for women. The positive difference in mean suggests the percentage of men in this education level is larger than that of women, and vice versa.

As Table 6.2 and Figure 6.5 show, the percentage of no formal education (illiteracy) decreased rapidly for both men and women retirees because the government had introduced a campaign to wipe out illiteracy in 1978. For men, the proportion changed from 33.51% in the 'Before 1995' group to 9.09% in the '2011-2018' group, and for women the percentage dropped from 36.59% in the 'Before 1995' group to 3.70% in the '2011-2018' group. The percentage of respondents with education only to primary school level also showed a decreasing trend during these decades for both genders. Education attainment to junior school and to high school levels accounted for around 50% of the respondents in all except the first group, in which no formal education and primary school level accounted for more than 50%. The sum of the percentages of junior school and high school achievement for men was consistently lower than that for women in the last four groups. For example, in the '2011-2018' group, the sum of the percentage for junior school and high school levels was 78.79% for men and 81.48% for women. For higher education, above high school, the proportion of male retirees who had achieved that level was consistently higher than that of female retirees in all five groups (the percentage difference was consistently positive), which suggests that men always had greater opportunity to receive higher education. For education to master's level and above, some caution is necessary as people who were already retired could hardly have achieved such high academic

qualifications when they were young, especially during the 1960s and 1970s in China – this was not only due to the cultural revolution but also at that time there were very few opportunities for advanced postgraduate study in Chinese universities. These results suggest that over the years, retirees of both genders had had more opportunity to move on to further education. For the lower education levels, the percentage continued to decline for both genders, yet the sum of the percentages of men without formal education and primary school declined more slowly than that of women. For the secondary education levels, the growth rate in the percentage of women whose highest education level was junior school or high school increased faster than the percentage of men for the same levels during these decades. For those who had achieved a higher level of education such as a three-year college course or a bachelor's degree, the percentage was always in favour of men. The gender gap in achieving each education level was quite different in the different groups, but the opportunity to have a better education was consistently tilted towards men.

Figure 6.5 Education by gender in the different groups
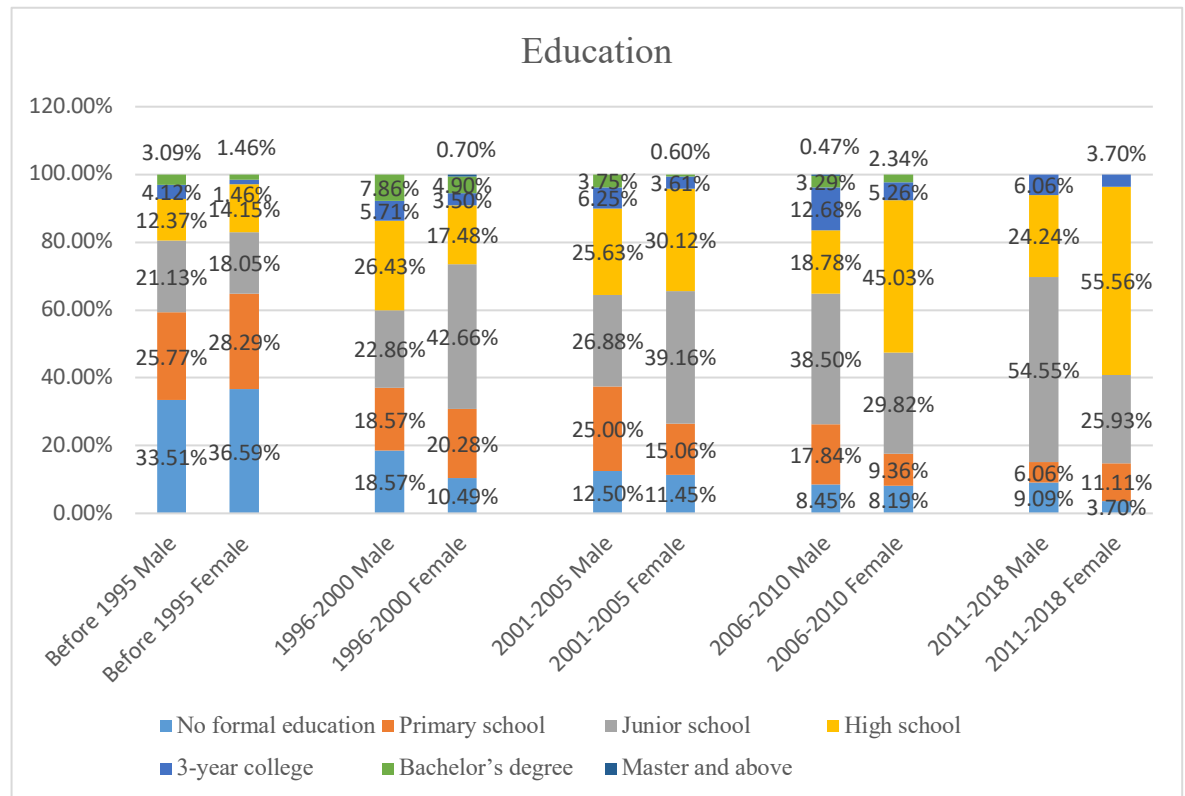
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Information about the other discrete variable, occupation type, is shown by gender and by group in Table 6.3 and Figure 6.6. The calculation and explanation about the difference in mean in Table 6.3 was consistent with those in Table 6.2. It can be seen that the percentages of male workers are much lower than those of female workers in all groups and that the percentages of male cadres are significantly higher than those of female cadres, which is another aspect that can reflect the gender inequality in the labour market as men usually had more opportunities for promotion than women. This tension can only be aggravated considering that men had a higher education level than women at that time (as shown in Table 6.2). The gender difference in occupation type (see Table 6.3) fluctuated around 20% during these years, with the exception of the '1996-2000' group whose gender difference increased to 29.02% and then dropped back to 21.17% in the subsequent five-year group. Table 6.4 presents the average pre-retirement salary in yuan by occupation type for men and women in the different retirement groups. The income gender difference is calculated using men's average pre-retirement salary minus women's average pre-retirement salary. Table 6.4 shows that cadres usually had a higher pre-retirement salary than workers for the same gender. When the occupation type is the same, in the same group, men usually had a higher pre-retirement salary than women with the exception of cadres in the first two groups. Tables 6.3 and 6.4 show that gender discrimination in the labour market

existed in all the retirement groups and that men usually had more opportunities for promotion than women and to earn higher wages as they get promoted.

Figure 6.6 Occupation type by gender in the different groups
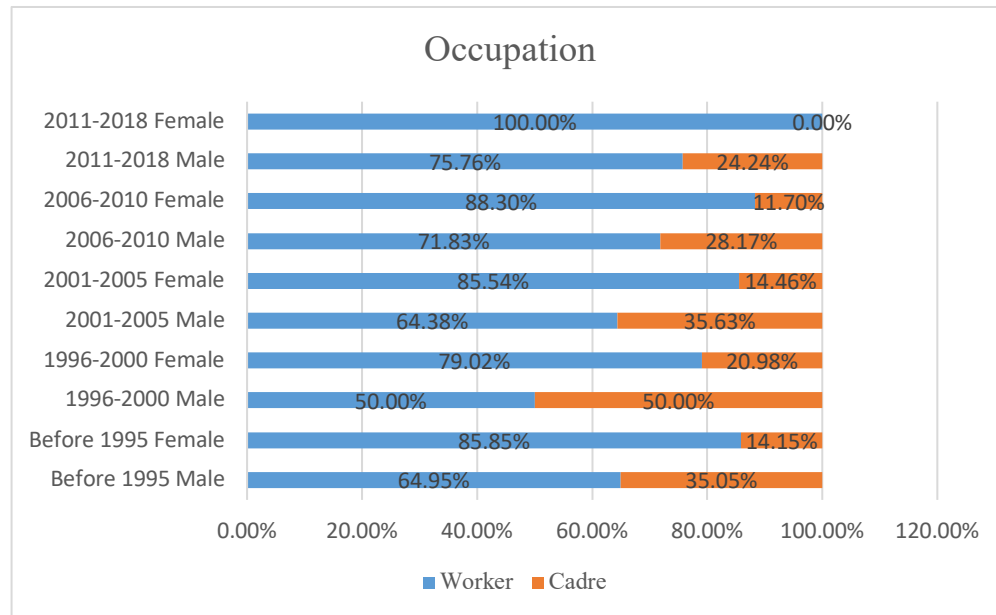
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

As can be seen in the previous tables and figures, the results clearly show that a gender gap did exist in these variables. The gender gap in monthly pension increased rapidly during these decades, especially in the fifth group. The gender gap in retirement age, working experience and pre-retirement salary also maintained an increasing trend over time (see Table 6.1), especially for pre-retirement salary, in which the gender gap increased from 0.64 yuan in the 'Before 1995' group to 497.85 yuan in the '2011-2018' group; the rapid economic growth and high inflation rate during these decades in China are two of the reasons for this but the gender gap certainly widened considerably.

The gender gap in education level and occupation type fluctuated during these years, but as shown in Tables 6.2 and 6.3, even though most of the gender gaps are positive, the percentage of women who could achieve higher levels of education continued to increase over time, but men always have more opportunities to have further education than women. The gender gap in occupation type fluctuated as the largest gender gap was in the '1996-2000' group (29.02%) whereas the '2006-2010' group had the smallest gender gap (16.47%). No comparison of the occupation data in the final group '2011-2018' was possible as no female cadres were recorded in that group in the new cross-sectional data. Even though the gender gap fluctuated a bit during these decades, the gender gap in occupation still shows that men always had more opportunities to be promoted at work than women and had more opportunity to earn more money as cadre

usually had higher wages. But the disadvantage for women was likely to decrease gradually and therefore the weakening of inequalities could be reflected in lower pension benefit gaps.

The tables and figures presented above show that a gender gap did and does exist in all of the variables which are related to the UEPS. Men had a higher monthly pension, a later retirement age, a higher pre-retirement salary and longer eligible working experience as well as more opportunity to go on to further education and to be promoted at work in all five groups. The gender gaps in these variables became even larger over time. In previous studies, many researchers have emphasized the importance of retirement age, the income gender gap and the gender gap in eligible working experience (for example, Pei, 2011; Zhang, 2010; Zhan, 2020; Wang, 2010; Ding and Zhang, 2006; Chen and Turner, 2015; Mi, 2016), showing that the difference in these factors could enlarge the gender pension gap. Most of these studies used simulation models and actuarial models to test how these factors could affect the gender pension gap, but some factors, such as education and occupation type, have not received much attention. Before I move to the present the findings from the regression models, I shall first compare the average pensions among the different education levels, occupation types and retirement ages to see whether there are positive correlations between these independent variables and the average pension benefit. The results of the comparisons will be shown in Tables 6.5, 6.6 and 6.7.

Table 6.5 Average pension (in yuan) by gender in the different groups for different education levels

Education	Before 1995			1996-2000			2001-2005		
	Male	Female	Female as % of Male	Male	Female	Female as % of Male	Male	Female	Female as % of Male
No formal education	317.66	225.9	71.11%	696.23	430.4	61.82%	637.55	424.84	66.64%
Primary school	275.00	295.74	107.54%	560.77	482.17	85.98%	742.61	536.16	72.20%
Junior school	449.00	424.75	94.60%	773.41	596.47	77.12%	825.26	672.15	81.45%
High school	514.33	506.55	98.49%	963.08	713.08	74.04%	1264.6	718.82	56.84%
Three-year college course	296.25	244.26	82.45%	685.00	1519.00	221.75%	1525.00	1532.70	100.50%
Bachelor's degree	987.50	293.33	29.70%	1794.55	1028.57	57.32%	1578.90	1200.00	76.00%
Master's and above					100				

Education	2006-2010			2011-2018			Total		
	Male	Female	Female as % of Male	Male	Female	Female as % of Male	Male	Female	Female as % of Male

No formal education	1087.39	706.07	64.93%	1400.00	350.00	25.00%	570.26	336.34	58.98%
Primary school	1112.41	741.88	66.69%	1140.00	833.33	73.10%	657.60	449.69	68.38%
Junior school	1232.58	938.21	76.12%	2048.66	1075.86	52.52%	1002.74	684.02	68.22%
High school	1511.75	1256.85	83.14%	2137.50	1104.20	51.66%	1182.64	927.54	78.43%
Three-year college course	2176.74	1875.44	86.16%	1950.00	1140.00	58.46%	1559.49	1480.96	94.96%
Bachelor's degree	3814.29	1625.00	42.60%				2061.28	1052.00	51.04%
Master's and above	3100.00						3100.00	100.00	3.23%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.6 Average pension (in yuan) by gender in the different groups for different occupation types

Retired as Worker or Cadre	Before 1995			1996-2000			2001-2005		
	Male	Female	Female as % of Male	Male	Female	Female as % of Male	Male	Female	Female as % of Male
Worker	335.28	295.31	88.08%	666.06	557.64	83.72%	785.38	609.49	77.60%
Cadre	458.84	487.55	106.26%	1023.73	884.40	86.39%	1291.57	1039.79	80.51%

Retired as Worker or Cadre	2006-2010			2011-2018			Total		
	Male	Female	Female as % of Male	Male	Female	Female as % of Male	Male	Female	Female as % of Male
Worker	1247.84	999.88	80.13%	1778.60	1040.15	58.48%	849.37	624.96	73.58%
Cadre	2017.30	1938.95	96.12%	2486.38		0.00%	1206.88	1013.64	83.99%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.7 Average pension (in yuan) by gender in the different groups for different retirement ages

Retirement age	Before 1995			1996-2000			2001-2005		
	Male	Female	Female as % of Male	Male	Female	Female as % of Male	Male	Female	Female as % of Male
< 60 (<50 for female)	317.64	304.80	95.96%	718.66	540.90	75.27%	885.17	623.08	70.39%
>= 60 (>=50 for female)	574.70	332.93	57.93%	1008.38	686.10	68.04%	1069.26	686.64	64.22%

Retirement age	2006-2010			2011-2018			Total		
	Male	Female	Female as % of Male	Male	Female	Female as % of Male	Male	Female	Female as % of Male
< 60 (<50 for female)	1119.89	1021.26	91.19%	1630.00	1103.00	67.67%	710.92	551.31	77.55%
>= 60 (>=50 for female)	1712.00	1126.29	65.79%	2021.33	1018.15	50.37%	1309.94	734.79	56.09%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Tables 6.5, 6.6 and 6.7 contains information of gender gap in three categorical variables, the gender gap is measured by women's pensions as a percentage of men's pensions. A higher percentage suggests a lower gender gap in pension benefit. For example, in Table 6.5, in the 'Before 1995' group, women's pension as a percentage of men's was 71.11% for no formal education. This shows that even though both men and women have 'no formal education' as their highest education level, the average monthly pension for women was only 71.11% of the monthly pension of men in the 'Before 1995' group, resulting in the gender gap of 28.89% (100% - 71.11%). Table 6.5 shows the average pension by gender and education level in the different groups, Table 6.6 shows the average pension by gender and occupation types in the different groups and Table 6.7 shows the average pension by gender and retirement age in the different groups.

Table 6.5 shows that education level had a positive relationship with average pension, which means that a higher education level will bring a higher average pension for both genders in all time periods. This positive correlation of education is consistent with the conclusion reached by Li (2004). For example, for men in the '2001-2005' group, the average pension benefit for those with their highest education level being primary school was 742.61 yuan, for those who had graduated from junior school it was 825.26 yuan and for men who had a bachelor's degree it was 1578.90 yuan. The situation was similar for women in the same group, as the average pension for those with their highest education level being primary school was 536.16 yuan, for those who graduated from junior school it was 672.15 yuan and for women who had a bachelor's degree it was 1200.00 yuan. This table shows that a higher education level usually led to a higher average pension benefit for both genders in all time periods, which suggests that a positive correlation exists between education level and average pension benefit.

Even so, even if the relationship between education level and average pension benefit is positive for both men and women, the findings suggest that the gender gap still exists. At the same level of education, women's average pension was much lower than men's, and this situation did not improve over time. There are some exceptions in the table. The first is that female retirees can have a higher pension than male retirees even though they have same education level in the same group. For example, for the retirees whose highest education level was primary school in the 'Before 1995' group, women's pension as a percentage of men's was 107.54%. The percentage rate being over 100% means that women's pension benefit was higher than men's. However, the ratio was less than 100% for primary school level from the second group onwards and the ratio dropped continuously in the next four groups. This suggests that men have gained an advantage in average monthly pension and such an advantage continues to magnify in the next decades. The second type of exception is when the ratio is quite close to 100%, for example, among retirees whose highest education level was high school in the 'Before 1995'

group, the female to male percentage was 98.49%. This indicates that women can have almost the same amount of pension as men at this education level in this retirement group.

The gender gap in average pension benefit reduced as the education level rose, as shown for the total group in Table 6.5. Taking each group separately, the gender gap fluctuated slightly but seems to have followed a downward trend as the education level rose. For example, in the '2006-2010' group, women's pension as a percentage of men's for no formal education was 64.93% but it rose to 76.12% for junior school level, and then to 86.16% for the three-year college course level before dropping to 42.60% for bachelor's degree level. In the '2006-2010' group, women with a higher education level were more likely to receive as much pension benefit as men except for the bachelor's degree.

Even so, the gender gap can be seen to widen for the same education level over time. For example, if we look at the high school level, women's pension as a percentage of men's started at 98.49% in the 'Before 1995' group, then dropped to 74.04% in the '1996-2000' group, and in the '2001-2005' group dropped again to 56.84%, before slightly increasing to 83.14% in the '2006-2010' group and then falling to 51.66% in the fifth group. This suggests that over time, women might have more opportunities to access higher education, but the income inequality still existed not only in the labour market but also in pension benefit. The gender gap in pension benefit became even larger for the same education level over time. The average pension benefit for a retiree educated to master's level and above is still an exception as there are too few available data to enable a comparison.

In Table 6.6, the average pension benefit is sorted by occupation type. The data suggest that cadres could always receive a higher pension than workers for the same gender in the same group; for example, in the '1996-2000' group, male cadres received 1023.73 yuan whilst male workers only received 666.06 yuan. When it comes to the gender gap, male retirees always had a higher pension benefit than women for the same groups, even if they had the same occupation type. For example, in the '1996-2000' group, male workers received 666.06 yuan as the average pension whilst female workers only received 557.64 yuan. So for the gender difference in average pension benefit, in the same group, the gender difference for workers was higher than for cadres. For example, in the '1996-2000' group, female workers only received 83.72% of male workers' average pension benefit but the percentage rose to 86.39% for cadres in the same group. The gender difference widened for workers and cadres during these decades. The range of variation among workers was greater than among cadres. The gender gap for workers changed from 88.08% in the 'Before 1995' group to 58.48% in the '2011-2018' group, whereas the gender difference for cadres fell from 106.26% in the 'Before 1995' group to 96.12% in the '2006-2010' group. There was no gender gap information for cadres in the '2011-2018' group

as there were no female cadres in that group. It can therefore be concluded that for the same occupation, men always received a higher pension than women for both workers and cadres, and the gender gap even widened over these years. There was also a gap in pension benefit within occupation type as those who retired as a cadre received a much higher pension than those who retired as a worker for both genders, so occupation status did have a positive correlation with pension benefit, and the gender gap in occupation status could widen the gender gap in pension benefit. The findings shown in Figure 6.6 suggest that the percentage of women who retired as a cadre was much lower than that of men, which means that women had fewer opportunities for promotion than men. Combined with the income gender gap in the labour market (see Tables 6.1 and 6.4), all these factors had effective repercussions for women's retirement income and women were less likely to have the same pension benefit as men.

In Table 6.7, retirees are divided into two groups, one contains retirees who retired earlier than statutory retirement age and the second group contains those who retired when they reached the statutory retirement age or later. As Table 6.7 shows, the gender gap in the group who retired earlier is lower than that in the group who retired at the statutory age or later.

Men always had a higher pension benefit than women regardless of whether they retired earlier or at the normal age. For example, in the '2001-2005' group, men who retired earlier received 885.17 yuan on average whilst for women who retired earlier, the pension was 623.08 yuan on average. For those who retired at or after the statutory retirement age, men could receive 1069.26 yuan on average whilst women only received 686.64 yuan on average in the '2001-2005' group. The gender gap for those who retired at or after the statutory age was much larger than among those who took early retirement. For example, in the '2001-2005' group, the gender gap was 29.61% (1-70.39%) for those who took early retirement and 35.78% (1-64.22%) for those who retired at or after the statutory age. The reason why people who retired early had a smaller gender gap could be that male early retirees had a much lower pension than men who retired at the statutory age (885.17 yuan compared with 1069.26 yuan in the '2001-2005' group) but the average pension benefit for women did not change very much (623.08 yuan compared with 686.64 yuan). The gender difference for those who retired early continued to increase as men's average pension benefit increased faster than women's average pension benefit over the years (the ratio of women's average pension to men's dropped from 95.96% in 'Before 1995' group to 67.67% in '2011-2018' group). The gender gap for those who retired after statutory age reduced as women's average pension as a percentage of men's increased from 57.93% in the 'Before 1995' group to 65.79% in the '2006-2010' group, but the gender gap widened again in the fifth group as it decreased to 50.37% in the '2011-2018' group.

Table 6.7. shows that regardless of whether retirees retired early or at or after the statutory retirement age, if they had the same retirement type, men always had a higher pension benefit than women; the gender gap for retirees who took early retirement increased with some fluctuation over time whereas the gender gap for those who retired at or after the statutory retirement age decreased over time but then increased again in the fifth group; the gender gap for retirees who took early retirement was always smaller than those who retired after the statutory retirement age. This means that the widened pension gap could be attributable to men's higher salaries and ability of working longer. The last few years before retirement lead to a higher pension gap between men and women, and between those who chose to retire early and at statutory age.

6.2 Results of the regression models

In this section, the results from regression models will be analysed to answer the third and fourth research questions '3. How do factors such as education, working experience and income before retirement affect the gender gap in the UEPS?' and '4. How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?'. The final question '5. When controlling for the same gender in both the UEPS and the NRSPP, are there similarities or differences in terms of how the abovementioned factors inter-relate?' will be answered after analysing the data from the NRSPP.

As explained in the methodology section, there were three regression models in this study:

the standard model:

$$Y_{it} = \beta_{gender}^{standard} Gender + \text{ error}$$

the complete model:

$$Y_{it} = \sum_{i=1}^{k} \beta_i X_{it} + \beta_{gender}^{complete} Gender + error$$

and nested models:

$$Y_{it} = \sum_{i=1}^{k-1} \beta_i X_{it} + \beta_{gender}^{nested} Gender + error$$

The complete model contains not only the gender variable, but also all the other selected pension-related variables as the independent variables, the coefficients of each explanatory

variable are used to interpret the effect of each independent variable on the dependent variable. The coefficients from standard model and nested model can not be used to interpret the effects on the dependent variable due to omitted variable bias, which occurred because the standard model and nested models left out at least one relevant variable as the determinants of the monthly pension benefit in the regression. The results of the regression models by groups will be divided into two sections for analysis: the results of unstandardized coefficients and the results of standardized coefficients. The unstandardized coefficients could give an explanation about how much monthly pension benefit could be affected if the independent variable changes one unit. To determine which variable has the most significant effect on the pension benefit level, the independent variables should be ranked by applying the standardized coefficients. The standardized coefficients have normalized the coefficients that can be ranked as they eliminate the unit of measurement. The results of unstandardized coefficients and standardized coefficients could help answer the ensuing questions: 'If the independent variable is positively related with average monthly pension benefit, will the independent variable also have a positive effect on the gender pension gap?', 'To what extent the gender gap in terms of pension benefit can be explained by each independent variable?' and 'After ranking the independent variables by their influence on average monthly pension benefit, will these independent variables have the same rank if I rank them by their influence on the gender pension gap?'. These questions can not be answered if merely coefficients from complete model were used, regardless the coefficients are standardized or unstandardized. This notion has been explained in the methodology: the coefficients from the complete model can not tell how these independent variables affect the gender gap in terms of pension benefit, not to mention rank the independent variables accordingly. To answer the questions about gender gap in pension benefit level, I shall apply the exponential function of the gender coefficients in each regression model to measure the effect of each independent variable on the gender pension gap, as was explained in the methodology section.

6.2.1 Unstandardized coefficients

The integrated results of cross-sectional regressions for the five groups are shown in Appendix C. Model 1 is the standard model, model 2 is the complete model, and models 3 to 7 are the set of nested models. Model 3 excludes retirement age, model 4 excludes working experience, model 5 excludes pre-retirement salary, model 6 does not include education level and model 7 does not have occupation type. The coefficients of the independent variables in model 2 from each group were used to interpret the relationship between independent variables and the dependent variable. The results of the complete model from each group are summarised in Table 6.8. In the standard model and the set of nested models which do not contain all the independent variables, there will be omitted variables bias if they are used to interpret the relationship between independent variables and the dependent variable.

As was explained in the methodology section, the regression model used in this study was a log-level regression[29]. The dependent variable in the model is the logarithm of monthly pension benefit, and the independent variables contain two dummy variables: gender and occupation type, three continuous variables: retirement age, working experience and pre-retirement salary, and one numerical categorical variable: education. To interpret the coefficient of independent variables in a log-level regression model, the researcher needs to know the units of independent variables. Given that the dependent variable is in the logarithm form, the unit of the dependent variable is irrelevant. In the log-level model, the interpretation for the coefficients of the independent variable is that "A unit increase in independent variable X will result in 100%*coefficient change in dependent variable". The detailed explanations and the examples of coefficients are clarified in the following sections.

The coefficients in Table 6.8 can be divided into two groups: statistically significant coefficients and statistically insignificant coefficients. The results of the significance of coefficients are shown in Table 6.8. The number of asterisk suggests the significance level of the coefficient. One, two, and three asterisks suggest there is a 10%, 5% and 1% chance that the independent variable is not associated with the dependent variable, respectively. Hence, the more asterisks, the higher probability to reject the null hypothesis that the independent variable is not related to the dependent variable. In this study, the significance level was set at 10%. That being said, one asterisk is sufficient to indicate that the coefficient is statistically significant and thus the null hypothesis could be rejected. Based on previous studies, such as Li, (2004), Wang and Cai, (2008) Zhang, (2010), Wang and Li, (2013) and Zheng, Xu and Liang, (2017), and the results from the descriptive data analysis, I formed the hypothesis that all the independent variables should have a positive relationship with pension benefit, except for gender which should have a negative coefficient.

The first independent variable listed in the complete regression model is the gender variable. As explained in the   Methodology chapter, the gender variable is a dummy variable, which equals 1 if the respondent is a woman and 0 for a man. If the gender coefficient is negative, for example, in Table 6.8, the complete model in the '1996-2000' group has a significant negative gender coefficient (-0.228**), it suggests that if the respondent is female, we can expect the monthly pension benefit to decrease by 22.8% compared with the reference group ('male' in this regression), all other things being equal. If the gender coefficient is positive, for example, in the '2006-2010' group the complete model has a positive gender coefficient (0.079), this suggests that if the respondent is female, the monthly pension benefit will be 7.9% higher than

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[29] The log-level regression means that the dependent variable is in logarithm form and the independent variable is in the original units: $\ln(Y) = \beta_0 + \beta_1 * X + \epsilon$

for the male group, all other things being equal. It can be seen that the gender variable is positive in the first and the last two groups and that the largest positive gender coefficient is 0.079 in the '2006-2010' group, whereas the gender coefficient is negative in the '1996-2000' and '2001-2005' groups and the largest negative gender coefficient is -0.228. The comparison of the gender coefficients in the five groups shows that women had a higher pension benefit than men if they had the same conditions before 1995, but the gap in pension benefit was quite small, only 5.6% higher than for men, since the coefficient for gender variable in the 'Before 1995' group is 0.056. However, this situation changed in the next ten years (1995-2005) and the gender pension difference shifted from favouring women to favouring men. As the gender coefficient is negative, men can always have a higher pension benefit than women, all other things being equal. The gender pension difference changed from 5.6% more for women in the first group to 22.8% more for men in '1996-2000' group (the coefficient for gender variable becomes negative in the '1996-2000' group, -0.228) and decreased again to 11.5% more for men in the '2001-2005' group (the gender coefficient is -0.115). The advantage shifted to women again in the '2006-2010' '2011-2018' groups (the coefficients are positive again, with values of 0.079 and 0.025, respectively). We can note that when the advantage is biased towards women, this advantage is significantly smaller than the degree of advantage when towards men.

As for other pension-related independent variables, as shown in Table 6.8, eligible working experience and pre-retirement salary always had significant positive coefficients in all the complete models. All these significant positive coefficients suggest that if eligible working experience or pre-retirement salary increase, the average monthly pension benefit will increase, and this positive relationship is statistically significant. For example, in the 'Before 1995' group, the coefficient of working experience is 0.031***, which means that if an individual has one more year of eligible working experience, the monthly pension benefit will increase 3.1%, all other things being equal. Another independent variable with significant positive coefficients in all groups is pre-retirement salary. However, the coefficients of pre-retirement salary are quite small, except for the 'Before 1995' group, and the coefficient of pre-retirement is 0.000*** in the complete model for all the other groups shown in Table 6.8. In the 'Before 1995' group, the coefficient of pre-retirement salary is 0.001***, which is quite significant and the coefficients indicate that if the pre-retirement salary increases by 1 yuan, the monthly pension benefit will increase by 0.1%, all other things being equal. All these statistically significant positive coefficients in all groups emphasize the importance of eligible working experience and pre-retirement salary because these two factors have always had a positive effect on monthly pension benefit and the influence has been maintained over decades.

Education and occupation type are two factors which have positive coefficients in all of the groups except one. The coefficients of education level are all significantly positive except in the

'2011-2018' group, in which the coefficient of education level is insignificant and negative (-0.03), and this insignificant coefficient indicates that with a one-year increase in education, the monthly pension benefit will decrease by 3%, which is inconsistent with Li's (2004) finding that retirees who have a higher final education level should have a higher pension benefit. The insignificant coefficient means the probability of no relationship between education and the logarithm of monthly pension benefit is at least 10% larger than that of the sample in the last group. The interpretation of the significantly positive education coefficients is quite similar to those of pre-retirement salary and working experience; for example, the coefficient of education level in the complete model in the '2001-2005' group was 0.036***, which suggests that with a one-year increase in education, the monthly pension benefit will increase 3.6%. These statistically significant positive coefficients for education in all groups show that education level always had a positive effect on monthly pension benefit, which is consistent with the results from the descriptive analysis that people with higher education levels could have higher monthly pensions. However, this relationship changed after 2011, that is, in the last group, retirees with higher education level would receive lower pension benefit.

The occupation coefficients in the complete models are all positive except for the 'Before 1995' group. The interpretation for the occupation coefficients is slightly different from the other pension-related factors as occupation is a dummy variable in this study; it is 0 if a person retired as a worker and 1 if the individual retired as a cadre. The coefficient of 'occupation' is explained in the same way as the coefficient of gender variable, both of which are dummy variables. If the interpretation is the positive coefficient, for example, the occupation coefficient is 0.184 in the complete model in the '1996-2000' group, this means that if the respondent retired as a cadre, the monthly pension benefit would be 18.4% higher than that of a worker, all other things being equal. As for the negative occupation coefficient, in the complete model in the 'Before 1995' group, the occupation coefficient was -0.181, which means that the monthly pension benefit will decrease by 18.1% if the person retired as a cadre compared with the reference group (the worker group). The coefficients of occupation type started as negative in the first group and changed to positive in the other four groups, which means that people who retired as a cadre would have a lower monthly pension than those who retired as a worker if they retired before 1995. After 1995, a cadre would always have a higher monthly pension than a worker as the coefficients for occupation were positive, and positive coefficients are consistent with the hypothesis drawn from the literature and the descriptive analysis in the previous section.

Most of the signs of the above coefficients of working experience, pre-retirement salary, education and occupation type are consistent with the results of the descriptive data analysis and the initial hypothesis. However, the sign of the coefficients of retirement age in the complete model for all five groups were quite different compared with other factors. The findings of

previous empirical studies using simulation models and actuarial analysis or regression models (Pei, 2011; Zhang, 2010; Li, 2008; Chen and Turner, 2015; Wang and Li, 2013; Guo and Yue, 2017; Wang, 2010) suggest that in their research, the monthly pension benefit should increase with a later retirement age. The descriptive data also show that among the CHARLS survey respondents, those who retire at a later age could receive a higher monthly pension, as shown in Table 6.7. However, the regression analysis explored the relationship between retirement age and monthly pension benefit, and only two groups ('Before 1995' and '2006-2010' in Table 6.8) had positive coefficients of retirement age. For example, in the '2006-2010' group, the coefficient of retirement age in the complete model is 0.003, which indicates that if the individual had retired one year later, the monthly pension would increase by 0.3%. The negative coefficient of -0.009 in the '2001-2005' group indicates that if the individuals had retired one year later, they would have a 0.9% lower monthly pension, which is quite contrary to the findings of previous studies. As the coefficients of retirement age changed over time, this suggests that the effect of retirement age on monthly pension benefit underwent many changes over the years. The retirement age started with an insignificant positive influence on the monthly pension benefit and changed to have negative effect on the monthly pension benefit in 1996. It then changed to have a positive effect in the '2006-2010' group and went back to having a negative effect in the fifth group. Only the negative coefficient in the group '1996-2000' is statistically significant, while all other coefficients for retirement age are statistically insignificant. The insignificant coefficient of retirement age in most groups indicates that retirement age is more likely to be uncorrelated with the pension benefit level. The ensuing question is that 'if retirement age is not significantly correlated with pension benefit level, will retirement age still have effect on the gender gap in the pension benefit level? If the answer is yes, how does the variables with insignificant coefficient (such as retirement age) affect the gender gap in pension benefit level?'. This question will be discussed in Section 6.3 of gender gap analysis along with other variables with insignificant coefficients.

The negative coefficients were inconsistent with the initial hypothesis that 'people who have a later retirement age should have a larger pension' drawn from previous empirical studies (such as Li (2008); Chen and Li (2004); Guo and Peng (2017)) in which the researchers all assumed that all workers are perfect workers and that once they enter the labour market, they will not stop working until they retire. This means that if workers enter the labour market at the same age, a later retirement age can equate to a longer eligible working life, and as eligible working experience is a major determinant in the calculation formulas of pension benefit and a longer eligible working life leads to a higher pension in all periods, the retirees who retire later, all other things being equal, will have a higher pension benefit according to the previous studies. The respondents in CHARLS, however, are not perfect workers; those who have the same retirement age could have very different numbers of eligible working years. There are three

account forms of eligible working experience. The first is the continuous calculation method. For example, if an employee changes his or her job from company A to company B, the eligible working experience in company A and company B should be counted as continuous working years without interruption. If an employee's eligible working experience is counted incorrectly, after a review and rectification, the time of the error can be calculated as continuous working experience with the eligible working experience before the error and the working experience after the rectification. The second calculation method is the combined calculation method. If the working experience is interrupted for non-subjective reasons, the time period of the interruption can be deducted and the two working periods before and after the break are calculated together as continuous working experience. The third method is for workers in a specific working environment or with heavy labour tasks such as miners; when calculating their continuous working years, for each year working in some specified places, they can have one year and three months as the eligible working experience. If employees took a break during their working life or changed their job or worked in a specific working environment, the eligible working experience can vary even though they have same retirement age.

Scatter plots with a line between retirement age and eligible working experience were used to see whether a later retirement age can be equivalent to longer working experience. The scatter plots are shown as Figures 6.7 and 6.8, where the x-axis is the retirement age and the y-axis is the eligible working experience years. As shown in these two figures, even if retirees have same retirement age, their eligible working experience can vary considerably. For example, in the '1996 -2000' group, the eligible working experience can vary from fewer than 10 years to more than 40 years for men who retired at 60. The eligible working experience for women who retire at same age also fluctuated widely. For example, in the '2006-2010' group, the eligible working experience for women who retired at 50 can fluctuate from fewer than ten years to more than 40 years.

The fitted line in the scatter plots shows that a positive correlation might exist between working experience and retirement age, which means the retirees with a later retirement age could have a longer eligible working experience. Whereas, the data also indicate that people who retired early can also have exactly the same eligible working experience as people who retired at a later age, which is not what was expected. Previous studies have shown that retirement age matters, but the analysis here shows that what actually matters is the combination of retirement age and eligible working experience. As a later retirement age can not be equated with a longer eligible working experience, the negative retirement age coefficient can be understood.

After reviewing the coefficients of the independent variables from the five complete models, it can be seen that pre-retirement salary and working experience always had a positive relationship

with pension benefit, which is consistent with the findings of previous empirical studies; occupation type and education had positive coefficients in most of the complete models which is also consistent with previous findings. However, the sign of retirement age coefficients is inconsistent during the five retirement periods which means that the effects of retirement age on monthly pension benefit are quite opposite in different retirement periods.

Table 6.8 The regression results of the complete model by groups

	Before 1995 Y	1996-2000 Y	2001-2005 Y	2006-2010 Y	2011-2018 Y
Gender	.056	-.228**	-.115	.079	.025
	(.111)	(.113)	(.098)	(.075)	(.297)
Retirement age	.016	-.026**	-.009	.003	-.019
	(.012)	(.011)	(.01)	(.008)	(.022)
Working experience	.031***	.017**	.024***	.024***	.045***
	(.008)	(.008)	(.006)	(.004)	(.011)
Pre-retirement salary	.001***	0***	0***	0***	0**
	(0)	(0)	(0)	(0)	(0)
Education	.038***	.029**	.036***	.024***	-.03
	(.012)	(.011)	(.01)	(.007)	(.03)
Occupation	-.181	.184	.161*	.289***	.441
	(.138)	(.121)	(.092)	(.07)	(.288)
_cons	2.978***	6.699***	5.728***	5.61***	6.725***
	(.562)	(.59)	(.534)	(.445)	(1.491)
Observations	399	283	326	384	60
R-squared	.312	.261	.321	.383	.456

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Figure 6.7 Scatter plots with a fitted line for males in the five retirement groups
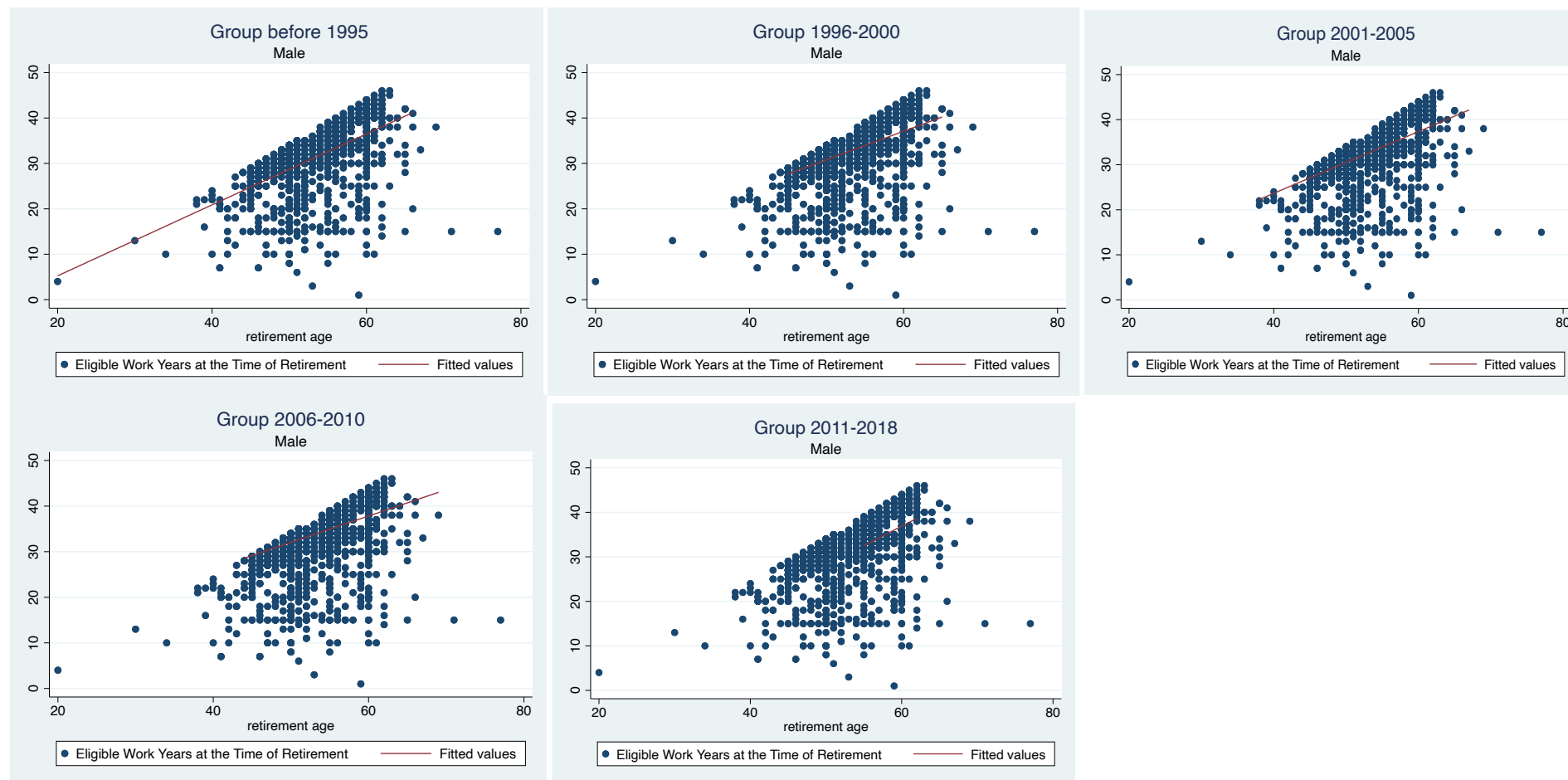
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Figure 6.8 Scatter plots with a fitted line for females in the different groups
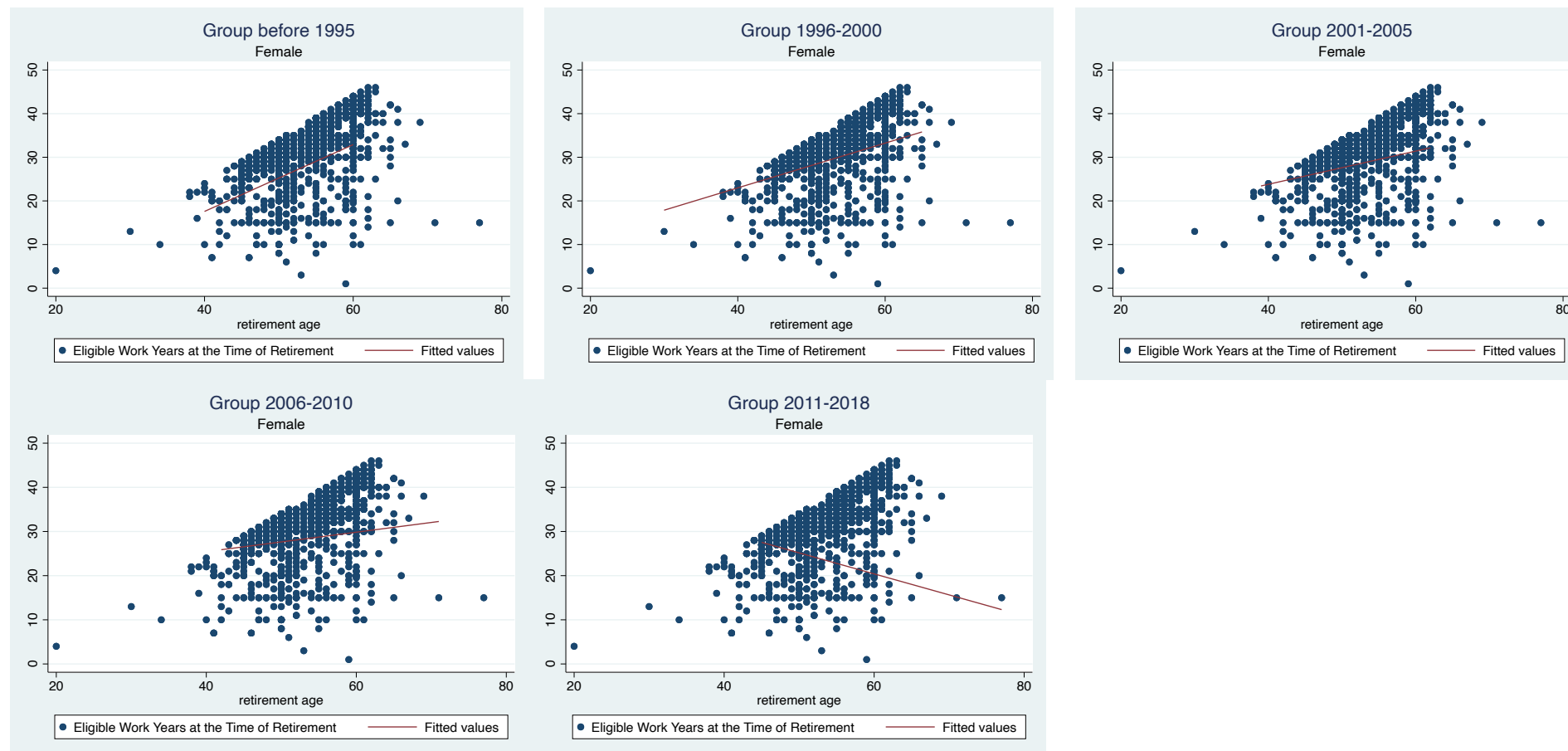
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

6.2.2 Standardized coefficients

The coefficients of each independent variable in the complete model for the five retirement groups has been interpreted and the relationship between each independent variable and monthly pension benefit is quite clear. In order to address the third and fourth questions '3. How do factors such as education, working experience and income before retirement affect the gender gap in the UEPS?' and '4. How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?' An initial hypothesis can be formulated in order of the effect of coefficients on monthly pension benefit, that is, which factor is likely to have the most significant impact on the gender pension gap. However, as all the coefficients were unstandardized and were used in different measure scales, it is impossible to compare them directly or to give a ranking in order of their influence on monthly pension benefit. The standardized coefficients therefore had to be applied. They were computed using the ratio of standard deviations of the independent variable and dependent variable and then by multiplying the unstandardized coefficients. After the standardization, all the coefficients then had the same measurement scales expressed as standard deviations. The standardized coefficients could then be compared directly and a ranking of the coefficients could be compiled to help to answer the research question. Summaries of the unstandardized coefficients and the standardized coefficients from the complete models for each retirement group are shown in Tables 6.9 and 6.10. The three columns in each retirement group in Table 6.9 give information about the unstandardized coefficients: the name of independent variables, the unstandardized coefficients and the absolute value of the unstandardized coefficients. The independent variables are listed in descending order of the absolute value of the unstandardized coefficients. The three columns for each group in Table 6.10 give information about the standardized coefficients in each group: the name of independent variables, standardized coefficients, and absolute values of standardized coefficients. The independent variables are also summarised in order of absolute values of the standardized coefficients.

Tables 6.9 and 6.10 shows that the rankings in the unstandardized and standardized groups are quite different. In the unstandardized group, occupation type and gender occupy the top two positions except for the last group, '2011-2018', in which occupation type and working experience occupy the first two positions. As for other factors, education always occupies the third position in all five groups and pre-retirement salary always stays at the bottom of the list. Working experience and retirement age usually occupy the fourth and fifth positions in turn. However, as explained above, all these independent variables have different measurements and therefore a comparison between the unstandardized coefficients will not make much sense. The ranking of the standardized coefficients in each model could be used to determine which factor has the most significant effect on average monthly pension benefit. In the standardized coefficients shown in Table 6.10, pre-retirement salary and working experience usually occupy

the top two positions in all of the retirement groups, except for the '1996-2000' group in which pre-retirement salary still ranks first whilst retirement age occupies the second position. Education level stands in the third position in the first three groups whilst occupation type ranks in the third position in the last two groups. The fourth, fifth and sixth positions would be more randomly occupied by the remaining variables.

Analysis of the ranking of the standardized coefficients in each group shows that pre-retirement salary and working experience always hold the top two positions, which suggests that these two factors have the most significant effect on monthly pension benefit in all models. Occupation type and education level are factors which follow pre-retirement salary and working experience in the standardized section, which indicates that occupation type and education level also have a greater effect on the dependent variable in this multiple regression, but the effect is not as significant as those of pre-retirement salary and working experience. Retirement age only has the second position in the '1996-2000' group and in other groups it fluctuates from fourth to sixth place. The rank of retirement age shows that it is not as important in the current data as in previous studies (for example, Li, 2008; Wang, 2010; Wang and Li, 2013; Zheng, Xu and Liang, 2017). In all those studies, a later retirement age was equivalent to longer working experience and from the pension policy it is known that the calculation formula for pension benefit was directly influenced by eligible working experience. However, in the current data, as shown in the scatter plots in Figures 6.7 and 6.8, a later retirement age can not be equated with a longer eligible working experience, and the fact that the influence of retirement age on average monthly pension benefit is much lower than that of working experience can be understood. The gender variable always ranks in the last two influential factors, which suggests that it is not as significant as other factors in its effect on average monthly pension benefit. Even though the gender variable does not have a significant effect on average monthly pension, the gender gap still exists in the context of the analysis of the previous descriptive data above. The gender gap exists not only in the average pension benefit, but also in independent variables, such as the gender gaps in eligible working experience and in education level. Will the independent variables that have a significant effect on pension benefit also have a significant effect on the gender gap in pension benefit? Will the variables that have the most significant effect on the pension benefit level, such as pre-retirement salary and working experience, also have the most significant effect on the gender gap in pension benefit? In the next step, which factors have significant effect on the gender pension gap will be discussed in order to address research questions 3: 'How do factors such as education, working experience and income before retirement affect the gender gap in the UEPS?' and 4: How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?'

Table 6.9 Unstandardized coefficients for the complete model in the five retirement groups

1995			1996-2000			2001-2005		
Unstandardized coefficients			Unstandardized coefficients			Unstandardized coefficients		
Occupation	-0.181	0.181	Gender	-0.228	0.228	Occupation	0.161	0.161
Gender	0.056	0.056	Occupation	0.184	0.184	Gender	-0.115	0.115
Education	0.038	0.038	Education	0.029	0.029	Education	0.036	0.036
Working experience	0.031	0.031	Retirement age	-0.026	0.026	Working experience	0.024	0.024
Retirement age	0.016	0.016	Working experience	0.017	0.017	Retirement age	-0.009	0.009
Pre-retirement salary	0.001	0.001	Pre-retirement salary	0.000	0.000	Pre-retirement salary	0.000	0.000
2006-2010			2011-2018					
Unstandardized coefficients			Unstandardized coefficients					
Occupation	0.289	0.289	Occupation	0.441	0.441			
Gender	0.079	0.079	Working experience	0.045	0.045			
Education	0.024	0.024	Education	-0.030	0.030			
Working experience	0.024	0.024	Gender	0.025	0.025			
Retirement age	0.003	0.003	Retirement age	-0.019	0.019			
Pre-retirement salary	0.000	0.000	Pre-retirement salary	0.000	0.000			

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.10 Standardized coefficients for the complete model in the five retirement groups

1995			1996-2000			2001-2005		
Standardized coefficients			Standardized coefficients			Standardized coefficients		
Pre-retirement salary	0.404	0.404	Pre-retirement salary	0.359	0.359	Pre-retirement salary	0.334	0.334
Working experience	0.216	0.216	Retirement age	-0.175	0.175	Working experience	0.223	0.223
Education	0.158	0.158	Education	0.152	0.152	Education	0.197	0.197
Retirement age	0.075	0.075	Working experience	0.138	0.138	Occupation	0.093	0.093
Occupation	-0.067	0.067	Gender	-0.134	0.134	Gender	-0.077	0.077
Gender	0.024	0.024	Occupation	0.103	0.103	Retirement age	-0.066	0.066

2006-2010			2011-2018		
Standardized coefficients			Standardized coefficients		
Working experience	0.308	0.308	Working experience	0.542	0.542
Pre-retirement salary	0.297	0.297	Pre-retirement salary	0.238	0.238
Occupation	0.195	0.195	Occupation	0.176	0.176
Education	0.157	0.157	Retirement age	-0.132	0.132
Gender	0.066	0.066	Education	-0.119	0.119
Retirement age	0.024	0.024	Gender	0.015	0.015

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

6.3 Gender gap analysis using multiple regressions results by groups

From the analysis of the descriptive data and the results of the regression models presented above, it is quite clear that a gender gap did exist in these independent variables and in the monthly pension benefit. The relationships between the independent variables and the dependent variable are quite consistent with the initial hypothesis in most groups, except for retirement age. To answer research questions '3. How do factors such as education, working experience and income before retirement affect the gender gap in the UEPS?' and '4. How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?', two sub-questions were applied; these were whether all these factors have a significant impact on the gender gap in pension benefit, and which pension-related factor has the most significant effect on the gender gap in monthly pension benefit. The ranking of standardized coefficients (see Table 6.10) gives could give an initial hypothesis that the factors which have the most significant effect on monthly pension benefit will also have the most significant effect on the gender gap in pension benefit. Is there is a fixed order of variables which have the most significant effect on the gender gap in pension benefit in all groups or are there some variables which always rank higher than others in all groups? To answer these sub-questions, the exponential function EXP(βgender) of gender variable will be used to measure the gender gap, where the EXP(βgender) equals to the female to male average pension benefit ratio. To explore how each independent variable affects the gender pension gap and how these independent variables collectively affect the gender pension gap, the deviation between the complete model's $EXP(\beta_{gender}^{complete})$ and other EXP(βgender) from the standard and nested models in the five groups were analysed. Information about the coefficients of gender variable, the exponential function of gender coefficient EXP(βgender) and the deviation between the exponential function of gender coefficient in the complete model and the other models and the adjusted R2 for the standard model, the complete model and the set of nested models in all groups are all summarised in Table 6.11.

As the respondents were put into different groups based on their year of retirement, there were five groups on which to run the regressions and obtain the gender coefficients in each model. The gender variable, its exponential function and the deviation for each model will be discussed together first. The equations of each model were explained in the methodology section, and the exponential function of gender coefficients EXP(βgender) is the female to male average pension benefit ratio. If the gender coefficient in the regression model is negative, the exponential function of the gender variable will be less than 1, which means that the female pension benefit is lower than the male pension benefit. If the regression model has a positive gender coefficient, the exponential function of the gender coefficients will be larger than 1, which indicates that the female pension benefit is higher than the male pension benefit. As with the results shown in the

descriptive data analysis, women consistently had a disadvantage in the labour market, including labour income (suggested by the gender difference in pre-retirement salary), promotion opportunity (suggested by the gender difference in the occupation percentages for men and women) and women usually had fewer years of working experience and an earlier statutory retirement age. Women also had a disadvantage in terms of access to higher levels of education. Based on these facts, my next hypothesis is that the gender coefficient will always be negative and the exponential function of the gender coefficient will always be less than 1. However, the results of the gender coefficients were quite inconsistent with this hypothesis in some groups. Table 6.11 summarises the gender coefficients, the exponential function of gender coefficients EXP(βgender), deviation between EXP(βgender) in the complete model and other models and the adjusted R2 for all models and all retirement groups. As different regression models used different groups of data, the adjusted R2 for the set of multiple regression models should be quite different, and the exponential function of gender coefficients EXP(βgender) in each model should also be different as each model has its own gender coefficients βgender. The deviation between the complete model's exponential function of gender coefficients EXP($\beta_{gender}^{complete}$) and the nested models' exponential function of gender coefficients EXP(β_{gender}^{nested}) are summarised in Table 6.12 in order of the magnitude of deviation.

In the standard model, the gender coefficient $\beta_{gender}^{standard}$ represents the total effect of the gender variable on the monthly pension benefit in the UEPS as the gender variable is the only independent variable in the standard model. The exponential function of the gender coefficients EXP($\beta_{gender}^{standard}$) in the standard model stands for the absolute value of the female to male average pension benefit ratio, and as shown in Table 6.11, it is clear that the gender gap is quite different in the different groups. The absolute value of gender gap equals to 1 minus EXP($\beta_{gender}^{standard}$) in the standard model. As shown in Table 6.11, in the standard model, the gender coefficients are all negative and EXP($\beta_{gender}^{standard}$) are all less than 1 in all five groups, which indicates that if we only consider the gender variable, women will always have a lower pension benefit than men. The absolute value of gender gap in each group is quite different as the EXP(βgender) in the standard model fluctuated a bit, but the absolute value of gender gap had an increasing trend over time. The 'Before 1995' group had the lowest absolute value of gender gap as the EXP($\beta_{gender}^{standard}$) was 0.8106, which means that in this group, women could receive 81.06% of a man's pension if only the gender variable is included. The absolute value of gender gap in pension benefit in the 'Before 1995' group is 18.94% (1- 81.06%). The EXP($\beta_{gender}^{standard}$) for the standard model in the '1996-2000', '2001-2005' and '2006-2010' groups are quite stable, at 75.96%, 71.32% and 78.11% respectively. The absolute value of gender gaps in these groups were 24.04% (1- 75.96%), 28.68% (1- 71.32%) and 21.89% (1- 78.11%,) respectively, whereas the '2011-2018' group showed the largest absolute value of gender gap in pension benefit with the EXP(β

$^{\text{standard}}_{\text{gender}}$) in standard model equalling 56.83% and the absolute value of gender gap equalling 43.17% (1- 56.83%). The decreasing EXP($\beta^{\text{standard}}_{\text{gender}}$) in the standard model indicates that the absolute value of gender gap in pension benefit was widening over the years.

As other pension-related variables were included in the regression model, the EXP($\beta^{\text{complete}}_{\text{gender}}$) in the complete models from the five retirement groups increased compared with the EXP($\beta^{\text{standard}}_{\text{gender}}$) in the standard model. After controlling the effects on the gender pension gap from retirement age, pre-retirement salary, education level, occupation type and eligible working experience, the EXP($\beta^{\text{complete}}_{\text{gender}}$) (female to male average pension benefit ratio) in the complete model increased compared with the EXP($\beta^{\text{standard}}_{\text{gender}}$) in the standard models. The EXP($\beta^{\text{complete}}_{\text{gender}}$) for the complete model in the 'Before 1995', '2006-2010' and '2011-2018' groups were 1.0576, 1.0822 and 1.0253 respectively, which means that women received 105.76%, 108.22% and 102.53% of a man's pension respectively in these three groups after controlling the gender gap from all other pension-related variables. The gender gaps, after controlling the effects of all pension-related variables, in these three groups were 5.76% (105.76% - 1), 8.22% (108.22% -1) and 2.53% (102.53% - 1), respectively. The EXP($\beta^{\text{complete}}_{\text{gender}}$) in the complete model was greater than 1 in these three groups, which indicates that the pension benefit was in favour of women rather than men after controlling other independent variables. In the remaining two groups, the EXP($\beta^{\text{complete}}_{\text{gender}}$) for the complete model was still less than 1 but much closer to 1 compared with the EXP($\beta^{\text{standard}}_{\text{gender}}$) in the standard model. The EXP(βgender) in standard model and complete model changed from 0.7596 to 0.7961 in the '1996-2000' group. The EXP($\beta^{\text{standard}}_{\text{gender}}$) in standard model compared with EXP($\beta^{\text{complete}}_{\text{gender}}$) in complete in the '2001-2005' group increased from 0.7132 to 0.8914 in the '2001-2005' group. The gender gaps, after controlling the effects of all pension-related variables, in these two groups were 20.39% (1 - 79.61%) and 10.86% (1 – 89.14%), respectively. In both groups, even when the effects of all pension-related variables were controlled, the pension benefit still favoured men. Although the degree of reduction of the gender gap is different in the different groups, the gender difference in pension benefit definitely reduced when the gender gaps caused by retirement age, pre-retirement salary, eligible working experience, education level and occupation type are excluded. After controlling the effect on the gender pension gap from retirement age, pre-retirement salary, education level, occupation type and eligible working experience, those who retired after 2011 had the smallest gender gap in pension benefit. In the '2011-2018' group, female retirees could receive 102.53% of the male pension as the gender gap was only 2.53% (1.0253-1). The gender benefit was in favour of women and the 2.53% gap was caused by the gender variable and the other omitted variables. The '1996-2000' group had the largest gender gap in pension benefit after controlling the effect from the selected independent variables. Female retirees could only receive 79.61% of the male pension and the gender pension gap in this group was 20.39% (1-.79.61%). After the first pension reform in

1995, there was a huge increase in the gender gap and the pension benefit changed from favouring women in the first group to favouring men after the 1995 reform. The gender pension gap after controlling the gender difference from other independent variables started to decrease in the third group to 10.86% (1-89.14%) in the '2001-2005' group, 8.22% (108.22%-1) in the '2006-2010' group and 2.53% (102.53%-1) in the '2011-2018' group. But the pension benefit was in favour of men stated from 1996 group and then changed back to favouring women after 2005. It can be notice that when the pension benefit favours to men, the gender pension gap was much larger than it favours to women. The results show that, after controlling the effects from these selected variables, women can have a higher pension benefit men, however, this situation is almost impossible to happen in the reality.

The deviation between the complete model's $EXP(\beta_{gender}^{complete})$ and the standard model's $EXP(\beta_{gender}^{standard})$ shows how much the gender gap in pension benefit would decrease if all other pension-related variables are included. As the absolute value of gender gap is calculated by 1 minus $EXP(\beta_{gender}^{standard})$ in the standard model, the percentage obtained by dividing the deviation between the complete model's $EXP(\beta_{gender}^{complete})$ and the standard model's $EXP(\beta_{gender}^{standard})$ by absolute gender gap represents how much the total gender gap that can be explained by retirement age, pre-retirement salary, eligible working experience, education level and occupation type in totality. The larger the deviation between the complete model and the standard model is, the more the gender gap in pension benefit can be explained by retirement age, pre-retirement salary, eligible working experience, education level and occupation type together in the retirement group. Information about the deviations is summarised in Table 6.11. I will use group '1996-2000' as an example to explain. The standard model's $EXP(\beta_{gender}^{standard})$ was 0.7596 whilst the complete model's $EXP(\beta_{gender}^{complete})$ increased to 0.7961; the deviation is 0.0366. These three numbers in the '1996-2000' group mean that for those who retired between 1996 to 2000, if only the gender variable is considered, the absolute value of gender gap is 0.2404 (1- 0.7596). This means that women's pension benefit will be 24.04% less than men's pension benefit if only gender variable is considered. If the gender gaps caused by retirement age, pre-retirement salary, eligible working experience, education level and occupation type together are excluded, the gender difference in pension changed to 0.2039 (1- 0.7961), and the deviation between $EXP(\beta_{gender}^{complete})$ and $EXP(\beta_{gender}^{standard})$ was 0.0366 (0.2404-0.2039). This means that 15.22% (0.0366 divided by 0.2404) of the gender gap in pension benefit in the '1996-2000' group was caused by retirement age, pre-retirement salary, eligible working experience, education level and occupation type together. For the group '2001-2005', using the deviation between the complete model's $EXP(\beta_{gender}^{complete})$ and the standard model's $EXP(\beta_{gender}^{standard})$, 62.12% (0.1782 divided by 0.2868 (1-0.7132)) of the gender gap in pension benefit in the '2001-2005' group can be explained by retirement age, pre-retirement salary, eligible working experience, education level and occupation type together. Even though only

15.22% of the gender gap in pension benefit can be explained by retirement age, pre-retirement salary, eligible working experience, education level and occupation type together for people who retired between 1996 and 2000, these variables still can explain part of the gender difference in pension benefit together. The EXP($\beta_{gender}^{complete}$) in the complete model in 'Before 1995', '2006-2010' and '2011-2018' groups are larger than 100%, which means once all the other independent variables have been considered, all the existing gender pension gap will be eliminated. The female retirees will have a greater pension than male retirees and the pension will no longer favour men.

Table 6.11 Gender indicators in the standard, complete and nested regression models in the five groups

		Adjusted R2	β(gender)	EXP(β)	Deviation
Before 1995	(1) standard	0.006	-0.21*	0.8106	0.247
	(2) complete	0.302	0.056	1.0576	0
	(3) retirement age excluded	0.3	0.029	1.0294	0.0282
	(4) working experience excluded	0.278	-0.05	0.9512	0.1064
	(5) pre-retirement salary excluded	0.153	0.141	1.1514	-0.0938
	(6) education excluded	0.284	0.09	1.0942	-0.0366
	(7) occupation type excluded	0.301	0.069	1.0714	-0.0138
		Adjusted R2	β(gender)	EXP(β)	Deviation
1996-2000	(1) standard	0.023	-0.275***	0.7596	0.0366
	(2) complete	0.245	-0.228**	0.7961	0
	(3) retirement age excluded	0.233	-0.122	0.8851	-0.089
	(4) working experience excluded	0.236	-0.28**	0.7558	0.0403
	(5) pre-retirement salary excluded	0.134	-0.231*	0.7937	0.0024
	(6) education excluded	0.231	-0.19*	0.827	-0.0308
	(7) occupation type excluded	0.242	-0.236**	0.7898	0.0063
		Adjusted R2	β(gender)	EXP(β)	Deviation
2001-2005	(1) standard	0.048	-0.338***	0.7132	0.1782
	(2) complete	0.308	-0.115	0.8914	0
	(3) retirement age excluded	0.308	-0.069	0.9333	-0.042
	(4) working experience excluded	0.281	-0.208**	0.8122	0.0792

	Adjusted R2	β(gender)	EXP(β)	Deviation
(5) pre-retirement salary excluded	0.211	-0.134	0.8746	0.0168
(6) education excluded	0.279	-0.08	0.9231	-0.0318
(7) occupation type excluded	0.303	-0.123	0.8843	0.0071

		Adjusted R2	β(gender)	EXP(β)	Deviation
2006-2010	(1) standard	0.039	-0.247***	0.7811	0.3011
	(2) complete	0.374	0.079	1.0822	0
	(3) retirement age excluded	0.375	0.063	1.065	0.0172
	(4) working experience excluded	0.318	-0.064	0.938	0.1442
	(5) pre-retirement salary excluded	0.297	0.069	1.0714	0.0108
	(6) education excluded	0.357	0.092	1.0964	-0.0142
	(7) occupation type excluded	0.347	0.098	1.103	-0.0208

		Adjusted R2	β(gender)	EXP(β)	Deviation
2011-2018	(1) standard	0.097	-0.573***	0.5638	0.4615
	(2) complete	0.395	0.025	1.0253	0
	(3) retirement age excluded	0.398	0.185	1.2032	-0.1779
	(4) working experience excluded	0.223	-0.555**	0.5741	0.4512
	(5) pre-retirement salary excluded	0.351	-0.004	0.996	0.0293
	(6) education excluded	0.394	0	1	0.0253
	(7) occupation type excluded	0.38	-0.025	0.9753	0.05

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

The deviation between the complete model's $EXP(\beta_{gender}^{complete})$ and the standard model's $EXP(\beta_{gender}^{standard})$ discussed above can only illustrate how the pension-related independent variables affect the gender pension gap in totality. To further determine how retirement age, pre-retirement salary, eligible working experience, education level and occupation type individually affect the gender gap in the pension benefit, the deviation between the complete model's $EXP(\beta_{gender}^{complete})$ and the nested model's $EXP(\beta_{gender}^{nested})$ was compared. The results are summarised and ordered by magnitude in Table 6.12, so as to show which factor(s) has(ve) the most significant effect on the gender pension gap. The larger the deviation between the $EXP(\beta_{gender}^{nested})$ for nested models and the complete model's $EXP(\beta_{gender}^{complete})$, the more significant the effect of the excluded variable on explaining the gender gap in pension benefit.

As shown in Table 6.12, in all five groups, the nested model excluding working experience always had positive deviations between $EXP(\beta_{gender}^{nested})$ and the complete model's $EXP(\beta_{gender}^{complete})$, and always had the largest deviation in all five groups. For example, in the '2001-2005' group, if working experience is excluded from the complete model, the exponential function of the gender coefficient will drop from 0.8914 in the complete model to 0.8122 in the nested model excluding working experience (the deviation is 0.0792) (see Table 6.11). The deviation for the nested model excluding working experience is the largest deviation from the nested model in the '2001-2005' group, indicating that if eligible working experience is discounted with other variables constant, the average pension benefit ratio for women to men will drop by 7.92%. Obviously, this is caused by eligible working experience individually. Compared with $EXP(\beta_{gender}^{nested})$ from the other nested models, the $EXP(\beta_{gender}^{nested})$ in the nested model excluding working experience decreases the most from the value of the $EXP(\beta_{gender}^{complete})$ in the complete model. As the deviation for working experience is the largest deviation, the working experience should have the most significant effect on the gender gap in the pension system. This situation has remained over time as the deviation for the nested model excluding working experience always held the top position. The findings here combine with Table 6.10 (Standardized coefficients for the complete model ordered by their magnitude of absolute value) suggests that the eligible working experience not only played an important role in the amount of pension benefit during these decades, it also had significant effect on the gender pension gap in UEPS during these decades. The finding is consistent with the previous empirical studies, such as Ding and Zhang (2006), Pei (2011) and Chen and Huang (2018) that highlighted the importance of eligible working experience in explaining the gender pension gap in UEPS.

Occupation type and pre-retirement salary were two other factors with significant effects for explaining the gender difference in pension benefit as they had a positive deviation in most of the groups. Specifically, occupation type and pre-retirement salary typically occupied the

second and the third positions in most groups. The deviation from the nested model excluding occupation type was in the second position in the '1996-2000' group (0.0063) and the '2011-2018' group (0.0500), and the deviation from the nested model excluding occupation type was in the third position among the nested models in the '2001-2005' group (0.0071). The deviation of the nested model excluding occupation type suggests if occupation type is excluded with other variables unchanged, the average pension benefit ratio of women to men will drop by 0.63% in the '1996-2000' group, 0.71% in the '2001-2005' group, and 5% in the '2011-2018' group than that in those complete models. Although the deviation from the nested model excluding pre-retirement salary was usually positive in most of the groups, it was in the second position among the nested models in the '2001-2005' group (0.0168), and the deviation from the nested model excluding pre-retirement salary was in the third position in the '1996-2000' group (0.0024), the '2006-2010' group (0.0108) and the '2011-2018' (0.0293) in the nested models. The deviation in the '2001-2005' group (0.0168) will be interpreted as an example. The deviation in the '2001-2005' group shows that if pre-retirement salary is discounted with other variables unchanged, the gender gap will increase, since the average pension benefit ratio of women to men decrease by 1.68%. Therefore, these two factors also have a significant effect on the gender pension gap, but the effect is smaller than that of working experience.

In the 'Before 1995' and '2006-2010' groups, retirement age had a significant effect on the gender gap in pension benefit and ranked second in the nested models (with the deviations of 0.0282 and 0.0.172 respectively). The positive deviations between $\text{EXP}(\beta_{\text{gender}}^{\text{complete}})$ and $\text{EXP}(\beta_{\text{gender}}^{\text{nested}})$ in these two groups suggest that the gender pension gap will widen if the effect of retirement age is not considered. The nested model excluding education consistently had a negative deviation in all groups but the last group, which means that the current situation in education is in favour of women. If the gender gap caused by education can be eliminated, the gender pension gap will narrow for the retirees who retired after 2011.

The reason why working experience consistently had the most significant effect on the gender gap can be explained by the changes in pension policy during these years. The policy for retirees who completed their retirement process before 1995 suggests that retirees with twenty successive work years could have up to a 75% replacement rate, which would decrease with a reduction in eligible working experience. The eligible working experience was the only criterion for determining the replacement rate. Because women had a legal retirement age ten years earlier that men, any maternity leave and the responsibility for caring for the family would also make their eligible working life even shorter than men's. The combination of the pension policy and women's particular circumstances increased the probability that they would not meet the requirement of twenty successive work years, which was why working experience can have the

most significant effect on explaining the gender difference in the retirement group 'Before 1995'.

The pension policy changed considerably after 1995. State Council Document No.6, 'Circular of the State Council on Deepening the Reform of the Urban Employees' Pension Scheme' (State Council, 1995) stated that employees and enterprises should make contributions together of no less than 16% of the monthly salary to the individual account. Employees should contribute no less than 3% of their monthly salary, which would increase by 1% each year, and employers should make a contribution of no more than 13%, which would decrease over time as the employees made larger contributions. The interest rate on the individual account refers to the interest on fixed-term deposits. The monthly pension benefit equalled the total amount of pension contribution in the individual account divided by 120. The policy changed again in 1997 under State Council Document No.26, 'Decision of the State Council on the Reform of the Urban Employees' Pension Scheme' (State Council, 1997b). Employees and employers now had to contribute 11% of the salary together into the individual account, and the contribution from employers should decrease over time to 3% as the employees made larger contributions. If employees who started work after 1997 had more than fifteen successive working years when they retired, their monthly pension would be 20% of the local average wage (based on the previous year) as the basic pension benefit plus the total amount in their individual account divided by 120. Employees with less than fifteen years would only receive the total amount in their individual account in a lump sum. Those who retired before 1997 had to continue with the previous calculation method. If they had started work before 1997 and retired after 1997, and if they had continuous or combined eligible working experience for fifteen years, they would also receive a social pooling pension benefit plus the total amount in their individual account divided by 120, and they were also entitled to an additional pension for the transitional period. The replacement rate during this period depended on the total amount in the individual account; it would effectively drop if the total amount in the individual account was lower than that of others, because retiring early would result in a lower total amount in the individual accounts.

In 2000, State Council Document No.42 'Circular of the State Council on the Urban Employees' Pension Scheme' (State Council, 2000) required employees to contribute 8% of their monthly salary to the individual account and employers had to contribute 20% of employees' monthly salary into the social pooling fund. If employees who started work after 2000 had at least fifteen years of successive work when they retired, their monthly pension benefit would be 20% of the local average wage in the previous year as the basic pension benefit plus the total amount in their individual account divided by 120. If employees had been making individual contributions for more than fifteen years, for every additional year they have worked an extra 0.6% of the provincial average wage will be added as their basic pension benefit (Sin, 2005). Employees

with fewer than fifteen years would not have any basic pension benefit and the money in their individual account would be paid in a lump sum. Those who retired before 2000 had to continue with the previous calculation method. If retirees who had started work before 2000 and retired after 2000 had continuous or combined eligible working experience of fifteen years, they would receive the social pooling benefit plus the total amount in their individual account divided by 120 and an additional pension for the transitional period.

The final important document relevant to the UEPS was State Council Document No.38 of 2005, 'Decision of the State Council on the Improvement of the Urban Employees' Pension Scheme' (State Council, 2005), under which calculation of pension benefit changed again, requiring employees to contribute 8% of their monthly salary to their individual account. There was an index based on the average monthly salary of the local workers in the previous year and the average monthly contribution of 1% of the index wage would be paid as a basic pension benefit if an employee had made a one-year contribution.

For employees who had started work after 1997 and had completed more than fifteen successive working years when they retired, their monthly pension would be the basic pension plus the total amount in their individual account divided by the life-table months. The life-table months were determined by the average life expectancy of the local urban population, retirement age, interest rate and other factors when they retired. The earlier you retire, the more life-table months there will be. For example, for women who retired at 50, the life-table months would be 195 months, whereas men who retired at 60 would only have 139 life-table months. Employees without fifteen years of eligible work would not have any basic pension benefit and the money in their individual account would be paid in a lump sum.

Taking into consideration the various pension reforms, I have identified the importance of the key variables for the pension calculation formulas. Table 6.13 summarises the key variables which seem to matter, at least according to government documents, for the calculation of the UEPS pension benefit.

After reviewing these changing pension policies, it can be seen that the length of eligible working experience has always played an important role in the calculation of the monthly pension. Before 1995, eligible working experience had a direct relationship with the amount of the pension benefit as the replacement rate was determined by the number of eligible years. Once retirees had satisfied the condition, they could receive a fixed replacement rate pension benefit because the replacement rate was determined only by the eligible working experience. After 1995, the eligible working experience could determine whether retirees could receive the basic pension benefit, it could also determine the amount of basic pension benefit as the policy changed. The total amount in the individual account also had a positive relationship with

eligible working experience because as the money in the account accumulated, the length of eligible working experience would have an increasing effect on the gender gap in pension benefit. The requirement of the minimum eligible working experience changed from twenty years to fifteen years in 1995, which meant that women would have more opportunity to receive the basic pension benefit and the income from their individual account every month, but the gender gap in eligible working experience did not reduce over time as the difference in the mean of working experience became even larger over time (see Figure 6.3).

After 1995, the monthly pension benefit not only depended on the length of the contributions, but also on the pre-retirement salary and type of occupation. As the monthly contribution to the individual account was calculated as a percentage of monthly wage whilst the basic pension benefit was calculated based on the local average wage in the previous year or the index based on the average monthly salary of those at work in the previous year and the average monthly contribution wage, the total amount of monthly pension benefit could be affected significantly by pre-retirement salary. The gender gap in pre-retirement salary could reflect the income gender inequality in the labour market, and in urban areas, women could only have 67.3% of men's income (Kim, 2017), all other things being equal. So there would be a gap in the accumulated individual accounts between men and women. After the 1995 reform, the pension was directly related to the accumulated individual account, so pre-retirement salary became a significant factor influencing the gender pension gap in the last four groups.

Occupation type was another factor which started to become important after the 1995 reform. The impact of occupation type on the gender gap in the pension benefit is always considered together with the impact on the gender gap in pre-retirement salary. As shown in Table 6.3 and 6.4, men always had more opportunity for promotion to retired as a cadre and a higher pre-retirement salary in both occupation types than women, so even in the same occupation, the average pension for men was always higher than that for women. These pieces of information show that gender inequality exists not only in pension benefit levels, but also in labour markets and labour indicators, such as the gender income gap and limited opportunities for promotion for women. The combinations of gender inequalities in the labour market can explain a significant proportion of gender pension gap in the UEPS.

Education did not have a significant negative impact on the gender gap in pension benefit in any of the groups (except the last group), and the possible reason for that could be that, as shown in the descriptive data analysis, there was not much difference in education level among the participants in the surveys. Most men and women only achieve junior school or high school as their highest education level in the last four groups, whereas in the first group, most of their education attainment was no formal education or primary school. The only difference was that

men had more opportunity to receive a higher level of education. Even so, the proportion of men whose highest education level was a three-year college course or a bachelor's degree was very small. Over time, the opportunity to receive further education could lead to more opportunity for promotion, and the salary of a cadre would be higher than that of other workers in the same company. These gender differences in education and occupation type would eventually show up in salary. Education level is first associated with occupation before affecting salary level, which may explain why 'occupation' has a more significant effect on the gender gap in pensions than education level. A larger gender difference in salary and in pre-retirement salary would result in a larger gender gap in pension benefit as salary was closely related to the pension benefit.

As for retirement age, the results of the regression data analyses showed that retirement age did not have a constant sign (negative or positive) of the coefficient in the regression model. Retirement age only had significant effect on the gender gap in pension benefit in two groups (the 'Before 1995' and '2006-2010' groups) and in the other groups it did not have a significant effect on the gender pension gap. The result in this thesis about retirement age and eligible working experience pointed out that retirement age is not as crucial as the previous literatures suggested, while the eligible working experience is the main factor to equalize the gender pension gap.

Table 6.12 Deviation of EXP(βgender) between the complete and the nested regression models in the five groups

	Variable	Deviation		Variable	Deviation
Before 1995	(4) working experience excluded	0.1064	1996-2000	(4) working experience excluded	0.0403
	(3) retirement age excluded	0.0282		(7) occupation type excluded	0.0063
	(7) occupation type excluded	-0.0138		(5) pre-retirement salary excluded	0.0024
	(6) education excluded	-0.0366		(6) education excluded	-0.0308
	(5) pre-retirement salary excluded	-0.0938		(3) retirement age excluded	-0.0890

	Variable	Deviation		Variable	Deviation
2001-2005	(4) working experience excluded	0.0792	2006-2010	(4) working experience excluded	0.1442
	(5) pre-retirement salary excluded	0.0168		(3) retirement-age excluded	0.0172
	(7) occupation type excluded	0.0071		(5) pre-retirement salary excluded	0.0108
	(6) education excluded	-0.0318		(6) education excluded	-0.0142
	(3) retirement age excluded	-0.0420		(7) occupation type excluded	-0.0208

	Variable	Deviation
2011-2018	(4) working experience excluded	0.4512
	(7) occupation type excluded	0.0500
	(5) pre-retirement salary excluded	0.0293
	(6) education excluded	0.0253
	(3) retirement age excluded	-0.1779

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 6.13 Impact Factors which are directly included in the pension calculation formula in different retirement period

	Before 1995	1996-2000	2001-2005	2006-2010	2011-2018
Eligible working experience	✓	✓	✓	✓	✓
Retirement age				✓	✓
Pre-retirement salary		✓	✓	✓	✓
Occupation type					
Education level					

Source: Summarised by the author

Chapter 7. The New Rural Social Pension Programme

7.1 Introduction

The pension system in rural areas of China was established much later than the UEPS. The UEPS protects almost all workers in urban areas, but the majority of the population in China who lived in rural areas were not eligible to be part of that scheme. In 1991, the Old Rural Social Pension Programme (ORSPP) was introduced first at county level and then began gradually to spread throughout the country. The main funding of that old scheme came from individual contributions and there were no subsidies from central or local government. In practice, the ORSPP was more like a voluntary individual savings account for rural dwellers than a social pension system at that time (Tao, 2010). This voluntary pension system failed to form a universal rural pension scheme as it lacked any component of social pooling and redistribution and rural people had few incentives to participate in it.

The Chinese government decided to end the ORSPP and introduce a new scheme in rural areas in 2009; this was the New Rural Social Pension Programme (NRSPP). Unlike the ORSPP, the NRSPP had improved to protect the livelihood of the elderly population in rural areas. The most crucial improvement was that the NRSPP was not only funded by individual contributions from participants, but also received subsidies from collectives, economic organizations, non-government organizations and other individuals and local and central government. The pension benefit in the NRSPP comprised the basic pension from the central government and the accumulated individual account divided by 139 months. The individual accounts included individual contributions and the subsidies from local government, collectives and non-government organizations, or financial support from other people. The NRSPP combined social pooling and individual accounts to protect the livelihood of the rural elderly and the reform also encouraged rural people to participate in it (Zhao et al., 2016)

7.2 Results and analysis

This chapter contains the results and analysis of the descriptive data and mixed-effects logit model results of the gender gap in the NRSPP. The selected independent variables in this study can be divided into three levels: the individual level, the family level and the community level. Gender, age, education level, health, marital status and *hukou* are included in the first level. The second dimension contains land space for the family, number of children and total family income. Region is the third dimension's variable and provides information about the community. The review of the relevant literature showed that the effects of these independent variables on the probability of participating in the NRSPP are quite ambiguous. The results of the coefficients for these independent variables in previous studies can be summarised into four categories: significant positive coefficient, insignificant positive coefficient, significant negative

coefficient and insignificant negative coefficient. It has already been stated that Yue (2004), Wu (2009), Jiang (2011), Deng and Liu (2013), Chen (2015), Tu and Hei (2015) and Liang and Wang (2016) found that the gender variable had a significant positive coefficient. Accordingly, the initial hypothesis about gender variable in this research would be 'the female respondents to the CHARLS surveys had a higher probability of participating in the NRSPP than males'. Wang (2011) and Mu and Yan (2012), however, found that the gender variable had significant negative coefficients, showing that based on their survey data, male respondents had a higher probability of participating in the NRSPP than females. The previous empirical studies did not provide a clear conclusion about how the gender gap came to exist in the NRSPP and there was no clear conclusion about how these impact factors could affect the probability of participating in the NRSPP for the different genders. In the following section, I shall address these questions using both descriptive data analysis and mixed-effects logit models with a revised panel dataset generated after merging four waves of CHARLS data.

7.2.1 Results of the descriptive data analysis

Before using the mixed-effects logit model to analyse the impact factors of the probability of participating in the NRSPP, the descriptive data analysis was carried out to see how far a gender gap exists in participation in the NRSPP to answer the second research question 'Is there a gender gap, in terms of participation rate, in the New Rural Social Pension Programme (NRSPP)? Is this gap narrowing or widening over time?' Table 7.1 shows the gender difference in terms of the participation rate in the NRSPP in the four waves of the CHARLS survey in 2011, 2013, 2015 and 2018. Female and male respondents are shown in different groups. The gender gap reflected in the different value of mean was calculated using the participation rate for men minus the participation rate for women. A negative gender gap means that women are more likely to participate in the NRSPP than men and if the gender gap is positive, it means that men are more likely to participate in the NRSPP than women. Table 7.2 shows a preliminary analysis of how the selected individual factors are correlated with the participation behaviour of rural residents in the NRSPP for women and men respectively in the four different waves. In the following sections, several figures will be used to visualize the data set out in Tables 7.1 and 7.2 and give a direct image showing how the gender gap existed in the NRSPP across the different waves.

The participation rate by gender in the different waves is shown in Figure 7.1 and Table 7.1. In 2011, the participation rate for men and women was quite low, at 25.76% and 29.91% respectively, but it increased rapidly in only two years. From 2011 to 2013, the rate jumped to 72.27% for women and 64.95% for men and then continued to increase until 2015 reaching 72.54% for women and 70.94% for men. However, the rate of increase in participation has been particularly slow since 2013, as there was a huge increase between 2011 and 2013. In 2015, the

participation rate started to decrease for both genders and had dropped to 64.83% for women and 58.82% for men in 2018.

The difference in mean for the participation rate is always negative as it is calculated by men's participation rate minus women's participation rate. As shown in Figure 7.1, the participation rates for female respondents were consistently higher than those of men in all waves. The gender gap in the participation rate fluctuated during these years, increasing from -4.15% in 2011 to -7.32% in 2013. It was then -1.60% in 2015 but increased again to -6.00% in 2018. Despite the fluctuation in the gender gap during these four waves, the participation rate gender gap did exist in the NRSPP and favoured women. The negative difference in mean in the four waves shows that the female respondents in this revised panel data consistently had a higher probability of participating in the NRSPP than the males.

Figure 7.1 Participation rate by gender in the different waves
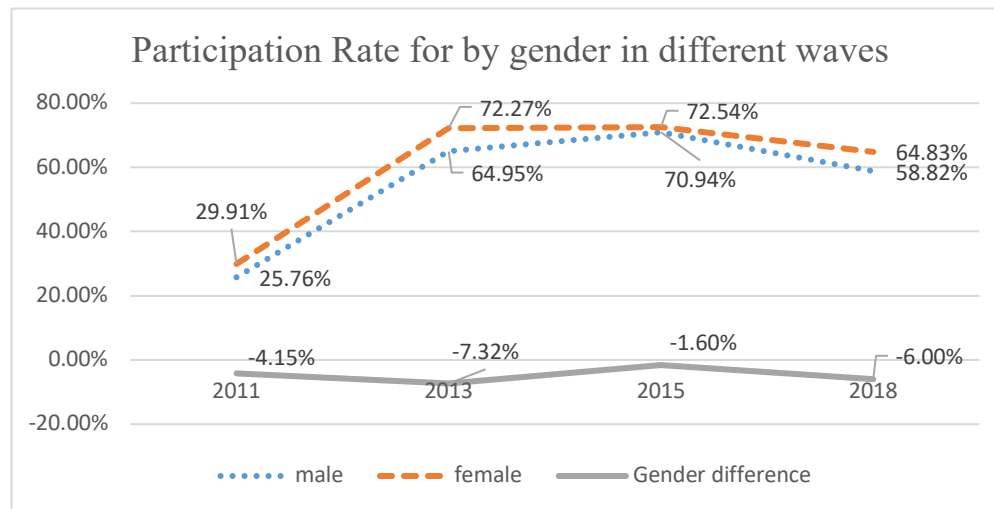
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 7.1 Participation rate in the NRSPP by gender in the different waves

	2011	2013	2015	2018
Male	25.76%	64.95%	70.94%	58.82%
Female	29.91%	72.27%	72.54%	64.83%
Difference in Mean	-4.15%	-7.32%	-1.60%	-6.00%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

As CHARLS collected data from people aged over 45, and all the participants in the NRSPP, regardless of gender, could start to receive a pension from the NRSPP at the age of 60, I divided the respondents into two groups, those who aged from 45 to 60 and those aged over 60, to see whether age can affect the participation rate in the NRSPP. The participation rate for the different age groups measures the participation rate of men and women in their own gender and

age groups. For example, as shown in Table 7.2, the participation rate for women in 2011 was 29.62%, which means that for female respondents aged 45-60 in the 2011 wave, only 29.62% of them were participating in the NRSPP. The participation rates did not vary much between genders if the respondents were in the same wave of dataset. The findings show that older respondents consistently had a higher participation rate than younger respondents for the same gender in the same waves. Hence, we could make the initial hypothesis that 'age is positively correlated with the participation rate'. For the same age group, the participation rate is like a reversed U-curve for both men and women. Figure 7.2 shows the change in participation rate for two age groups in which the participation rate increased rapidly and then slowly, before decreasing over time for both genders. For both genders in all groups, no matter how they are divided in relation to age, marital status, region or *hukou*, the pattern of the change in the participation rate in these four waves was quite consistent, as Figures 7.2, 7.3, 7.4 and 7.5 show. The patterns of the participation rate changed for both genders as a reversed U-curve, with the lowest participation rate taking place in 2011. Over time, the rate for both genders showed a dramatic increase in 2013 and continued to increase until 2015 for nearly all education levels. By 2018, the rate for both men and women had decreased slightly, although it remained higher than in 2011.

The difference in mean in Figure 7.2 was consistently negative which means that the female respondents had a higher participation rate than males, except for 2015, when male respondents in the '45-60' group had a higher participation rate and the gender difference was 0.71%. In the '45-60' group, the gender difference increased from -4.39% in 2011 to -8.39% in 2013 and returned to -4.63% in the final wave. The gender difference in the 'Over 60' group also fluctuated during the waves but the overall trend was still upward. Even the changing pattern of participation rate were similarly for both genders in these four waves, men's participation rate was always lower than women's and the decreasing speed of the participation rate for men was much faster than the decreasing speed of the participation rate for women in both groups, which resulted in a rise in the gender gap in 2018.

Table 7.2 The participation rate in the NRSPP by variables in the different waves

Variables	Groups	2011		2013		2015		2018	
		Male	Female	Male	Female	Male	Female	Male	Female
Age	45-60	25.23%	29.62%	63.36%	71.75%	70.31%	69.60%	58.50%	63.13%
	>60	26.32%	30.33%	66.16%	72.96%	71.39%	75.93%	58.96%	65.98%
Education	No formal education	25.99%	29.67%	70.37%	73.23%	76.09%	74.53%	63.21%	65.88%
	Primary school	24.51%	31.38%	65.80%	69.98%	72.86%	72.24%	59.94%	60.29%
	Junior school	28.41%	31.96%	63.70%	71.32%	69.74%	65.80%	58.08%	65.51%
	High school	23.37%	17.39%	54.31%	72.41%	61.88%	71.74%	46.90%	63.86%
	Three-year college course	7.69%	50.00%	13.33%	100.00%	5.56%		23.08%	
	Bachelor's degree			25.00%		33.33%			100.00%
	Master's and above								
Health condition (self-reported)	1 Excellent	11.11%	42.86%	45.45%	81.82%	66.67%	80.00%		
	2 Very good	36.25%	34.38%	61.00%	65.12%	70.35%	72.57%	60.39%	67.63%
	3 Good	25.10%	31.26%	65.91%	71.90%	64.53%	76.52%	53.55%	65.00%
	4 Fair	25.03%	30.68%	61.81%	71.84%	70.27%	70.15%	56.18%	65.00%
	5 Poor	24.57%	27.15%	71.82%	74.54%	74.71%	74.93%	62.89%	64.88%
	6 Very Poor	26.67%	33.33%	73.33%	73.00%	78.72%	74.07%	70.97%	60.32%
Marriage status	Married	26.50%	30.58%	63.87%	72.42%	70.84%	72.12%	58.98%	65.48%
	Single	12.03%	43.33%	75.86%	100.00%	100.00%	100.00%	42.86%	83.33%
	Divorced	30.77%	41.67%	59.09%	66.67%	58.82%	50.00%	66.67%	65.00%
	Widowed	24.70%	27.04%	73.13%	71.28%	70.48%	74.16%	60.07%	62.78%
Hukou	Non-Agriculture	2.90%	10.14%	10.44%	40.00%	20.28%	26.53%	9.96%	34.95%

	Agriculture	27.34%	30.38%	70.36%	73.30%	75.58%	74.39%	63.88%	66.14%
	East	27.80%	31.22%	57.19%	66.15%	67.04%	69.25%	51.87%	60.29%
Region	Middle	31.10%	39.65%	72.77%	78.46%	76.25%	78.99%	59.26%	66.75%
	West	19.11%	20.56%	65.65%	72.27%	70.09%	69.58%	64.97%	67.49%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018; *Note*: There was no 'excellent' option for 'Health' in the fourth wave's questionnaire

Figure 7.2 Participation rates by age group in the different waves

Participation rates for respondents aged 45-60 by gender in the different waves

Participation rates for respondents aged over 60 by gender in the different waves
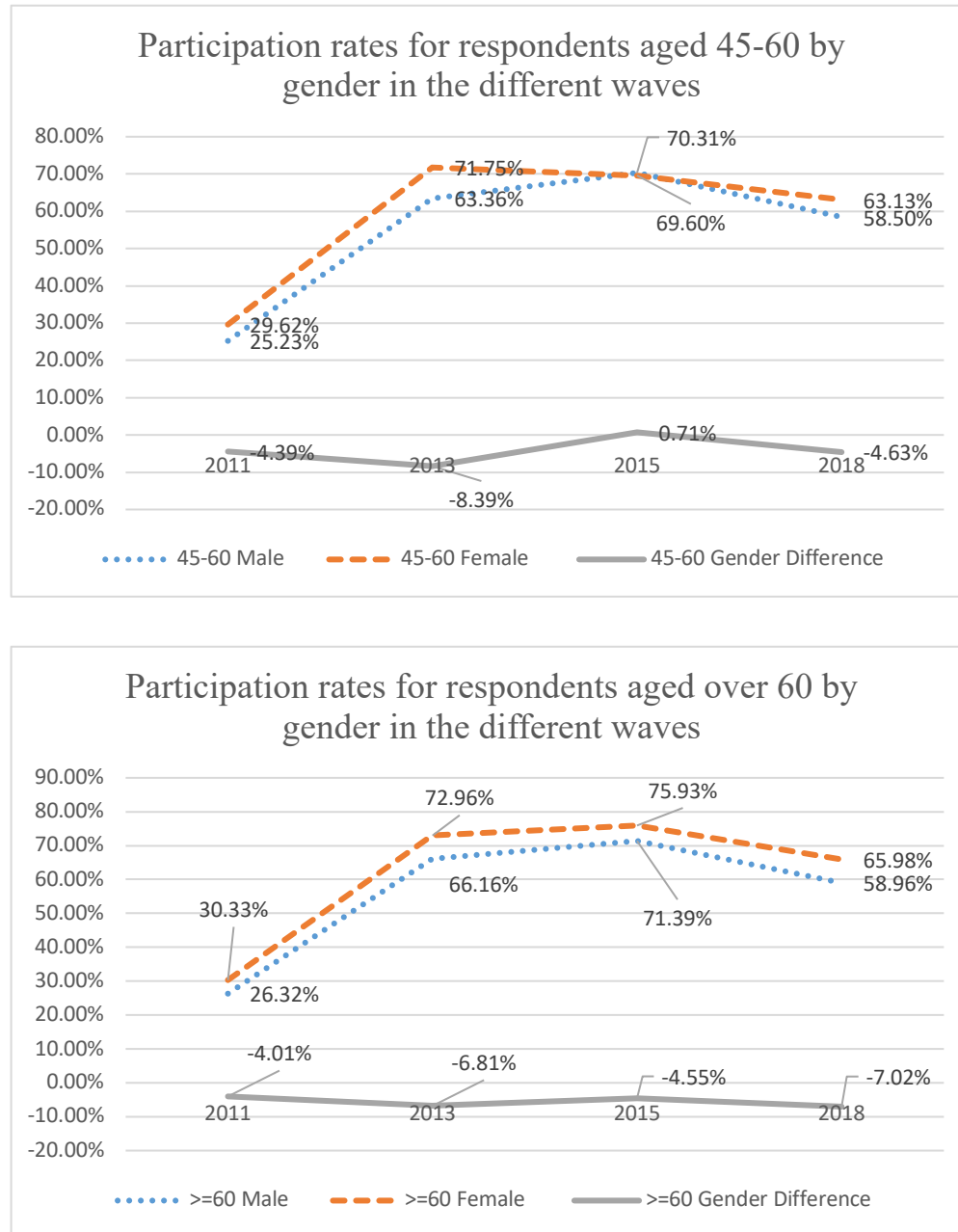
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

As seen in Table 7.2, the participation rates for female respondents in different education levels are quite similar in each wave, showing an overall increasing trend with the elapse of time. For example, in 2011, the participation rates for female respondents were around 30%, except for high school (17.39%) and three-year college course (50.00%). Then the rate increased to around 70% for female respondents in 2013, except for three-year college courses (100%). The participation rate for female respondents continuously increased to around 72% in 2015, except for junior school level (65.80%) and finally dropped to around 65% in the fourth year, except for bachelor's degree (100%). The situation was different for males, whose higher education

level usually resulted in a lower participation rate for the respondents in the same wave. For example, in 2013, male respondents with no formal education had the highest participation rate at 70.37%. The rate then decreased as the education level rose. For example, the participation rate for male respondents who had a bachelor's degree was only 25%. The participation rates for men and women show a large common growth trend. These results could support the initial hypothesis that the education level of men is negatively correlated with the participation behaviour, and that no clear correlation could be observed for women.

Even the participation rate in the NRSPP for men and women with different education level exhibited an increasing trend, the apparent gender gap could not be dismissed. The gender difference in participation rate by education level is shown in Table 7.3 which illustrates that the gender difference was usually negative, which means that, in the same wave and with the same education level, women usually had a higher participation rate in the NRSPP than men; the only exception occurred in 2015. The gender gap was positive for most of the education levels. That means the male respondents had a higher participation rate in the NRSPP than female respondents in most of the education levels in 2015. In most of the education levels, the gender differences were quite consistent over the years with small fluctuations. For example, the gender difference for junior school level was -3.55% in 2011, increased slightly to -7.62% in 2013 and then become positive in 2015 at 3.93% before turning back to negative at -7.43% in 2018. Three-year college course and bachelor's degree levels showed the most fluctuation during the years and the gender differences for these education levels were much higher than for other levels. For example, the gender gap in bachelor's degree was 25% in 2013, increased to 33.33% in 2015 and then decreased to -100.00% in the final year. This -100% is an outlier as there was no male respondent with a bachelor's degree level in 2018. The data for the relatively higher education level in these four waves (see Table 7.3) suggest that men with an education to bachelor's level had a higher probability of participating in the NRSPP than women with the same education level.

Table 7.3 The gender difference in participation rate in the NRSPP by education in the different waves

	2011	2013	2015	2018
No formal education	-3.67%	-2.85%	1.56%	-2.67%
Primary school	-6.86%	-4.18%	0.62%	-0.35%
Junior school	-3.55%	-7.62%	3.93%	-7.43%
High school	5.98%	-18.10%	-9.86%	-16.96%
Three-year college course	-42.31%	-86.67%	5.56%	23.08%
Bachelor's degree		25.00%	33.33%	-100.00%
Master's and above				

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

The gender difference is not only present in the participation rate by education level but also exists in the opportunity to have higher education for both men and women. Table 7.4 shows the education levels of men and women in the different waves. As the numbers of respondents were different in the different groups, the differences in education level were therefore compared using percentages rather than numbers, just as was done in Chapter 6. The gender difference was generated using the percentage of men minus the percentage of women at the same education level. The results in Table 7.4 show that in rural areas, most of the women (around or over 60% in the four waves) only had no formal education (illiteracy) as their highest education level. About 60% of women in the rural area were deprived the opportunity of education. As for the other 40% of women with access to education, 30% of them had primary school or junior school as their highest education level. The percentage of women in each education level decreased notably as the education level became higher. Around 3.5% of women had high-school education or higher education in each wave whereas less than 0.1% of women had a three-year college course or higher education level in each wave. The situation was different for men in that the percentage of men with no formal education, primary school or junior school levels was quite similar (around 30% in each education level) with small fluctuations in the four waves. Around 10% of men had high-school education or higher education in each wave and around 1% had a three-year college course or higher education as their highest level in each wave. In spite of the low percentage of men attending high-school education or higher education, they still possessed a definite advantage than women. The gender difference was negative at the no formal education level which means that a higher percentage of women had no formal education as their highest education level than men. At all other education levels, the gender difference was constantly positive. The results in Table 7.4 show that in rural areas, men had greater access to education and also more opportunity to be educated to a higher level than women.

Table 7.4 Education shown in percentages by gender in the four waves

Education	2011			2013		
	Male	Female	Difference in %	Male	Female	Difference in %
No formal education	36.84%	65.68%	-28.84%	34.91%	60.68%	-25.77%
Primary school	28.76%	18.22%	10.54%	28.01%	19.70%	8.31%
Junior school	24.49%	12.97%	11.52%	24.49%	15.13%	9.36%
High school	9.08%	3.07%	6.00%	11.36%	4.45%	6.90%
Three-year college course	0.81%	0.07%	0.74%	1.09%	0.04%	1.05%
Bachelor's degree	0.03%		0.03%	0.15%		0.15%
Master's and above						
Total	100.00%	100.00%	0.00%	100.00%	100.00%	0.00%

Education	2015			2018		
	Male	Female	Difference in %	Male	Female	Difference in %
No formal education	32.10%	59.01%	-26.91%	35.17%	65.56%	-30.39%
Primary school	28.06%	22.11%	5.95%	27.55%	16.89%	10.65%
Junior school	26.71%	15.18%	11.53%	24.87%	14.11%	10.76%
High school	11.83%	3.62%	8.21%	11.76%	3.39%	8.37%
Three-year college course	1.05%	0.08%	0.98%	0.53%		0.53%
Bachelor's degree	0.18%		0.18%	0.12%	0.04%	0.08%
Master's and above	0.06%		0.06%			
Total	100.00%	100.00%	0.00%	100.00%	100.00%	0.00%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

For self-reported health condition, there were six categories in this variable and the 'health' variable was an ordinal variable with a numeric value: the larger the value, the worse the health condition. For both genders, respondents with the same health condition had a higher participation rate in the NRSPP over time except for 2018 (see Table 7.2). For male participants who reported a 'Very good' health condition, the participation rate increased from 36.25% in 2011 to 61.00% and 70.35% in the subsequent two waves, yet decreased to 60.39% in the final year. If we focus on the participation rate within one wave, men with better health usually had a lower participation rate in the NRSPP. For example, in 2015, the participation rate for male respondents who reported their health as 'excellent' was 66.67%. In that same year, the participation rate gradually increased as health deteriorated and reached 78.72% of male respondents who reported their health as 'very poor' (see Table 7.2). Among the female respondents, the trend of their participation rate was the opposite. In the same 2015 wave, female respondents with better health usually had a higher participation rate in the NRSPP than those with poorer health. In 2013, for example, the participation rate for women who reported 'excellent' health was 81.82% but it decreased as health deteriorated to 73.00% for women who reported their health as 'very poor'. The findings about health condition in Table 7.2 show that, the correlation between health conditions and participation rate could be opposite between genders, as men have a positive correlation while women have a negative correlation.

Table 7.5 shows the gender difference in the participation rate in the NRSPP by health condition in the different waves, and most of them were negative. A negative gender difference shows that with the same health condition, female respondents consistently had a higher participation rate than males as the gender gap was calculated by subtracting females' participation rate from males'. Even though the trend in the participation rate for men increased as their health deteriorated and that for women decreased as their health deteriorated, the rate for female respondents was still higher than that for males. The gender difference for most of the health conditions fluctuated between -11.99% to 10.65% during these waves with the health category 'excellent' as an exception, as the gender gap was greater than -30% in the first two waves and decreased to -13.33% in 2015, which was still higher than the gender difference in the other categories. The gender difference for the category of 'very poor' was negative in 2011 and was increased to be positive from 2013 onwards, and the value widened over time. The changing gender difference for the category of 'very poor' suggests that men with poor health showed higher participation rates in the NRSPP than women.

Table 7.5 The gender difference in participation rates in the NRSPP by health condition in the different waves

		2011	2013	2015	2018
Health (self-reported)	1 Excellent	-31.75%	-36.36%	-13.33%	
	2 Very good	1.88%	-4.11%	-2.22%	-7.24%
	3 Good	-6.17%	-5.98%	-11.99%	-11.45%
	4 Fair	-5.65%	-10.03%	0.13%	-8.81%
	5 Poor	-2.58%	-2.72%	-0.22%	-1.99%
	6 Very Poor	-6.67%	0.33%	4.65%	10.65%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Marital status was a nominal variable with four categories: married, single, divorced and widowed. The participation rate for the same category of marriage status in 2018 was much higher than that in 2011. The participation rates for male and female respondents in the different waves are shown in Figure 7.3: it can be seen that single women generally had the highest participation rate in all four waves, and it was 100% in 2013 and 2015. In those years, except for the 'single' category, the highest participation rates for other marital statuses were 72.42% in 'married' category (in 2013) and 74.16% in 'widowed' category (in 2015) for women. Furthermore, the participation rates for 'married' and 'widowed' in all four waves followed roughly the same path.

For male respondents, in 2013 and 2015, the 'single' groups had the highest participation rates at 75.86% and 100% respectively whereas those in the 'divorced' groups had the lowest participation rates at 59.09% and 58.82% respectively in 2013 and 2015. In 2011 and 2018, the 'divorced' groups had the highest participation rate, 30.77% and 66.67% respectively and 'single' groups had the lowest participation rates at 12.03% and 42.86% respectively. Information about the gender difference in each category in all four waves is summarised in Table 7.6, which shows that the 'single' group had the widest gender difference among all other categories in all the waves except for 2015, when both male and female respondents had a 100% participation rate and the gender difference was 0. The gender differences in the participation rate for married and widowed respondents did not change much between the waves. Except 'widowed' group in 2013 where the gender difference was positive (1.85%). The 'divorced' group also had positive gender differences in 2015 and 2018 at 8.82% and 1.67% respectively, which suggests that the gender gap in participating in the NRSPP changed from being in favour of women to being in favour of men. In the last two waves, divorced males rather than divorced female respondents were more likely to participate in the NRSPP. The review of the descriptive analysis about participation rate by marriage for men and women could not help make the initial hypothesis about how marriage status affects the participation rate of men and women,

respectively. The only reasonable hypothesis is that people in 'single' categories are more likely to participate in the NRSPP. However, the condition of other marriage status should be tested in the mixed-effects logit models.

Figure 7.3 Participation rates by marital status in the different waves
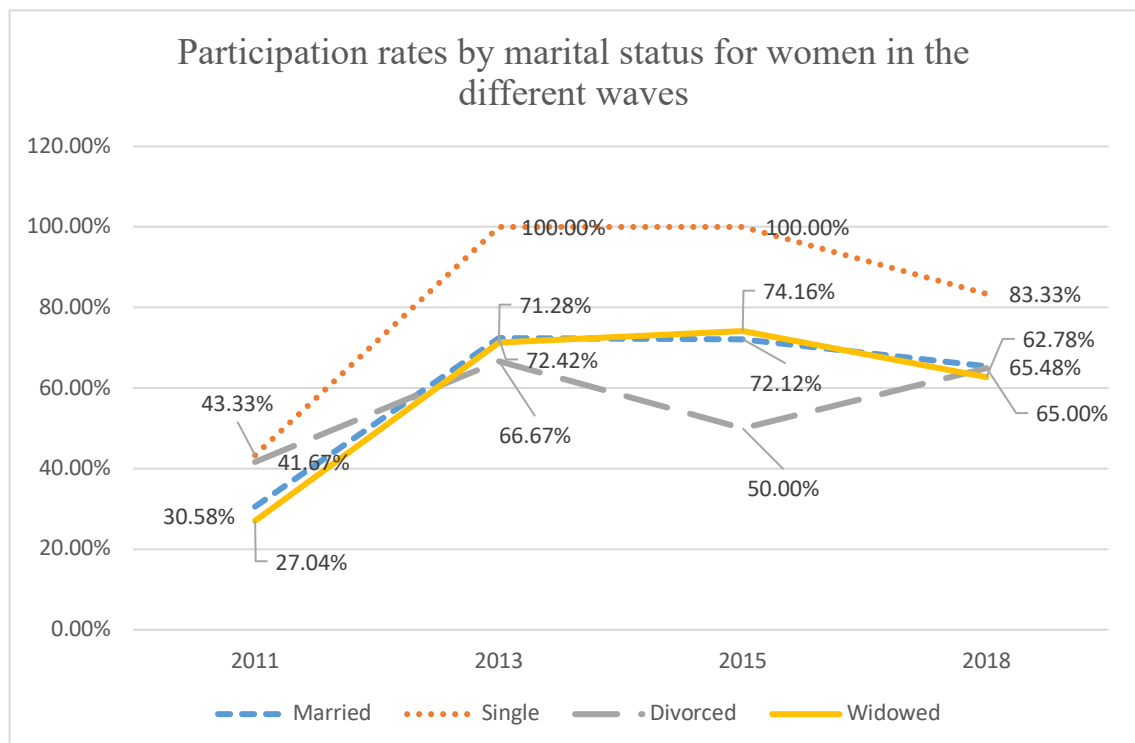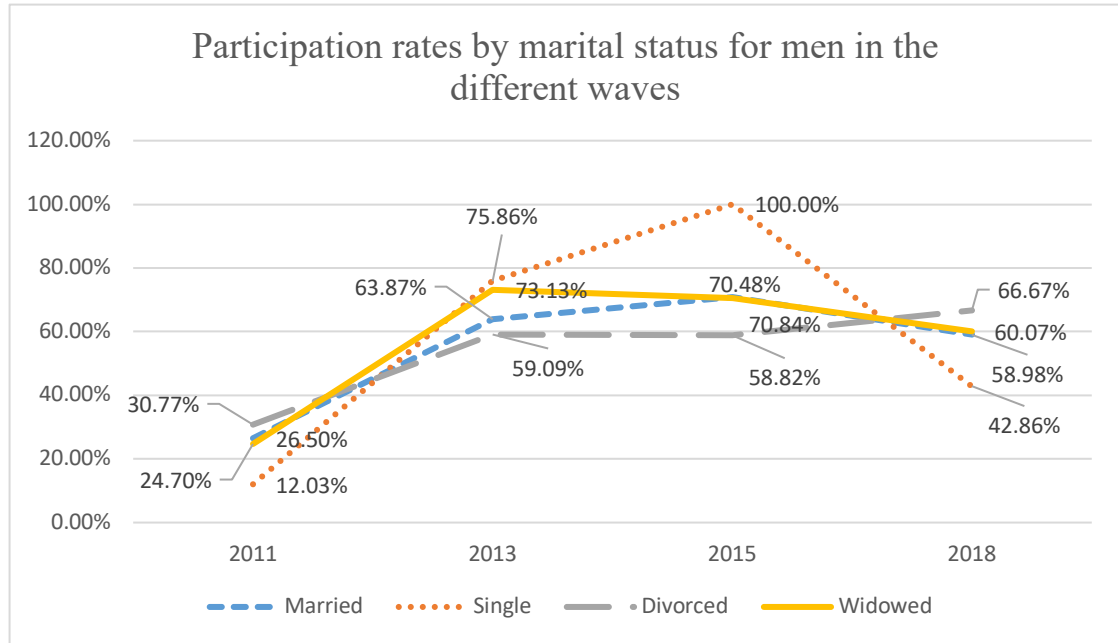
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 7.6 The gender difference in participation rates in the NRSPP by marital status in the different waves

		2011	2013	2015	2018
Marriage status	Married	-4.08%	-8.55%	-1.28%	-6.50%
	Single	-31.30%	-24.14%	0.00%	-40.48%
	Divorced	-10.90%	-7.58%	8.82%	1.67%
	Widowed	-2.34%	1.85%	-3.68%	-2.71%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

The NRSPP was designed to cover residents in rural areas, so it should only cover those with a rural (agricultural) *hukou*. While, there were people who had used to have a rural *hukou* but had then transferred to an urban *hukou*, and before that transition took place, they had already been participated in the NRSPP. In the CHARLS dataset, these people would be categorized as having an urban *hukou* but also having participated in the NRSPP. The participation rate and gender difference for males and females in urban and rural *hukous* is shown in Figure 7.4 and Table 7.7. For both genders, people with an agricultural *hukou* had a much higher participation rate than those with a non-agriculture *hukou* as the NRSPP was designed for residents in rural areas. For people with a rural *hukou*, the participation rates for male and female respondents were quite close and the rate for women was only slightly higher than that for men in all waves except for 2015, when the rate for men was slightly higher than that for women (75.58% for men and 74.39% for women). As the participation rates for the two genders were very close, however, the gender difference was around 0 during these four waves. The situation for those with an urban *hukou* was slightly different: the participation rates for female respondents were consistently higher than those for males. The change in the participation rate for women with urban *hukou* is like a climb with twists and turns: it started at a low level in 2011 (10.14%), climbed to 40.00% in 2013, turned back to 26.53% in 2015 and rose again to 34.95% in 2018. The change of participation rate for men with urban *hukou* was simpler, showing a continuous rise from 2011 to 2015 and then dropping back down to the 2013 level in the final wave. The gender difference for people with an urban *hukou* was consistently negative, which suggests that the rate for women with an urban *hukou* was always higher than that for men with an urban *hukou*. The gender difference started at -7.25% in 2011, reached a peak of -29.56% in 2013, then reduced to -6.25% in 2015 before ending at a larger gender difference of -24.99% in 2018. The initial hypothesis generated from the descriptive data analysis is that both male and female respondents bearing rural *hukou* are more likely to participate in the NRSPP than those with urban *hukou*.

Figure 7.4 Participation rates by *hukou* in the different waves

Participation rates by gender for urban *hukou* holders in the different waves

Participation rates by gender for rural *hukou* holders in the different waves
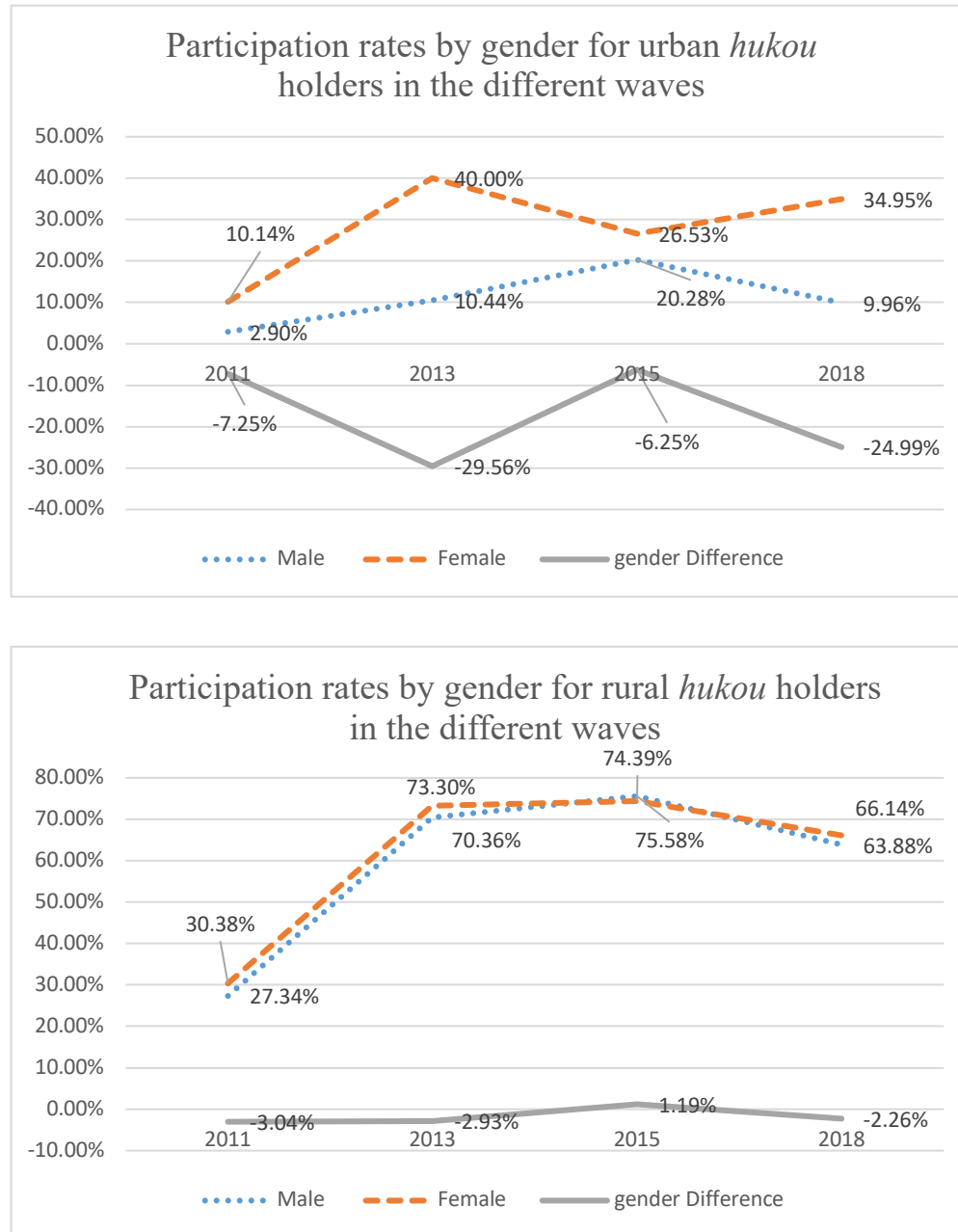
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 7.7 The gender difference in participation rates in the NRSPP by *hukou* in the different waves

	2011	2013	2015	2018
Urban (non-agricultural) hukou	-7.25%	-29.56%	-6.25%	-24.99%
Rural (agricultural) hukou	-3.04%	-2.93%	1.19%	-2.26%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

The final variable was 'region', which comprised three categories: east, middle and west. I divided the provinces surveyed in CHARLS into 'east', 'middle' and 'west' according to the

division used by the National Bureau of Statistics of China (National Bureau of Statistics of China, 2011). The revised dataset included 26 city and provinces. The eastern category contained Beijing, Tianjin, Hebei Province, Jiangsu Province, Zhejiang Province, Fujian Province, Shandong Province, Guangdong Province, Heilongjiang Province, Jilin Province, Liaoning Province. The central area contained Shanxi Province, Anhui Province, Jiangxi Province, Henan Province, Hubei Province and Hunan Province. The western area contained the Inner Mongolia Autonomous Region, Guangxi Province, Sichuan Province, Guizhou Province, Yunnan Province, Shaanxi Province, Gansu Province, Qinghai Province and Xinjiang Province. From the west area to the east area, from inland to the coast, the economic levels in the geographical locations showed an obvious increasing trend (National Bureau of Statistics of China, 2011). The participation rates for male and female respondents to the CHARLS surveys in the different regions are shown in Figure 7.5. For both genders, the middle area usually had the highest participation rate in all waves except for 2018, when the western area had the highest participation rate for both genders. The eastern area usually had the lowest participation rate in all waves for both genders except for 2011, when the western area had the lowest participation rate for both genders. The gender differences in all three areas were consistently negative except for the western area in 2015, as shown in Table 7.8. The changing patterns in the gender difference in the participation rate were quite similar for the west and east areas: it started at a low level in 2011, reached a peak in 2013, turned back to a low level in 2015 and increased again in the final year. For example, in the east area, the gender difference began at -3.42% in 2011, reached -8.96% in 2013, then turned back to -2.21% in 2015 and increased again to   -8.42% in 2018. The largest gender difference for the middle area was at the beginning (-8.55%), after which it continued to decrease to -5.69% in 2013 and -2.74% in 2015, and then jumped to -7.49% in the fourth year. These negative gender differences suggest that wherever the respondents were and consistently in every wave, women usually had a higher tendency to participate in the NRSPP than men.

Figure 7.5 Participation rates by region in the different waves

Male participation rates by region in the different waves

- East
- Middle
- West

Female participation rates by region in the different waves

- East
- Middle
- West

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

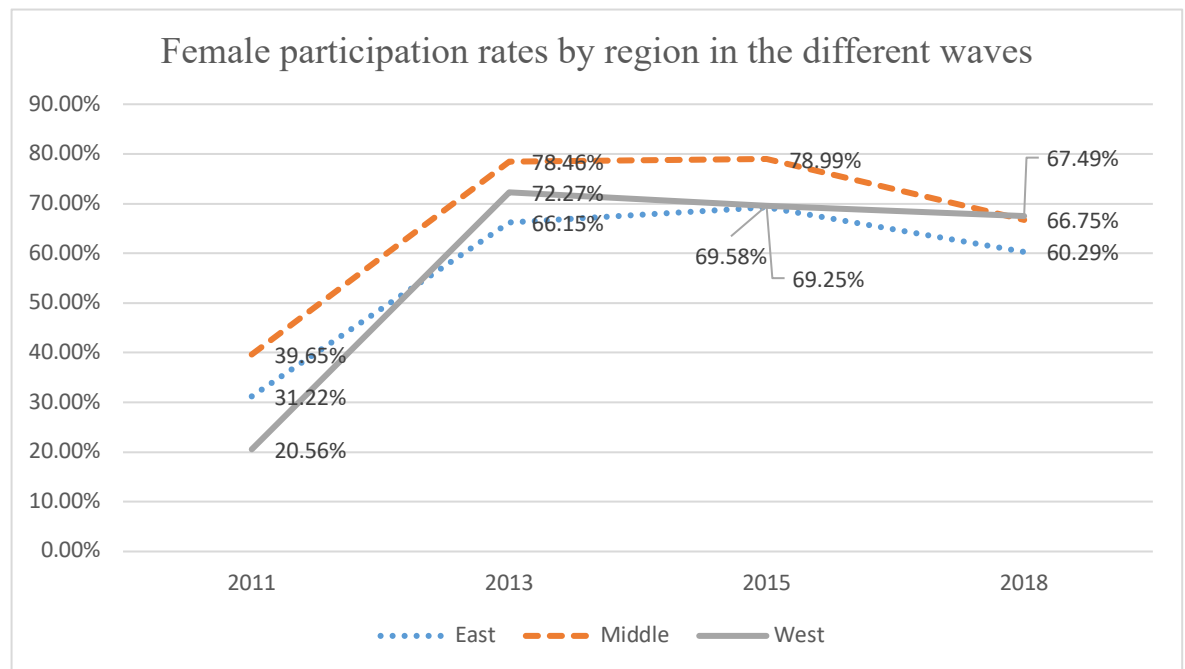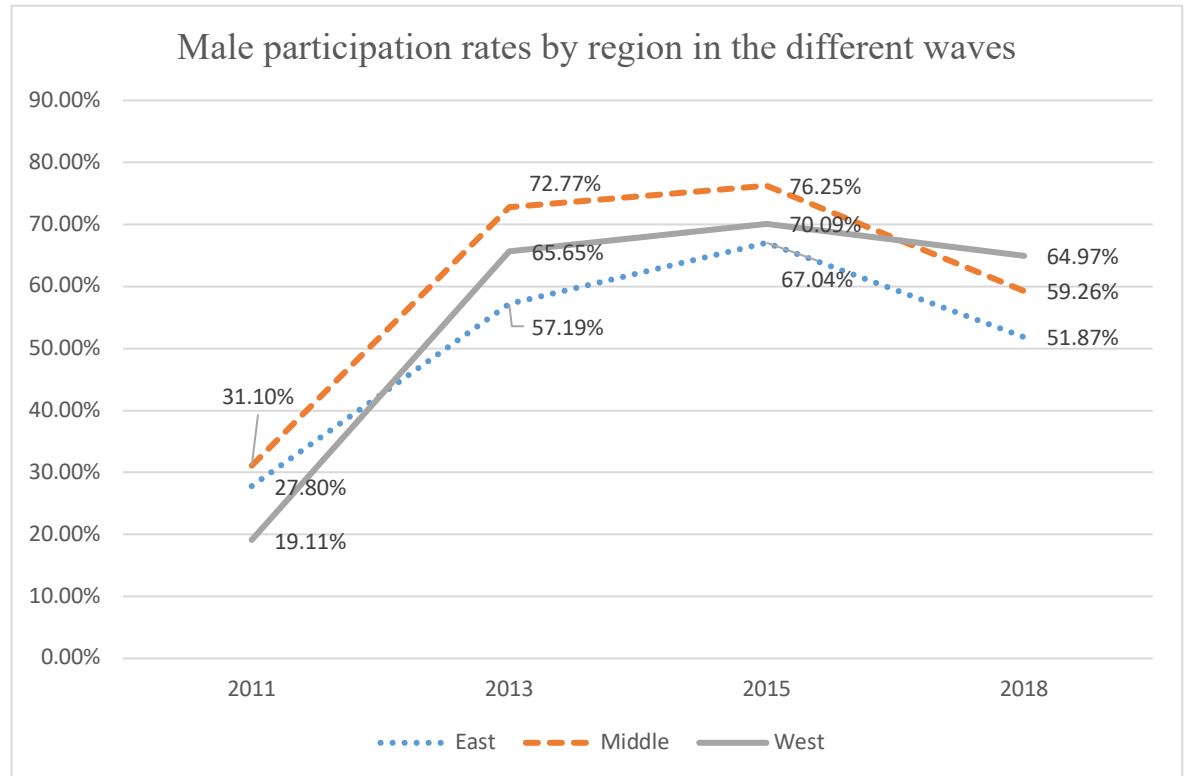**Table 7.8 The gender difference in participation rates in the NRSPP by region in the different waves**

	2011	2013	2015	2018
East	-3.42%	-8.96%	-2.21%	-8.42%
Middle	-8.55%	-5.69%	-2.74%	-7.49%
West	-1.44%	-6.62%	0.51%	-2.52%

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

As has already been explained (see section 3.2.5), participants in the NRSPP could choose to make annual contributions continuously for at least fifteen years,[30] make a lump sum contribution,[31] or finally pay a specific fee first then make the annual payments until they retire.[32] The averages of these three payment methods by region in the different waves are shown in Figure 7.6, and the gender differences in these averages are shown in Tables 7.9, 7.10, 7.11 and 7.12. The gender difference is calculated as the average contribution of men minus that of women.

Figure 7.5 shows that both genders in the middle area consistently had a higher participation rate than the other two regions. Both genders in the middle area usually chose to make fewer contributions than in the eastern and western areas. People from less developed areas had more incentive to participate in the NRSPP and preferred a lower contribution category than people in the more developed areas, which is consistent with the findings made by Huang and Zhan (2012). Taken together with the participation rate in the different regions, it can be seen that both male and female participants from the middle area had a greater tendency to participate in the NRSPP but they usually chose to make lower contributions than those in the other two regions. The contribution system will be discussed in greater detail next.

The situation for male and female participants who chose to make annual contributions was quite similar: participants in the eastern area usually had the highest average annual contribution, with the western area ranking second and the middle area usually having the lowest average annual contribution for both genders. The only exceptions were male participants in 2018 and female participants in 2015 and 2018. In these groups, the eastern area still had the highest annual contribution, the average annual contribution in the middle area was a little bit higher than in the western area. For the lump sum payment, for both genders, the average lump sum payments in the eastern and western areas were consistently higher than in the middle area. The only exception was for women in 2015, when women in the eastern area had the lowest average

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[30] This payment method is for participants under 45 years old when they first participate in the NRSPP.
[31] This payment method is for participants over 60 years old when they first participate in the NRSPP.
[32] This payment method is for participants between 45 and 60. There was no question about the third payment in the 2011 questionnaire, information about this payment started to be collected in 2013.

lump sum contribution. For the third group of people who had to pay a specific fee first then make annual payments, the eastern area usually had the highest contribution for both genders in terms of the specific fee, followed by the western area and middle areas. The exception was men living in the middle area in 2013 and 2015 who showed the highest average contribution in this fee section. For the annual contribution section in the third payment method, men from the eastern area usually had the highest annual contribution followed by men from the western and middle areas, except in 2013 when the middle area had the highest annual contribution and the eastern area had the lowest. Women in the western area usually had the highest annual contribution and those in the eastern area had the lowest annual contribution except for 2015, when women in the eastern area had the highest annual contribution and those in the middle area had the lowest.

The results from Tables 7.9, 7.10, 7.11 and 7.12 shows that female respondents usually chose to make higher annual contributions in the first two payment methods (annual or lump sum contributions) in 2011 and 2018. In 2013 and 2015, the contribution of men was usually higher than that of women for the first two payment methods. For the last payment method (fee and annual contribution), men made much more contributions than women in 2018. Women in rural areas had higher participation rates than men in all three regions, which means that women in rural areas were more likely to plan ahead for their old age. As has been suggested in the literature review and the findings chapter, this was a trend which reflected their inability to secure their old age compared with men, possibly because of their limited sources of income, including the income from farming and family support.

Figure 7.6 Average contributions by region and gender in the different waves

Average annual contributions by region and gender in the different waves

Average lump sum contributions by region and gender in the different waves

Average Certain Fee section (third payment) by genders and regions in the different waves

Average annual payment section (third payment) by gender and regions in the different waves
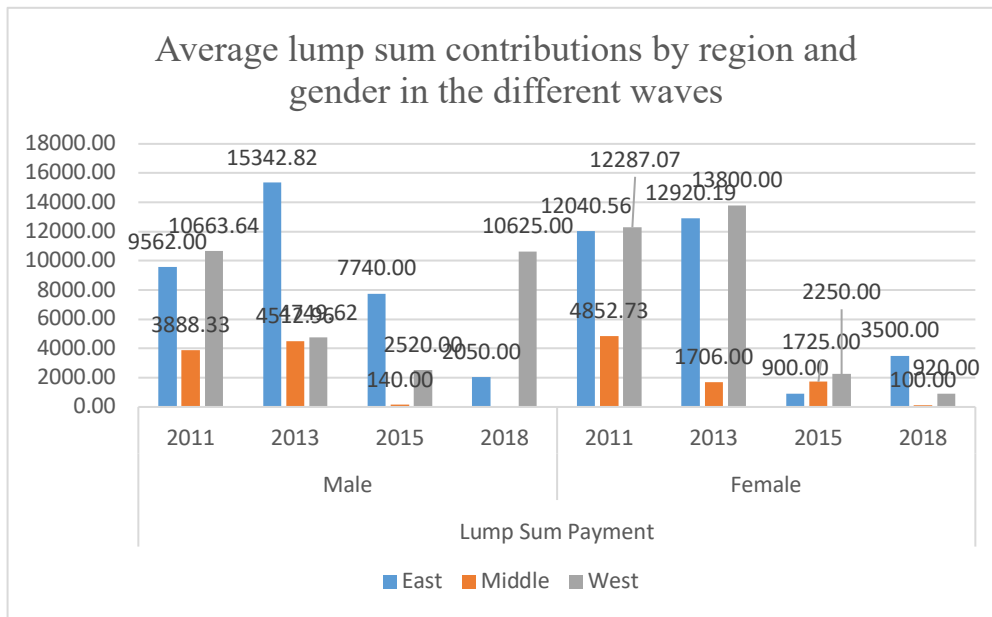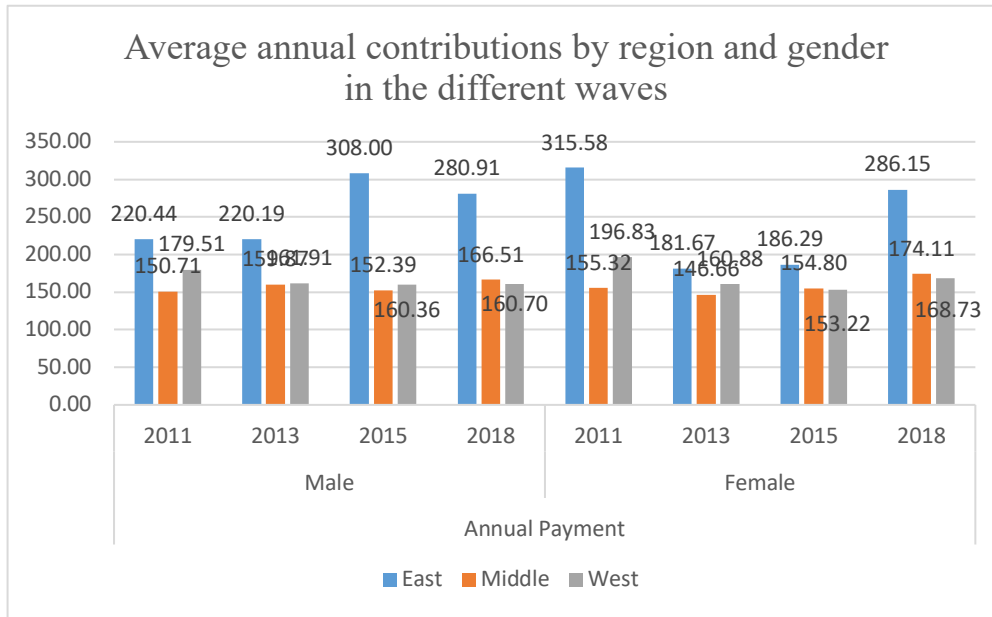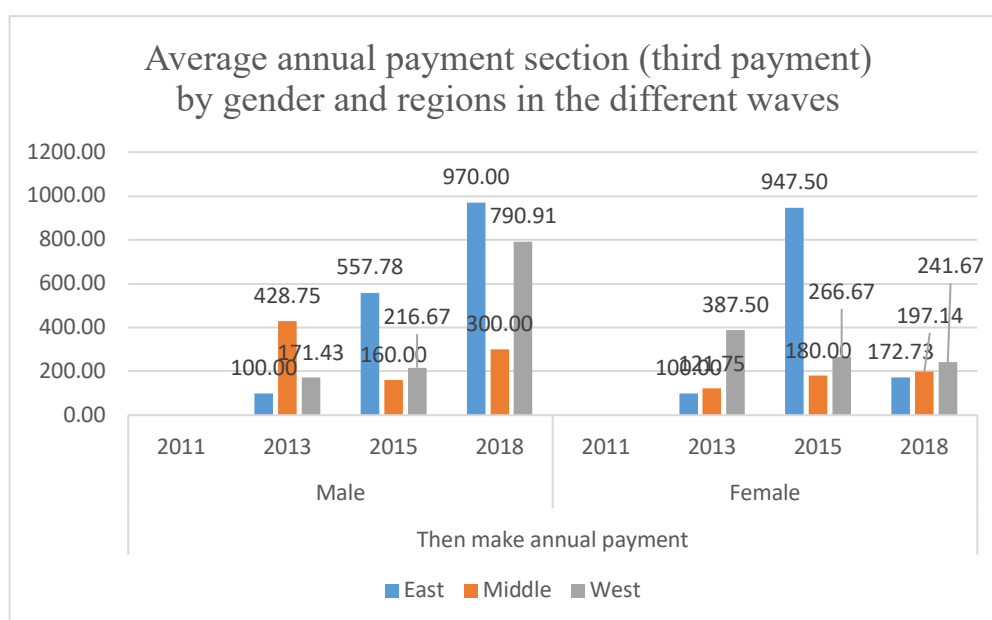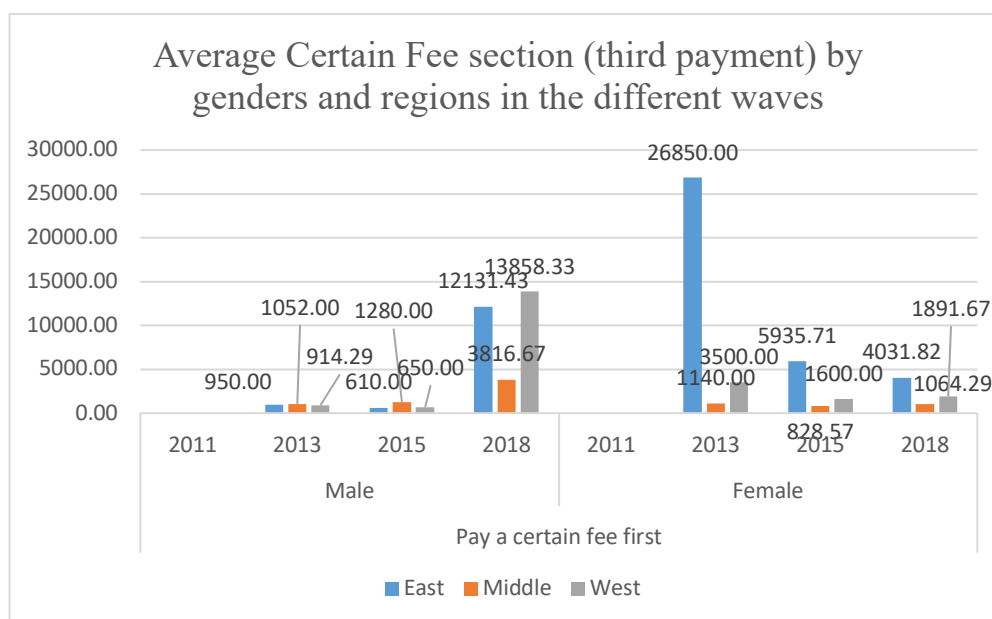
Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 7.9 Gender differences in average annual contributions by region in the different waves

	2011	2013	2015	2018
East	-95.14	38.53	121.71	-5.24
Middle	-4.61	13.21	-2.40	-7.60
West	-17.32	1.02	7.15	-8.04

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 7.10 Gender differences in average lump sum contribution by region in the different waves

	2011	2013	2015	2018
East	-2478.56	2422.63	6840.00	-1450.00
Middle	-964.39	2806.96	-1585.00	-100.00
West	-1623.43	-9050.39	270.00	9705.00

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 7.11 Gender differences in certain fee section in the third payment method by region in the different waves

	2011	2013	2015	2018
East		-25900.00	-5325.71	8099.61
Middle		-88.00	451.43	2752.38
West		-2585.71	-950.00	11966.66

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Table 7.12 Gender differences in annual contribution section in the third payment method by region in the different waves

	2011	2013	2015	2018
East		0.00	-389.72	797.27
Middle		307.00	-20.00	102.86
West		-216.07	-50.00	549.24

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

After analysing how these variables correlated to the participation rate for both genders, it can be clearly seen that for both genders, regardless of which variable is considered, the overall trend in the participation rate change was constant: the initial rate in 2011 was fairly low but it underwent a rapid increase in 2013 and then continuously increased at a very slow rate in 2015 before falling slightly in 2018, but not below the 2011 levels.

Although the gender difference varied in different waves or for different variables, most of the differences were negative, which means that women tended to have a higher probability of participating in the NRSPP in all conditions. After the analysis of the descriptive data, a hypothesis can be generated about the correlation between each variable and the probability of participating in the NRSPP: age is positively correlated with participating in the NRSPP for both genders; education level is negatively correlated with participation for men. Nevertheless, the correlation between education and women remains clear. Male respondents with worse health are more likely to participate in the NRSPP but the opposite is true for women. The relationship between marital status and participation in the NRSPP could be complicated, and comparisons could be made between the different categories within the marital status variable.

People with a rural *hukou* had higher probability of participating in the NRSPP than those with an urban *hukou* for both genders, and in terms of region, respondents of both genders in the middle area had a higher probability of participating the respondents in the other two regions. In the next section, the mixed-effects logit model will be used with a revised panel dataset to test the correlation between each variable and the dependent variable 'participating in the NRSPP'.

7.2.2 Results of logit model

In this study, the revised panel data which combined the four waves of data from the four successive CHARLS surveys were used to analyse the relationship between the independent variables and the probability of participating in the NRSPP. As explained in Chapter 5, the dependent variable for the NRSPP was a dummy variable of 'participate in the NRSPP or not', the logit model should be used to estimate the relationship between the impact factors with the dependent variable. Three models are discussed in this section to determine what factors affect the dependent variable and how they do so. As the logit model is not linear, the coefficient of the independent variables is not their marginal effects, it is the marginal change of the log odds ratio if X_{it} changes one unit. The value of the coefficient in the logit model can not directly tell how the odds ratio of the dependent variable will change if a unit of the independent variable change. The coefficient can usually only show whether the independent variable has a positive or a negative correlation with the dependent variable. The exponential function of β_i (EXP(β_i)) was applied to test us how many times the new odds ratio will change from the old odds ratio if one unit of X_{it} changes. As described in the methodology section, three mixed-effects models were used in this research.

The first model:

$$\text{logit}(p_{it}) = \log\left(\frac{p_{it}}{1 - p_{it}}\right) = \beta_0 + \sum_{i=1}^{k} \beta_i X_{it} + \beta_{gender} Gender + error \quad (1)$$

The second model only includes female respondents (i can only be women):

$$\text{logit}(p_{it}) = \log\left(\frac{p_{it}}{1 - p_{it}}\right) = \beta_0 + \sum_{i=1}^{k} \beta_i X_{it} + error \quad (2)$$

The third model only includes male respondents (i can only be men):

$$\text{logit}(p_{it}) = \log\left(\frac{p_{it}}{1 - p_{it}}\right) = \beta_0 + \sum_{i=1}^{k} \beta_i X_{it} + error \quad (3)$$

The results of these three mixed-effects models are summarised in Table 7.13. As stated above, the coefficient from the logit model is the marginal change of the log odds ratio if X_{it} changes by one unit, and the sign of the coefficient will be used to explain how the independent variables can affect the probability of participating in the NRSPP for the different genders. The exponential functions of β_i (EXP(β_i)), which is the odds ratio, for the three models are also summarised in Table 7.13. When the independent variable was a continuous variable, the exponential function of β_i (EXP(β_i)) is expressed as a percentage. When the independent variable is a categorical variable, the exponential function of β_i (EXP(β_i)) is expressed by time. The example about how to interpret the coefficients will be detailed in the following sections. The standard to decide the significance level of the coefficients in the logit model was similar with the standard in the multilinear regression model. One, two, three asterisks suggest 10%, 5% and 1% significance level, respectively. The lower the significance level, the higher probability to reject the null hypothesis that the independent variable is not associated with the dependent variable.

In the first model, the gender variable was included to test the difference between men and women taking into consideration the effects from all other related independent variables. The gender coefficient in the first model had a positive significant coefficient, which means that women were more likely to participate in the NRSPP than men with the same observed and unobserved characteristics. The positive coefficient for the gender variable is consistent with the finding from the descriptive data analysis that 'female respondents have higher participation rates than male respondents in all waves'. The EXP(β_i) was 1.160, which means that if the respondent changed from a man to a woman, the odds of participating in the NRSPP are multiplied by 1.160. This significant positive gender coefficient is consistent with the findings of Yue (2004), Wu (2009), Jiang (2011), Deng and Liu (2013), Chen (2015), Tu and Hei (2015) and Liang and Wang (2016). The reasons for this could be that women have a longer life expectancy than men in China and that if they find themselves facing the risk of poverty, the pension benefit from the NRSPP is one of the stable income resources which they can access after their retirement (Deng and Liu, 2013; Tu and Hei, 2015). Yue (2004) stated that female rural dwellers have less opportunity to participate in off-farm work as they grow older, so because their ability to earn an income from farm work will decrease over time, they will be more likely to participate in the NRSPP in order to secure their income in their old age.

To answer the third research question 'How do factors such as education, working experience and income before retirement affect the gender gap in the NRSPP?', two sub-questions were applied 'how other independent variables would affect the probability of participating in the NRSPP for men and women respectively' and 'what is the difference between the independent

variables which have significant effect on the probability of participating in the NRSPP between genders', the second and third models were applied.

In the second model, only female respondents were included. There were five continuous variables in the logit model: age, education level, number of children, total income and land space. The age variable was found to have an insignificant positive coefficient, which is consistent with the findings of Shi, Fan and Wang (2009), Lin (2010), Jiang (2011), Deng and Liu (2013), Li (2013), Liu and Xu (2014), Wu (2014), Zhang and Wu (2014) and Chen (2015). The finding of a positive sign is also consistent with the finding from the descriptive data analysis, which also shows that older people are more likely to participate in the NRSPP than younger people. The odds ratio of 1.003 means if the age for women increases by 1 year, the odds of them participating in the NRSPP will increase by 0.3% (1.003-1). This positive coefficient can be explained as older people usually having more anxiety about their life after retirement than younger people (Huang and Xie, 2012; Liang and Wang, 2016; Hu, 2014a). The pension policy in the NRSPP also lacks any mechanism to encourage younger generations to participate in the NRSPP as the pension benefit will not have a huge increase if they decide to join at an earlier age (Lei, Zhang and Zhao, 2013). As suggested in the literature, younger people are more likely to participate in the NRSPP from the age of 45 to meet the requirement of fifteen years of contributions, because in their 20s and 30s, they can save money in a savings account to form another secure layer for their life after retirement (Luo and Shu, 2011; Mu and Yan, 2012).

Education level was the second continuous variable with an insignificant negative coefficient (-0.011) and the odds ratio was 0.989, suggesting that with one more year of education, the odds of participating in the NRSPP for women would decrease by 1.1% (0.989-1). The negative coefficient for education level suggests that for well-educated women, the NRSPP will be less attractive as the contribution amount and pension benefit are at a low level (Mu and Yan, 2012; Su, 2014a). With a higher level of education, women will have more opportunities to earn a larger income to prepare for their retirement (Liu and Xu, 2014; Liang and Wang, 2016; Wu, 2008).

The number of children was the third continuous variable with an insignificant positive coefficient of 0.016 and an exponentiation of 1.016, which means that the odds of women participating in the NRSPP will increase by 1.6% (1.016-1) with each additional child. The positive correlation between the number of children and the probability of participating in the NRSPP suggests that people living in rural areas have started to make the transition from traditional family support to the social pension programme (Chen, 2015; Shi, Fan and Wang, 2009; Liu and Xu, 2014). On the other hand, the NRSPP requires fifteen years of contributions

or a supplementary payment when people reach the age of 60. So as the contribution amount is fixed, the more adult children there are in the family, the lower the average contribution they will each need to pay for their parents to participate in the NRSPP. This finding confirms that of (Shi, Fan and Wang, 2009) that the probability of adult children making the contribution to let their parents participate in the NRSPP increases with the number of children. Total income also had an insignificant positive coefficient but it was very close to zero and might not have that much effect on the probability of women participating in the NRSPP. The coefficient for land space was significantly positive at 0.002, and the odds ratio was 1.002, which suggests that for every additional unit of land, the odds of a woman participating in the NRSPP would increase by 0.2% (1.002-1). Most of the previous studies found that land ownership does have a positive relationship with the probability of participating in the NRSPP, suggesting that a family with more land would have more revenue from farm work and the contributions or the supplementary payment would be more affordable (Yang, 2011). Wu (2009), however, pointed out that a family with more land would have to devote more labour to the farm work and would therefore have less opportunity to find work in an urban area and to be covered by other types of pension programme. Also, a family with more land has to bear more of the risk of poor harvests caused by natural and man-made disasters, or the potential market risk that the price for their produce would fluctuate, so rural people with more land could be more likely to want to have an extra layer of security (Wu, 2008; Yue, 2004; Wu, 2009; Liu and Xu, 2014).

As for the other categorical variables, different method was applied to interpret the odds ratio for the categorical variables. The odds ratio for categorical variables should be interpreted as a multiplier multiplied by the odds ratio of the reference category. The first category variable in the mixed-effects logit model is health condition. All the categories in health had negative coefficients, which means that women with a poorer health would have a lower probability of participating in the NRSPP, which is consistent with the finding from the descriptive data analysis. The odds ratios for all categories for health were less than 1, which means that if the health of a woman changes from excellent to a poorer level, the odds of their participation in the NRSPP will decrease compared with those with excellent health condition. For example, for women reporting their health as 'Very good', the odds ratio was 0.645, which means if a woman's health changes from 'Excellent' to 'Very good', the odds of her wanting to participate in the NRSPP will be multiplied by 0.645. As shown in Table 7.13, the odds ratio decreases as the health condition worsens. The possible explanation for this is that women with better health would usually be more aware of the need for risk prevention and would have longer life expectancy, and such people usually prefer to have an extra secure layer for their retirement, including saving money in a bank and participating in the NRSPP (Shi, Fan and Wang, 2009). Possibly, women with poorer health conditions need to prioritise immediate health and care costs and can not either afford or prioritise the costs of participating in the NRSPP.

The next categorical variable was marital status. For women, 'Single' and 'Divorced' had positive coefficients of 0.954** (odds ratio = 2.595**) and 0.072 (odds ratio = 1.074) respectively and their odds ratios were greater than 1, which means that if a woman's marital status changes from 'Married' to 'Single' or 'Divorced', the odds of her participating in the NRSPP will increase. For example, the odds ratio for 'Divorced' was 1.074, which means that if a woman changes her status from 'Married' to 'Divorced', the odds of her participating in the NRSPP would be multiplied by 1.074. 'Widowed' was the only category that had a negative coefficient. The odds ratio for 'Widowed' was 0.842, which means that if a woman changes her marital status from 'Married' to 'Widowed', the odds of her participating in the NRSPP would be multiplied by 0.842. 'Single' is the category with the highest odds ratio, which means that single women are more likely to participate in the NRSPP than those with other marriage status. The findings for marital status are inconsistent with those of previous studies suggesting that married people are usually more likely to participate in the NRSPP. An explanation for this could be that a woman who changes her marital status to single or divorced could lose the support from of her family and would need to find some other income resources to support her old age. But a woman whose status changes from married to widowed is culturally expected to have all the continuing financial support from the family as she has become the only elderly people in the family.

In terms of *hukou*, women with a rural *hukou* were found to have a significant positive coefficient (1.634***) and the odds ratio was quite large, at 5.126, meaning that if a woman were to change from an urban *hukou* to a rural *hukou*, the odds of her participating in the NRSPP would be multiplied by 5.126. This result is consistent with the findings from the descriptive data analysis as female peasants do not have that many opportunities to be covered by other pension programmes. So once they change to a rural *hukou*, the probability of them participating in the NRSPP will be much higher.

Region was the final discrete variable. 'Middle' and 'West' both had positive coefficients but that for 'Middle' was significant and that for 'West' was insignificant. The odds ratio for the 'Middle' and 'West' areas were both larger than 1 but the odds ratio for 'Middle' was larger than that for 'West', which means that if the region for women changes from 'East' to 'Middle' or 'West', the odds of them participating in the NRSPP will increase. This suggests that women in a less developed area would be more likely to participate in the NRSPP and that women in the middle area had the highest probability of participating in the NRSPP and the result is consistent with that of descriptive data analysis. The possible explanation for this could be that in the developed areas, peasants have more money and more choices to participate in a commercial insurance scheme rather than the NRSPP, or could rely on their own savings, but in

the less developed middle or western areas, the NRSPP could be the only choice for women in rural areas to provide them with an income when they are too old to continue with farm work.

Because I had revised the CHARLS dataset and compiled a panel dataset containing four time points (2011, 2013, 2015 and 2018), the coefficient for the four waves should also be included in the mixed-effects models to see how things changed over time. All the coefficients for the 'year' variable were significant positive and the odds ratios were greater than 1, which means that as time changed from 2011 to 2013, or 2015, or 2018, women had a higher probability of participating in the NRSPP. However, the odds ratio in 2018 was much smaller than those in 2013 and 2015, which means that the probability of women participating in the NRSPP in 2018 was smaller than those of participating in 2013 or 2015, but the probability of women participating in the NRSPP in 2018 was still much larger than the probability of participating in 2011. The findings for these four waves are also consistent with the results in descriptive data analysis that over time the probability of women participating in the NRSPP will increase.

Comparison with the mixed-effects logit model result for male respondents, including education level, *hukou*, number of children, land space, region and years, showed the same sign of coefficients as women. What changed was the magnitude. For education level, both genders had negative coefficients, but the coefficient for women was insignificantly negative (-0.011) and for men was significantly negative (-0.025***). The odds ratio of education level for the two genders did not vary much: for women it was 0.989 and for men it was 0.975***, which means with each additional year of education, the odds of women participating in the NRSPP for women would decrease by 1.1% and the odds of men participating would decrease by 2.5%. For *hukou*, both genders had significant variables but the odds ratio for men's *hukou* was much larger than that for women's *hukou*. The odds ratio says that if a woman were to change from an urban *hukou* to a rural *hukou*, the odds of her participating in the NRSPP would be multiplied by 5.126, but if a man were to make the same change in *hukou*, the odds of him participating in the NRSPP would be multiplied by 26.492, five times greater than the women's odds ratio. Thus, the effect of changing from an urban *hukou* to a rural *hukou* was much more significant for men than for women. The coefficients and odds ratios for number of children and land space, region and year were quite similar for both genders, which means that even though these variables do have effects on the probability of participating in the NRSPP, the effect on the probability would be negligible, regardless of gender. For example, for number of children, both genders had insignificant positive coefficients and the magnitude of the odds ratio were quite similar for men and women. The odds ratio suggests that if a woman had one more child, the odds of her participating in the NRSPP would increase 1.6%, and the increase rate for men would be 4.2%. The gender gap between the probability of participating in the NRSPP would not be led by these variables.

Age, health and marital status were the three variables which had different signs of the coefficients between genders. For the age variable, women had an insignificant positive coefficient (0.003) whilst men had an insignificant negative coefficient (-0.005). The odds ratio for women was 1.003 and for men was 0.995, which means that if the age for women increases by one year, the odds of participating in the NRSPP would increase 0.3% (1.003-1), whereas if the age for men increases by one year, the odds of them participating in the NRSPP would decrease by 0.5% (0.995-1). The negative coefficient for age can be explained by the fact that as peasants can make a supplementary payment at the age of 60, with an older age, men will be prefer to make a supplementary payment in their 60s to receive the pension rather than make long-term contributions in their 40s or 50s (Chang et al., 2014).

For health, women had all insignificant negative coefficients, and the odds ratios were all less than 1, which means that if women's health condition changes from 'excellent' to a worse condition, the probability of them participating in the NRSPP will decrease, and the worse the health condition is, the lower the odds will be of participating in the NRSPP. The situation was quite different for men. For men, the coefficients for all categories in health were significantly positive and the odds ratios were all greater than 1. These odds ratios mean that if the health condition of a man changes from excellent to a poorer health condition, the odds of him participating in the NRSPP will increase. For example, for the health condition 'Very good', the odds ratio was 2.727, which means if a man's health changes from 'Excellent' to 'Very good', the odds of him participating in the NRSPP would be multiplied by 2.727. This example applies to both women and men. Table 7.13 shows that the odds ratio for men decreased mildly when the health condition worsened and then recovered in the category 'poor'. Practically, these results suggest that with a worse health condition, men will be more likely to participate in the NRSPP, and men with 'very poor' health had the highest probability of participating in the NRSPP. The possible explanation for this is that people in rural areas are usually engaged in farm work and rely on themselves and their family when they become old, so their health condition will be directly related to their ability to earn an income. Men with worse health usually have less savings and if they want to reduce their dependence on financial support from their family and reduce the financial burden on family members when they get old, they have to participate in the NRSPP (Mu and Yan, 2012).

The final variable which showed large differences between the genders was marital status. Women who were 'Single' or 'Divorced' had positive coefficients at 0.954** and 0.072 respectively and their odds ratio was larger than 1; 'Widowed' had a significant negative coefficient (-0.172**) and the odds ratio was smaller than 1, which means that if a woman's status changes from 'Married' to 'Widowed', the odds of her participating in the NRSPP will be multiplied by 0.842. For men, all three unmarried categories had negative coefficients for

'Single' (-0.724***), 'Divorced' (-0.049) and 'Widowed' (-0.009). The odds ratios for these three categories were all less than 1, which means that when a man's marital status changes from 'married' to another status, the odds of him participating in the NRSPP will decrease. Married men had the highest probability of participating in the NRSPP. However, the inconsistent finding of descriptive data analysis suggests that divorced or widowed men usually had the largest participation rate.

After comparing the second model for female respondents and the third model for male respondents, it can be seen that age, health and marital status were the three variables which had the opposite effect on the probability of participating in the NRSPP and the opposite sign of coefficients, and the difference between the odds ratios could be the principal reason leading to the gender difference in the probability of participating in the NRSPP. For the other variables, even though they had the same direction of the effect on the probability of participating in the NRSPP, the magnitude of the odds ratio could vary a lot, for example, in respect to *hukou*. Changing from an urban *hukou* to a rural *hukou* can make an enormous difference to the probability of participating in the NRSPP, all other things being equal. This could be another reason for the gender gap in the probability of participating in the NRSPP. Other variables which had the same sign in their coefficients and similar odds ratios for both genders, for example, education level, number of children and land, did not have a significant effect on the gender difference when they changed a unit or changed from the baseline category to another.

Table 7.13 The results of the mixed-effects models

	(1) Total		(2) Female		(3) Male	
	NRSPP	OR	NRSPP	OR	NRSPP	OR
Age	-0.002	0.999	0.003	1.003	-0.005	0.995
	-0.003		-0.003		-0.004	
Education Level	-0.02***	0.981***	-0.011	0.989	-0.025***	0.975***
	-0.005		-0.008		-0.008	
Health 1. Excellent						
2. Very Good	0.351	1.421	-0.439	0.645	1.003*	2.727*
	-0.371		-0.567		-0.515	
3. Good	0.279	1.322	-0.429	0.651	0.88*	2.412*
	-0.369		-0.564		-0.514	
4. Fair	0.233	1.263	-0.495	0.609	0.848*	2.336*
	-0.367		-0.56		-0.51	
5. Poor	0.292	1.339	-0.523	0.593	1.002*	2.723*
	-0.368		-0.561		-0.512	
6. Very Poor	0.399	1.49	-0.549	0.578	1.322**	3.749**
	-0.378		-0.572		-0.531	
Marital Status 1. Married						

2. Single	-0.354**	0.702**	0.954**	2.595**	-0.724***	0.485***
	-0.169		-0.376		-0.201	
3. Divorced	0.011	1.011	0.072	1.074	-0.049	0.952
	-0.223		-0.381		-0.28	
4. Widowed	-0.115*	0.891*	-0.172**	0.842**	-0.009	0.991
	-0.06		-0.076		-0.1	
Hukou 1. Urban (non-agricultural)						
2. Rural (agricultural)	2.646***	14.095***	1.634***	5.126***	3.277***	26.492***
	-0.111		-0.163		-0.159	
Number of children	0.033*	1.033*	0.016	1.016	0.041	1.042
	-0.02		-0.027		-0.028	
Total income	0	1	0	1	0	1
	0		0		0	
Land space	0.001***	1.000**	0.002***	1.002***	0	1.000
	0		-0.001		0	
Gender 1. Male						
2. Female	0.148***	1.160***				
	-0.045					

Region						
1. East						
2. Middle	0.512***	1.669***	0.506***	1.659***	0.515***	1.674***
	-0.053		-0.071		-0.077	
3. West	0.093*	1.098*	0.008	1.008	0.136*	1.146*
	-0.05		-0.069		-0.073	
2011.year						
2013.year	2.233***	9.330***	2.173***	8.782***	2.285***	9.826***
	-0.057		-0.08		-0.082	
2015.year	2.369***	10.690***	2.169***	8.748***	2.55***	12.805***
	-0.078		-0.109		-0.111	
2018.year	1.803***	6.066***	1.749***	5.749***	1.858***	6.411***
	-0.067		-0.092		-0.097	
_cons	-4.135***		-2.445***		-5.239***	
	-0.421		-0.62		-0.596	
/var(_cons[ID])	1.076***		.807***		1.297***	
	-0.098		-0.125		-0.149	
Observations	19446		9312		10134	
Pseudo R^2	.z		.z		.z	

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

Source: Author's own based on CHARLS 2011, 2013, 2015 and 2018

Chapter 8. Discussion and Conclusion

8.1 Summary of the research

The review of the empirical literature exploring the gender pension gap in China's pension system identified a series of key factors which can affect the gender gap in the Urban Employees' Pension Scheme (UEPS) and the New Rural Social Pension Programme (NRSPP). For the UEPS, the gender difference in retirement age, education level, occupation type, income gap, length of contribution years and life tables have all been mentioned as principal causes of the gender pension gap. The most commonly used model in the previous empirical literatures for the UEPS was simulation model and were usually based on a particular point in time. For the NRSPP, the previous researchers usually used simple logit models with the data collected by the authors themselves, but the effects of impact factors on the gender pension gap, which have been detailed discussed in Chapter 4, have been quite ambiguous in previous empirical studies.

This thesis opted to explore some of these hypotheses but instead of applying simulation models and a dataset based on a particular point in time, this thesis opted to use multi-linear regression model to explore how far the different policies in place at the time could affect the gender pension gap in UEPS. First, this would offer an important contribution to the knowledge by explaining the factors leading to the gender gap in the UEPS. The scope for this analysis also offered a missing and yet crucial nuanced dimension: the importance of the retirement year and time period of the retirement for explaining the gender pension gap in the UEPS. Adding this dimension to the analysis enabled the findings to offer a more detailed mapping and understanding of how successive pension reforms and changes in the policy environment have mattered for explaining the gender gap and how far some of the factors identified in the literature are endemic or stable through different retirement periods.

For the NRSPP, instead of using a simple used logit model with cross-section dataset, a set of mixed-effects models with panel data were used to explore the gender gap in the NRSPP and showed that the impact factors of willingness to participate in the NRSPP differed for men and women. This analysis is unique because previous studies only considered the gender variable as one of the independent variables to capture participation in the NRSPP. At the time of writing this thesis, there have been no studies reported in the literature into how these impact factors can affect men and women differently.

To make these solid analytical contributions to advancing the knowledge, the appropriate micro-level datasets are needed. However, as explained in Chapter 5, the available datasets would not offer these detailed and nuanced data. I therefore decided to use an existing dataset, CHARLS, for the purpose of creating a new dataset which would categorise pensioners based on the year

of their retirement for the UEPS and a panel dataset was compiled which contained information about rural dwellers observed at four points of time for the NRSPP. It is important to say that the current research incorporated the latest wave of CHARLS data for 2018, which only became available in late 2020. These new resources enabled me, in agreement with CHARLS officials, to incorporate any new entries in the CHARLS waves into the new cross-national dataset and the new panel dataset, which could be updated over time. This empirical and data contribution represents an attempt to maximise the use of existing datasets and transform them into new resources.

This thesis also reviewed existing theories of social policy that could provide explanation or solution to gender gap in the pension system, as most of the previous studies about gender pension gap problem were empirical and data driven. In this current research, I reflected upon the work of Esping-Andersen, as well as some feminist scholars' critical comments on it. The concept of decommodification, defamilialisation and demotherization were explained and linked with gender pension gap problem. Moreover, the gender role expectations under traditional culture, industrialisation, the role of institutions and pension legacies and an East Asia regional focus theory that 'social policy often becomes subordinated to the needs of the economy' have been reviewed to examine the potential of these approaches for explanation.

The findings of the current study not only make an empirical contribution to the knowledge but also an analytical contribution by providing a new dataset by reconfiguring the existing data in CHARLS as a resource which future researchers could use[33] for both the UEPS and the NRSPP. The analytical contribution also includes the fact that in the UEPS, retirement year and time period of the retirement were considered as dimensions for explaining the gender gap. Also the impact factors of participation in the NRSPP were explored for men and women separately, which had not been done before. The findings from the literature review and the results of the descriptive and inferential data analysis presented in this thesis will be drawn together to address the five research questions under the urban and rural pension schemes individually in this chapter. The theoretical reflections will be discussed by using the theoretical approach introduced in Chapter 4 and reflecting the findings in light of these theories. The potential policy suggestions, and the limitations of this study will be discussed and recommendations for future research directions will be made in the final section of this chapter.

As a reminder, the research questions which this study sought to explore were:

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[33] The researcher plans to contact CHARLS to inform its officials about the existence of this new dataset and ask whether they would be willing to publish it.

1.   Is there a gender gap, in terms of pension benefit, in the Urban Employees' Pension Scheme (UEPS)? Is the gap narrowing or widening over time?

2.   Is there a gender gap, in terms of participation rate, in the New Rural Social Pension Programme (NRSPP)? Is this gap narrowing or widening over time?

3.   How do factors such as education, working experience and income before retirement affect the gender gap in China's pension systems including both the UEPS and the NRSPP?

4.   How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?

5.   When controlling for the same gender in both the UEPS and the NRSPP, are there similarities or differences in terms of how the abovementioned factors inter-relate?

8.2 Findings and discussion: a reflection with empirical literatures

In this section, the main findings of the descriptive and inferential data analysis reported in Chapter 6 and Chapter 7 will be combined with those from empirical literature review to answer the research questions about UEPS and NRSPP, respectively.

8.2.1 Urban Employees' Pension Scheme

In this section, research questions 1, 3 and 4 will be answered using the data analysis in Chapter 6. The first research question, 'Is there a gender gap, in terms of pension benefit, in the Urban Employees' Pension Scheme (UEPS)? Is the gap narrowing or widening over time?' can be answered from the descriptive data analysis. The third and fourth research questions, 'How do factors such as education, working experience and income before retirement affect the gender gap in the UEPS?' and 'How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?', can be answered from the analysis of the regression results for the UEPS.

From the descriptive data analysis in Chapter 6, it is evident that a gender pension gap does exist in the UEPS and that it also increased after recent reforms (Hu, 2009; Chen and Turner, 2015). Not only did the average pension benefit display a gender gap, but women were also at a disadvantage in all pension-related independent variables, including retirement age, pre-retirement salary, working experience, education level and occupation type. This shows that pension provision represents a policy area which encapsulates the gender inequalities during the life course. For example, a family's preference for investing in the education of boys is one of the first behaviours to put girls in an inferior position. According to Chinese cultural practices, the opportunity to receive a higher level education usually favoured boys in the family rather

than girls (Wang and Cai, 2008; Pei, 2011) (see Table 6.2 in Chapter 6). When boys and girls grow up, the difference in education level for men and women could then be linked to the gender wage difference in the labour market (Gustafsson and Li, 2000). After they get married, Chinese cultural practice also requires women to take more responsibility for caring for family members, including giving birth to children and caring for older parents (Ai, 2015; Wang and Yang, 2015). Some women choose to become a housewife and give up the opportunity to enter the labour market (Ai, 2015).

For those women who choose to continue to work after getting married, maternity leave could interrupt their career. After giving birth to children, the responsibilities to take care of family (children and aging) could also interrupt their working life and make their eligible working life shorter than men's. These interruptions of women's working life could be the reason that the gender gap in eligible working experience was much larger than the gender gap in retirement age in all of the retirement year groups. The discrimination in the labour market gives women less opportunity to participate in the labour market and less opportunity for promotion compared with men, which could also be attributable to the gender wage difference (Wang and Cai, 2008; Wang, 2012). All these disadvantages for women in pension-related variables are usually caused by the gender discrimination in the labour market. The results from the descriptive analysis show that the gender pension gap keeps increasing over time, with recent pension reforms not being able to reverse this trend. Women are disadvantaged in every aspect and the gender gap in each independent variable has continued to increase. The gender pension gap was not caused by any single factor because, as was discussed in Chapter 6, men and women had almost the same level of pre-retirement salary before 1995, but the gender gap in other factors could still result in the gender gap in pension benefit. These findings match those of Li (2004) and Chen and Li (2004).

To answer the research questions 3, 'How do factors such as education, working experience and income before retirement affect the gender gap in the UEPS?' and 4, 'How do these inter-relations change over time? Is there a consistent trend or is the change stochastic in the UEPS?', the results from the regression models should be analysed.

Before answering the questions, I summarised the factors which have a significant effect on the gender pension gap in ranking for the different retirement groups (see Table 8.1[34]). Table 6.13 showed what, at least on government documents, seem to be the key variables in the pension calculation formula. Table 8.1 shows which variables had the most significant effect on the gender pension gap related to the retirement period and pension reform history in the UEPS.

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[34] Detailed information on each variable's effect on the gender pension gap is shown in Table 6.12.

The variables which are not assigned a rank in Table 8.1 indicate that this variable does not show a significant effect on the gender pension gap in the UEPS in that retirement group. From the discussion in Chapter 6 we know what seems to affect for the calculation formula (see Table 6.13), but what we did not know before this analysis was which of those factors seemed to matter the most (that is, had the most significant effect on the gender pension gap) and how the significant variables change along with policy changes over time. This is a key point which my analysis offers for understanding the dynamics of the gender gap development but also how each reform has re-ordered the importance of these variables.

Table 8.1 Factors directly affecting the gender pension gap in ranking in the UEPS

	Before 1995	1996-2000	2001-2005	2006-2010	2011-2018
Eligible working experience	1	1	1	1	1
Retirement age	2			2	
Pre-retirement salary		3	2	3	3
Occupation type		2	3		2
Education level					4

Source: Summarised by the author

The findings from the regression models in Chapter 6 could be summarized as three points to answer the third and fourth research questions. First, retirement age, pre-retirement salary, eligible working experience, education level and occupation type together can have a significant effect on the gender gap in pension benefit. Second, the variables which are directly included in the pension calculation formula usually have a more significant effect on the gender pension gap in the UEPS, like eligible working experience and pre-retirement salary. Third, there is no fixed order of variables ranked by their influence on the gender gap in pension benefit over time, only eligible working experience had the most significant effect on the gender gap in pension benefit in all groups.

Retirement age was regarded as the variable with the most significant effect on gender pension gap in the UEPS in the previous empirical literatures (including Pan (2001, 2002); Li (2007); Zhang (2010); Pei (2011); Wang and Li (2013); Mi (2016); Ma (2016) and Wu (2020)). They pointed out that the most major step to equalise women's and men's benefits in pension system

was to raise the retirement age for women. However, these results tell a different story. In the current study, eligible working experience is the factor which needs to be highlighted as it consistently had the most significant effect on the gender pension gap across all time periods, ranking first in all five groups in all the other nested models as shown in Table 8.1. The importance of eligible working experience is easy to understand: eligible working experience was always a determinant in the calculation formula for pension benefit in all retirement period. However, the importance of working experience for the gender pension gap has not been highlighted in previous studies, which usually considered effect of eligible working experience together with the effect of gender difference in retirement age (Zhang, 2010; Pei, 2011; Mi, 2016; Zhan, 2020). The findings of the current study have shown that between the two variables it is not the retirement age that matters most, as suggested by previous studies (for example, Chen and Turner (2015) and Ba and Li (2017)), but eligible working experience. Only Ding and Zhang (2006) stated that postponing the retirement age for women did not have a significant effect in reducing the gender pension gap but that the eligible working experience did. Retirement age only played significant roles in two groups, it is because in 'Before 1995' group, the fitted line of retirement age and eligible working experience in the scatter plots shown as Figure 6.7 and 6.8 for the 'Before 1995' group had the steepest slope, which suggests that in that group, the relationship between retirement age and eligible working experience was closest to the perfect positive relationship, but still not perfect. As for '2006-2010' group, retirement age becomes important again as the calculation formula changed after 2005. The average monthly pension benefit from an individual account equalled the total amount of pension contribution in the account divided by a number decided by a life-table month. The earlier retirement age for women and their longer life expectancy will increase the number of life-table month and decrease their monthly pension.

Pre-retirement salary also had a significant effect in all groups except the first group because it is a variable which is directly included in the pension calculation formula in all time periods except in the 'Before 1995' group. The effect of pre-retirement salary was much smaller than that of eligible working experience but still had significant effect, which is consistent with the findings of previous studies (Chen and Li, 2004; Zhan, 2020; Pei, 2011). The previous literatures claimed occupation does not have significant effect on the gender pension gap (Zhang, 2010; Pei, 2011). Nevertheless, the result in this study confirmed its significant effect on some of the retirement groups. The magnitude of the effect from occupation type was similar to the magnitude of the effect from pre-retirement salary, but without overtaking the explanatory power of eligible working experience's effect on the gender pension gap. It is interesting to note that occupation type was not a variable which was directly included in the pension calculation formula, but the effect of occupation type usually paralleled the effect of pre-retirement salary on the gender pension gap (see Table 6.4). This kind of correlation between occupation type and

pre-retirement salary could be the reason why occupation is not directly included in the pension calculation formula to have significant effect on gender pension gap in UEPS.

All these findings highlight how the recent pension reforms, including the calculation formula for pension payments, might have shown more clearly the importance of labour market participation and career progression for all citizens, showing that women were more affected as they were likely to be under-represented in both labour market participation rates and senior job positions (Chen and Huang, 2018; Zhan, 2020). This is consistent with Esping-Andersen's (1990) argument that the 'commodification' of women (increasing female participation in the labour market) is a crucial step to allow women to have a higher earnings-related pension just as men do. However, the enhancement of women's labour market participation (make women more commodified) alone is not sufficient to close the gender gap. In the current study, all the female respondents who receive their pension benefit from the UEPS have been commodified already, yet the gender pension gap is still exists significantly and the gender gap proves to be larger with the elapse of time. The findings confirm the importance of policy and institutional legacies for creating and reproducing inequalities within a welfare system (Esping-Andersen, 1990; Skocpol, 1984; Pierson, 1994). The several pension reforms during the past decades morphed UEPS into a more earnings-related scheme. As a result, the gender inequality in China's labour market exposed women when they retired (Frericks, Knijn and Maier, 2009).

8.2.2 New Rural Social Pension Programme

In this section, research questions 2 and 3 will be answered using the data analysis in Chapter 7. The second research question, 'Is there a gender gap, in terms of participation rate, in the New Rural Social Pension Programme (NRSPP)? Is this gap narrowing or widening over time?', can be answered from the descriptive data analysis. The third research question, 'How do factors such as education, working experience and income before retirement, affect the gender gap in the NRSPP?', can be answered from the analysis of logit regression results for the NRSPP.

According to the previous studies reported in the literature which focused on the impact factors on the participation rate in the NRSPP, there is no consistent conclusion about how each impact factor can affect the rate. Another thing is that the gender variable was usually included as one of the independent variables in previous studies. How the impact factors on the participation rates in the NRSPP differ for men and for women respectively has not been considered in previous studies. This is one of the main empirical contributions which this study offers.

The descriptive data analysis in Chapter 7 shows that the participation rate in the NRSPP became much higher for both men and women after 2011 and reflected the ongoing agenda of the Chinese government to achieve full coverage of the NRSPP. Even though both genders' participation rates showed an overall increasing trend after 2011, women always had a higher

participation rate than men. I divided the participants into different groups based on their marital status, education level, health condition, *hukou* and region, and the findings showed that regardless of how the participants are grouped, the participation rate for women was consistently higher than that of men in most of the cases. This result is consistent with those of a number of previous studies (Liang and Wang, 2016; Wu, 2009; Jiang, 2011; Yue, 2004; Tu and Hei, 2015; Chen, 2015; Deng and Liu, 2013; Wang, 2011) which have found that women are more likely to participate in the NRSPP than men. Yue (2004), Deng and Liu (2013) and Tu and Hei (2015) claimed that women in rural areas have usually been in a weaker position than men as they are less likely to earn money from farming when they become older. Additionally, Chinese cultural practices require women to stay at home to take care of the family and this keeps them away from opportunities to find jobs in urban area and in the formal labour markets to earn money as men do. Most crucially, any money earned is more likely to be part of the family income, rather than personal. Women are therefore more motivated to participate in the NRSPP to add an extra layer of security for their old age.

The descriptive analysis identified some commonalities for the increased participation of men and women in the NRSPP. Peasants with older age, with rural hukou, with single marriage status or peasants who live in a less developed area, no matter what gender they have, they all have a higher participation rate in the NRSPP. The findings about 'region' variable contradicts most of the existing studies (Wu, 2009; Wang, 2011; Shi, Fan and Wang, 2009; Yue, 2004; Xu, 2011; Huang and Xie, 2012; Chen and Luo, 2016) which said that peasants from developed areas would be more open-minded to the social pooling security system rather than following the traditional concept of raising children to support them in their old age, and peasants from developed areas would also have spare money to invest for their old age. This findings in the current study can be understood with the consideration of contribution level (see Figure 7.6). Peasants from less developed area have the highest participation rate with the lowest contribution level, which is consistent with Huang and Zhan's (2012) study. Even peasants in less developed areas could afford the minimum annual contribution which is only 100 yuan (around £11) and they would be happy to pay this to ensure that there will be a source of income after their retirement. Additionally, the local governments in developed areas are more likely to be able to offer subsidies to the individual account and incentives which attract peasants to participate in the NRSPP, which is consistent with Wilensky's (1975) suggestion that a higher level of industrialization would have higher aggregate social spending. However, the pension benefit from NRSPP is still too low to attract peasants in developed areas to participate.

As for other variable, education and health condition showed completely different correlations with participation rates in the NRSPP for men and women. Men who had been educated to a higher level were less likely to participate in the NRSPP. As for women, it did not matter which

education level they reached, the participation rate did not change a lot. Health condition was the second discrete variable which showed an opposite correlation for men and for women. Men with better health usually had a lower participation rate in the NRSPP whereas the situation was the opposite for women.

When all the impact factors were added into the mixed-effects logit model to see how these variables can jointly affect the participation rate, the research question 'How do factors such as education, working experience and income before retirement affect the gender gap in the NRSPP?' can be answered. The results of the total model, which contained data on men and women together and used the gender variable as one of the independent variables as previous studies had done, showed similar results to the male model. Comparison of the results from the male and female models showed that the results of the coefficients for some independent variables could be exact opposites. This applied even when the variables in the regression were identical for men and women. The opposite sign of coefficients in the two models suggests that the same variable could have the opposite effect on the participation rate of the two different genders. This comparison shows that the results reported in previous studies might be inaccurate as they put men and women together in one model with a gender variable to test how impact factors can affect the participation rate in the NRSPP instead of creating separate models for women and for men.

In particular, education level, *hukou*, number of children, total income, total land space and region all had the same sign in the coefficients between genders. People with a higher level of education, or an urban *hukou*, or who lived in more developed areas were less likely to participate in the NRSPP for both genders. These correlations suggest that an individual person with more opportunities to make money tend to have less incentive to participate in the NRSPP because the benefit level is not so attractive to them. For example, the finding about education is consistent with Mu and Yan (2012), Liu and Xu (2014), Tu and Hei (2015), Liang and Wang (2016), Hu and Shen (2016)'s study. People with a higher education level usually have a more stable income and more individual savings, so they usually have more ability to secure their own livelihood after retirement (Liang and Wang, 2016; Mu and Yan, 2012). The amount of pension benefit may be too low to attract them to participate (Hu and Shen, 2016). The results of 'region' variable also show that people who live in a more developed area tend to have less inventive to participate in the NRSPP as they have more opportunity to earn money, like find a job in the urban area. Even the local government in developed area spend more resources on their welfare provisions, for example, they can provide more subsidy to the pension scheme and the pension benefit level could be much higher than in a less developed area. The participation rate in the NRSPP in the more developed area is still lower than in the undeveloped area. This finding is interesting as it finds little evidence to back up the logic of industrialisation thesis for

explaining or addressing the gender gap in the NRSPP. Variables 'Number of children' and 'total land space' are family-related variables which were both positively correlated to the participation rate for both genders. The positive correlation between these two variables can be interpreted from the fact that a family with more land would need more workers to carry out agricultural work, so the family members would be less likely to search for non-agricultural jobs, for example in urban areas (Wu, 2009). The traditional concept of raising children to support you in your old age has been gradually abandoned while the aging peasants prefer to find the most stable income source (the pension benefit) to secure their retirement life (Liu and Xu, 2014; Shi, Fan and Wang, 2009). More adult children could also share the responsibility of making contributions for their parents and ensuring that their parents would have a stable income after retirement (Shi, Fan and Wang, 2009).

As for the variables which had opposite signs for coefficients in the models for men and for women, the results in terms of health for the different genders were the same as those from the descriptive data analysis. The finding on the correlation for men is consistent with the findings of Yang (2011), Deng and Liu (2013) and Chen and Luo (2016) who stated that if people are aware of their poor health, they will have more incentive to participate in the NRSPP as their future income can not be guaranteed and they would expect to share the risk by participating in the NRSPP. Women's health had the opposite association with participation rate, which is consistent with studies such as Shi Fan and Wang (2009) and Zhang and Wu (2014) explained that peasants with better health usually expect to have a longer life expectancy and be more aware of the need for risk prevention and thus be more motivated to participate in the NRSPP.

In terms of marital status, single women had the highest probability of participating in the NRSPP which agrees with the results from the descriptive data analysis, whereas married men were more likely to participate in the NRSPP, the results for married men is consistent with the claims that married people have more incentive to participate in the NRSPP as they want to avoid financial risk for the family and to reduce the finance stress on their children when they get old (Su, 2014a; Deng and Liu, 2013).

After carrying out these comparisons between the rates of men's and women's participation in the NRSPP, the findings show that first, women consistently had a higher incentive to participate in the NRSPP than men. Second, even though the independent variables used in the logit model were identical for men and women, the results in the regression could have significant differences.

8.3 What have we learned after comparing the impact factors on the UEPS and the NRSPP? A theoretical reflection

This study explored two forms of the gender pension gap: the first focused on the gender inequalities captured by the monthly pension benefit in the UEPS and the second examined the gender gap in terms of the participation rate in the NRSPP. The descriptive data analysis showed that a gender gap does exist in both pension schemes. The difference is that in the UEPS, women usually are at a disadvantage in pension benefit level whilst in the NRSPP women were found to have a consistently higher participation rate in the NRSPP. However, the higher participation rate in the NRSPP does not necessarily suggest that women are experiencing more advantages in rural areas, as often the payments are low and the reasons for participating might reflect higher levels of social risk.

The fifth research question, 'When controlling for the same gender in both the UEPS and the NRSPP, are there similarities or differences in terms of how the abovementioned factors (that is, the factors mentioned in the previous four research questions) inter-relate?', can be answered after comparing the results from both the UEPS and the NRSPP with a theoretical reflection.

The comparison of the findings from the two schemes has shown that gender, education level, and income (wages in the UEPS) were the common variables used in the regression models in these analyses.

As noted in Chapter 4, the two household forms brought up by the scholars are the male-breadwinner-female-housewife model (Lewis, 1992) and the individual model (Sainsbury, 1994). The difference is that the former excludes women from participating in the labour market and that women take up virtually all the family obligations. By contrast, the individual model allows women to enter the labour market to make their own contributions to the pension system rather than rely on their husband's pension benefit and support from their family. The UEPS is more likely to build the individual model in which both genders can enter the labour market and receive pension benefit from the second or third pillar, rather than make do with basic pensions. Compared with the UEPS, the NRSPP is more likely to build the traditional male-breadwinner-female-housewife model. Although both men and women living in rural areas are likely to be involved in farming activities, women have less opportunity to enter the labour market than men: only 34.8% of rural migrant workers were women in 2020 (National Bureau of Statistics of China, 2021b). The comparison of these two pension schemes found that women in the NRSPP are less commodified compared with their peers in the UEPS.

Reflecting on social policy theory and the work of Esping-Andersen (1990, 1999), we know that women can be subject to decommodification through the basic pension as well as the earnings-related pension schemes or private pensions (if they can afford them). The crucial principle here

is that for women to build this entitlement, they have to be commodified first. If this argument is adopted, then women have to be commodified and build up their career contributions first in order to avoid relying only on minimum or means-tested pensions (Knijn and Kremer, 1997). Women in the UEPS have been commodified as they enter the labour market to contribute to the pension system for at least 15 years and are thus entitled to the pension benefit. However, women in the NRSPP are much less commodified compared with men. Frericks, Knijn and Maier (2009) suggested that the commodification of women (in terms of women having a higher participation rate in the labour market) can not reduce the gender pension gap. The results of the analysis of the UEPS suggested the gender pension gap can still be significant even though the labour market participation rate for both genders is similar in the UEPS. The argument of Frericks, Knijn and Maier (2009) are in agreement with this study, as commodification of women does not have such a crucial effect for equalising pension benefit in the UEPS. In the UEPS, wage (pre-retirement salary) was the variable which had a significant effect on the gender gap rather than the participation rate in labour market. In the UEPS, pre-retirement salary had a significant effect on both monthly pension and the gender gap in pension benefit. As for the NRSPP, the labour market participation rate is not included in the study, nor does CHARLS provide macro-level data. The involvement in agriculture activities is often signalling informal and householding work, not necessarily indicated as a formal employment.

In the traditional culture framework, the responsibility for care is genderised (Saxonberg, 2013) and women are the ones who deliver it (Roumpakis, 2020), the only requirement on men is to earn money (Gutek, Nakamura and Nieva, 1981; Gutek, Searle and Klepa, 1991). Such traditional gender role expectation is also applicable in the context of China. However, it is important to note here that in both urban and rural areas, women are not only required to earn money but also to reconcile work and family obligations (Lewis, 1997, 2002). This is especially the case for women in urban areas, who are required to have a full-time job and to fulfil the gender stereotype of a 'good mother/wife' taking care of the whole family. McLaughlin and Glendinning (1994) suggested that more women in the labour market will eventually push away from the process of defamilialisation and the duty of care will be offloaded from the family. The marketization of care jobs will defamilialise caring responsibilities (Daly and Saraceno, 2002) but it is not clear if this would also indicate a culture change in gender roles and stereotypes.

The situation in China confutes what McLaughlin and Glendinning (1994) suggested. In China, especially in urban area, both genders have a quite high participation rate in the labour market, but there has been no growth in public caring institutions. The duty of care is still on the family, especially on women whether or not they have a formal job. Due to the lack of affordable child-care in urban areas, the commodification of women has not resolved the inequalities in the labour market and let women make a sufficient contribution to their individual accounts in the

pension system as Esping-Andersen (1999) suggested. Maternity leave and breastfeeding leave, make it more difficult for women' career and hinder their promotion opportunities. Women who are at high risk of being distracted by personal issues, such as having children and caring for infants for at least three years (let alone parents), could be discouraged at work. The abolishment of the 'one-child policy' makes matters even worse, resulting in implicit discrimination against women. Under such circumstance, companies prefer to hire men rather than women. Therefore, women are against all odds when it comes to labour market and becoming commodified in China. The responsibility for care could interrupt women's careers and result in a shorter contribution record. As the eligible working experience and pre-retirement salary are the two key variables with the most significant effects on gender gap in terms of pension benefit in the UEPS, the lower wage levels and fewer contribution years for women will then enlarge the gender pension gap even further.

In rural areas, women cannot be decommodified as they are less likely to be commodified first. The participation rate for women in the NRSPP is always higher than men but this does not mean that women are enjoying significantly more support for offloading their care responsibilities as the benefits provided are mainly aimed to prevent poverty and not for maintaining living standards. Women in rural areas are less likely to participate in the labour market as they are involved in agricultural work. They also have to stay at home to deliver care to children and the elderly. Women participate in the NRSPP to seek for the minimum pension and their contribution is less than men (see Tables 7.9, 7.10, 7.11, and 7.12) as they are less likely to have sufficient savings to support their life in their retirement.

The gender sensitive typology of welfare regimes called 'demotherization' was put forth by Mathieu (2016). Compared with 'defamilialisation', 'demotherization' argues that women should be freed from care jobs within the family. Defamilialisation requires a rising number of public caring institutions to relieve families, especially mothers, of their caring responsibilities. However, this task can not be achieved in a short term. Women in urban China has been commodified since the founding of New China (1949), yet the market could not provide affordable public caring institutions. The care responsibilities still remain domesticated within the family, especially on mothers. The significant growth of women's participation rates in the labour market has not led to a substantially increased share of care responsibilities for men (Peng, 2012). Instead of relying on the market or the government to provide such public caring institutions, 'demotherization' offered an alternative solution of transferring the responsibility to other family members, such as fathers or even grandparents. As a matter of fact, in China, grandparents (usually grandmothers) are the solution to keep urban women staying in the labour market in most of the families, especially for dual-income families. The grandparents could take children to school, cook meal and look after the children. However, mothers still need to take

maternity leave, breastfeeding leave and parental leave, while fathers' employment careers are less interrupted. Gender discrimination in the labour market may be reduced gradually by transferring the care responsibilities to grandparents, but this does not apply for all dual-earner families. Fathers should also take the equal responsibilities as mothers. Otherwise, men are still more advantageous in the labour market than women. It is important to note that this reflects the current pension system – therefore indicating that how the conditions in labour market and care need to change as well as how the pension system can reform to recognise care (or not) for the calculation of women's pension benefits. The calculation formula has been adjusted for several times in the past decades and the calculation formula became more earning related as time goes by. However, women's interrupted working life and unpaid caring job were not recognised by the calculation formula. To recognise the caring or the fact that women have more interrupted careers in the pension calculation formula could be a solution to the gender pension gap. In rural area, there is no legal retirement age for peasants, as the old people need to work in the farm until they are unable to do so. The caring responsibilities are usually taken by mothers and grandmothers, who sincerely believe that caring for the next generation when they are young will pay off in the future. However, they can still choose to participate in the NRSPP to get a minimum guarantee.

Another common variable in the regression models in the UEPS and the NRSPP was level of education. In both the urban and the rural pension schemes, women consistently had fewer opportunities to access higher levels of education than men. The family's preference in terms of the investment in children's education always favoured males regardless of urban or rural areas (see Tables 6.2 and 7.4). The gender difference in level of education leads to different results in urban and rural pension schemes. In the UEPS, a higher education level was found to be associated with higher pensions for both genders as education can indirectly affect wages. In the NRSPP, men with a higher level of education are not attracted by the low-level contribution and corresponding pension benefit. However, even if the pension benefit is too low to attract men who are well-educated, women have always had a higher participation rate as they want to have a stable income when they get old. The conclusion about the influence of level of education reached in this study agrees with Holliday's (2000) argument that social policy in China, and particularly in the case of the pension system, is actually subordinated to economic development. A higher education level is essential for people to have higher skills and be more productive in order to increase economic growth. In the UEPS, a higher level of education could increase the wage level as well as the opportunities for promotion. In the NRSPP, the higher education level would give women more opportunity to find a job in an urban area rather than only be involved in agricultural work. The traditional gender role expectations can also be reflected from gender difference in education level. As men are assigned to work and women are assigned to take domestic work and caring responsibilities, educational resources are naturally skewed towards

men. A higher education is important in the labour market for a decent job and promotion. However, housework and childcare do not require any schooling education, women just need to practice constantly. Moreover, the traditional concept of 'raising children for old age'[35] make parents rely more on their sons rather than daughters. This notion is more pronounced in rural areas with scarce educational resources.

We can conclude from the analysis of three concepts that commodification, defamilialisation and demotherization are not sufficient to solve the gender gap in China's pension system. All these three concepts may contribute to women's access to the social security entitlement individually, but the disproportionate gender gap can not be ignored in China's urban and rural pension schemes. The gender inequalities in the labour market, including both income gender gap and the unequal opportunities for promotion, can not addressed by the application of these three concepts alone. The traditional cultural practices of regarding education and family responsibilities reflect important challenges to women's ability to ensure a retirement life equal to men's. It is important to note that the pension system captures the duration and longevity of cultural practices over the last 30-40 years. How far recent reforms and economic development might change the existing cultural practices, for example for the current generation of workers, remains to be seen.

In the UEPS, the gender gaps in education level and wage perpetuated the inequalities and translated them into a gender pension gap. The higher participation rate in the NRSPP for women seems to give them an opportunity to have a more secure source of income after retirement, but it is actually because of the fact that men can maintain their standard of living after retirement with their labour income and individual savings. The demand for the low-level pension benefit for men is much lower than for women. To reduce the pension gap in China's pension system, the commodification of women should not only focus on including them in the labour market but also equalising the education opportunities to enable them to obtain well-paid jobs and opportunities for promotion. Additionally, more consideration should be given to care arrangements and to address how they could be perpetuating all the inequalities in the labour market.

8.4 Conclusion

The purpose of this study was to analyse the gender gap in both the Urban Employees' Pension Scheme and the New Rural Social Pension Programme in China. Not only to explore how the gender gap exists in these two pension schemes, but also what the impact factors on the gender

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[35] The 'children' here in the traditional cases usually imply sons rather than daughters.

gap are and how they affect the gender gap in the two pension schemes. The study has explored gender inequalities in the UEPS and contributed towards a better understanding of how the gender gap has changed along with reforms and changes to retirement ages. It also empirically analysed how the impact factors on the gender gap changed under successive policy reforms and has shown which factors should be paid attention if future reforms are to eliminate the gender pension gap in the UEPS.

The NRSPP was established much later than the UEPS but it covers most of the rural residents and has become the largest voluntary pension scheme in China. How the impact factors which can affect the participation rates for men and women respectively have never been considered in any previous studies. This thesis therefore makes a contribution to the knowledge by offering an empirical analysis and scoping a better understanding of the differences in participation rates between men and women. Aside from empirical contributions, this thesis also makes analytical contributions with a theoretical reflection on the consequences of empirical findings. It is therefore important to consider what policy suggestions can be made for the future of this scheme in order for the Chinese government to achieve its aims of full coverage. In the next section, I shall summarise the findings, the contribution and the limitations of this thesis, make policy suggestions to the Chinese government based on the findings of the study, and consider the challenges which could be addressed in future studies.

8.4.1 Summary of the findings

The first thing that needs to be highlighted is the retirement age in the UEPS. The gender gap in retirement age which has been mentioned in most previous studies was not found to have a significant effect on the gender pension gap in the UEPS. In the literature, those studies which used the ideal person in their simulation model always emphasized that the gender gap in retirement age is the main reason for the gender pension gap (Wang and Li, 2013; Li, 2004; Zhang, 2010; Wang et al., 2013). In real life, however, the ten-year gap in retirement age between men and women does not have a significant effect on the gender pension gap at all. Instead, eligible working experience and pre-retirement salary have been found to be the two most important variables during the time periods explored. In conjunction with the pension policy reform history, the variables which are directly included in the pension benefit calculation mechanism are the main reasons for the gender pension gap in the UEPS.

Second, the participation rate in the NRSPP is mainly affected by the income-related variables. Education level, geographic region and health are all related to the ability to earn money. As the NRSPP is a voluntary pension scheme with low contributions and low benefits, the higher participation rate for women does not necessarily indicate a positive outcome for them. Men who are well-educated or live in a more developed area or have better health have a greater

ability to earn money and to decide not to opt into the NRSPP. The low-level pension benefit in the NRSPP is not attractive enough for them to participate. The fact that this level of pension is more appealing to women is rather worrying as it indicates that women lack opportunities to participate in better schemes. This could relate to women's employment opportunities in rural areas but also reflects the fact that women are more tied to domestic work and have fewer opportunities to earn extra money and build up individual savings in anticipation of their old age. Even though the benefit level in the NRSPP is low, women still need it.

Third, the concepts of 'commodification of women', 'defamilialisation' and 'demotherization' can only help women to get access to the second or third pillar by improving women's opportunity to be commodified, but cannot solve the gender gap in China's pension system. Gender gap still exists in China's pension system.

Fourth, the traditional cultural practices not only have an impact on women in rural areas, but also affect women in urban areas. The gender difference in educational investment can be regarded as the start of the gender gap in everything (see Tables 6.2 and 7.4). In both areas, if women do not have an opportunity to have a higher level of education, the opportunity for them to find high-paying jobs will be slim. Not only will the opportunity for them to find jobs be slim, the opportunities for promotion will also be slim. After women marry, the traditional concept requires them to focus more on their children and their family rather than on a job. As women can not get promotion even if they do have a job, the investment in education will always be more favourable to men, thereby creating a vicious circle.

8.4.2 Contributions, limitations and potential future studies

The contribution of this thesis can be summarised from three aspects: the analytical contributions include the creation of a new dataset and a new framework for analysing the gender gap in the UEPS and the NRSPP, the empirical contribution derived from the analysis and a detailed theoretical discussion reflected on the empirical findings of the UEPS and the NRSPP. I generated two new datasets using data from the CHARLS surveys; the first dataset contained information about retirees under the UEPS, grouped by their year of retirement. The second dataset provided panel information about participants in the NRSPP, not only people who were receiving their pension, but also members of the rural population who were making contributions to the NRSPP. These two datasets will be published later for use by academics who are interested in China's pension system. These new datasets offer a set of important dimensions for future research directions as they will enable researchers to take into consideration the importance of retirement years for exploring the UEPS and NRSPP schemes.

The second analytical contribution of this thesis is that I grouped the participants based on their year of retirement and the milestones of reform in the UEPS to analyse how the impact factors

of the gender pension gap have changed across different retirement years and the respective pension policies in place. For the NRSPP, a larger size of panel data could provide more accurate results, whereas the logit model was estimated for men and women separately to see how the impact factors affected their participation rates differently.

The empirical contribution which this study makes to knowledge, as explained in the findings section, is that the factors which are directly included in the pension calculation mechanism are the key to reducing the gender pension gap in the UEPS. The gender gap in retirement age was found not to have a significant effect on the gender pension gap as has been claimed in previous studies of the UEPS. In the NRSPP, the income-related variables had a significant effect on the participation rate. People with more ability to earn money were less likely to participate in the NRSPP. The higher participation rate for women in the NRSPP shows that women in rural areas are at a disadvantage when it comes to their options for improving their income, such as getting a higher level of education or getting a job. Even though the pension benefit in the NRSPP is too low to attract men who can earn more money, women still need it as a protection for their old age. The data analyses of both pension schemes led to the conclusion that the Chinese pension system is still embedding gender inequalities insofar as it reproduces the gender inequalities in the labour market without taking into consideration how care arrangements disproportionately undermine women's earning ability and/or job prospects.

The final contribution is the review of the theories of social policy that could be used to explain or even solve the gender gap in pension system. A theoretical discussion reflected on the findings in Chapter 6 and Chapter 7 pointed out that the 'commodification of women', 'defamilialisation' and 'demotherization' cannot sufficiently address the gender gap in pension system on their own. Instead, traditional practices, especially education opportunity and traditional gender role expectation are the key parameters to reducing the magnitude of gender gap in China's pension system.

There are three principal limitations to this study. The first is the newly generated dataset. After cleaning the dataset for the UEPS, the sample size for each retirement group was relatively small, especially for the final group (that is, those who retired most recently). The descriptive data analysis and the multi-linear regression results may not able to reflect the characteristics of the whole population as the sample size was too small. For the NRSPP, the panel data formed an unbalanced panel dataset, which means that there were some missing participants in all four waves. As I explained in the research design chapter, CHARLS is the dataset which most fitted my research, and it was neither within the scope of nor a realistic strategy for my research to collect a panel dataset myself for use in a PhD study.

The second limitation is that the study of the gender gap in the NRSPP has mainly focused on participation rates whilst the study of the gender gap in the UEPS focused on pension benefit. This principally reflects the data availability and two different sets of debate – one focusing on pension income during retirement in urban areas and the other on low coverage and levels of income support in rural areas. Despite the different scopes of these two analytical chapters, the importance of education level and income stand out. Similarly, the effect of cultural practices has also been highlighted throughout this study. Although income does not have a significant effect on participation rates in the NRSPP, and level of education seems not to have a significant effect on the gender pension gap in the UEPS, these two variables should not be ignored if the government wants to eliminate the gender gap in these two pension schemes.

The third limitation is that, the extents to which gender gap can be reduced by commodifying women, and to which women can be relived from 'defamilialisation' or 'demotherization' are hard to measure, because the current CHARLS dataset does not provide sufficient information about it. It is questionable that to what extent the help from other family members could help women become more commodified, but the form of help was not detailed in this study.

For possible future studies extending the findings of this study, as the new dataset generated for the UEPS grouped participants by their year of retirement, if there are any other reforms in the UEPS and after the new waves of CHARLS data have been released, the data set can be updated accordingly. The impact factors of the gender gap in the UEPS on the new retirement years group can be estimated and then directly compared with the previous groups. For the NRSPP, as the generated dataset is a panel dataset, not only can new released waves of data be merged into my dataset, but the gender gap in contributions and pension benefits in the NRSPP can also be analysed to determine whether there are any commonalities or differences between the impact factors on participation rate, contribution level and benefit level. This thesis has given some insight into how Chinese culture and traditional concepts could directly affect the gender gap, especially in terms of level of education and family responsibilities affecting women. The concept of 'demotherizaiton' seems to have helped women to reduce the gender gap to some extent. More detailed research could be carried out in the future using interviews to capture how these cultural factors and how the help from other family members can affect the gender gap in China's pension system.

8.4.3 Policy suggestions to Chinese government
There are some policy suggestions which I would like to present after analysing the gender gap in the current Chinese pension system. According to the empirical results, the factors which are directly related to pension benefit should be given more attention in order to reduce the gender pension gap. First, more attention should be paid to the status of gender in China's pension

system. Second, financial security should be achieved especially for female retirees. The government could introduce flexible retirement ages for women to extend their eligible working experience. However, if the retirement age for women is extended, it might put more pressure on women. Most Chinese women sacrifice a career in order to take care of the family and their children, so they have a shorter working life and fewer contribution years compared with men. In order to address this, the recognition of care as eligible for pension entitlement would be able to reduce these gender inequalities and also offer recognition of women's care responsibilities, and time which they consume. Third, the government should do more to promote the idea of equality between men and women by ensuring equal opportunities to access education for both genders. Responsibilities for caring for the family should also be shared by a married couple together. However, it could take decades to change cultural practices and long-standing gender-role traditions. One of the ways to narrow the gender gap in China's pension system is to acknowledge women's responsibility for care and add contributions to their pension records. Additionally, a higher contribution and replacement rate for women could also temporarily mitigate existing inequalities.

Appendices

Appendix A: Question number of each variable for different pathways retirees in each wave of questionnaires in the UEPS

	Are you currently receiving pension from the UEPS			
	2011	2013	2015	2018
Legal retirement	FM019	FN002_W2	FN002_W2	FN002_W4_a
Early retirement	FM019	FN002_W2	FN002_W2	FN002_W4_a
Internal retirement first, then completed legal retirement procedures	FM019	FN002_W2	FN002_W2	FN002_W4_a
receding position procedures	FM019	FN002_W2	FN002_W2	FN002_W4_a
Migrate different types of retirement into one	FM019	FN002_W2	FN002_W2	FN002_W4_a
After all cleaning process	FM019			

	Which year did you get retired			
	2011	2013	2015	2018
Legal retirement	FM014	FM014	FM014	FM014
Early retirement	FM014	FM014	FM014	FM014
Internal retirement first, then completed legal retirement procedures	FM030	FM030	FM030	FM030
receding position procedures	FM005	FM005	FM005	FM005
Migrate different types of retirement into one	FM014	FM014	FM014	FM014
After all cleaning process	FM014			

	pre-retirement salary			
	2011	2013	2015	2018
Legal retirement	FM016	FM016	FM016	FM016
Early retirement	FM016	FM016	FM016	FM016

Internal retirement first, then completed legal retirement procedures	FM028	FM028	FM028	FM028
receding position procedures	FM007	FM007	FM007	FM007
Migrate different types of retirement into one	FM016	FM016	FM016	FM016
After all cleaning process	FM016			

	How much did you receive when you first get retired			
	2011	2013	2015	2018
Legal retirement	FM020	FN004_W2	FN004_W2	FN004_W2
Early retirement	FM020	FN004_W2	FN004_W2	FN004_W2
Internal retirement first, then completed legal retirement procedures	FM030	FN004_W2	FN004_W2	FN004_W2
receding position procedures	FM020	FN004_W2	FN004_W2	FN004_W2
Migrate different types of retirement into one	FM020	FN004_W2	FN004_W2	FN004_W2
After all cleaning process	FM020			

	occupation			
	2011	2013	2015	2018
Legal retirement	FM012	FM012	FM012	FM012
Early retirement	FM012	FM012	FM012	FM012
Internal retirement first, then completed legal retirement procedures	FM012	FM012	FM012	FM012
receding position procedures	FM012	FM012	FM012	FM012
Migrate different types of retirement into one	FM012	FM012	FM012	FM012
After all cleaning process	FM012			

	How much did you receive when you first get retired			
	2011	2013	2015	2018
Legal retirement	FM020	FN004_W2	FN004_W2	

Early retirement	FM020	FN004_W2	FN004_W2
Internal retirement first, then completed legal retirement procedures	FM030	FN004_W2	FN004_W2
receding position procedures	FM020	FN004_W2	FN004_W2
Migrate different types of retirement into one	FM020	FN004_W2	FN004_W2
After all cleaning process	FM020		

	Eligible working experience (years)			
	2011	2013	2015	2018
Legal retirement	FM024	FM024	FM024	FM024
Early retirement	FM024	FM024	FM024	FM024
Internal retirement first, then completed legal retirement procedures	FM036	FM036	FM036	FM036
receding position procedures	FM024	FM024	FM024	FM024
Migrate different types of retirement into one	FM024	FM024	FM024	FM024
After all cleaning process	FM024			

Source: Author's own based on CHARLS, 2011, 2013, 2015, 2018

Appendix B: Question number of each variable in each wave of questionnaires in the NRSPP.

	2011	2013	2015	2018	after cleaning
Education	bd001	bd001_w2_4	bd001_w2_4	bd001_w2_4	bd001
Hukou	bc001	bc002_w3_1/bc002_w3_2	bc002_w3_1/bc002_w3_2	bc002_w3_1/bc002_w3_2	bc001
Whether participate in NRSPP	fn071	fn069_w2	fn057_w3	fn058_w4	fn071
The reason that did not participate in NRSPP	fn072	fn070_w2	fn057_w3_6_1	fn057_w3_6	fn057_w3_6_1
Annual contribution	fn074_1	fn072_w2_1	fn072_w3_4_1_1	fn062_w4_b_2	fn074_1
Lump sum contribution	fn074_2	fn072_w2_2	fn072_w3_1_1_1	fn072_w3_1_1	fn074_2

Source: Author's own based on CHARLS, 2011, 2013, 2015, 2018

Appendix C: Regression results for all groups in the UEPS.

Regression results for groups before 1995

	(1) Y	(2) Y	(3) Y	(4) Y	(5) Y	(6) Y	(7) Y
Gender	-.21*	.056	.029	-.05	.141	.09	.069
	(.116)	(.111)	(.109)	(.109)	(.122)	(.112)	(.111)
Retirement age		.016		.037***	.026**	.011	.012
		(.012)		(.011)	(.013)	(.012)	(.011)
Working experience		.031***	.036***		.031***	.037***	.03***
		(.008)	(.007)		(.009)	(.008)	(.008)
Pre-retirement salary		.001***	.001***	.001***		.001***	.001***
		(0)	(0)	(0)		(0)	(0)
Education		.038***	.036***	.048***	.053***		.033***
		(.012)	(.011)	(.011)	(.013)		(.011)
Occupation		-.181	-.134	-.149	-.036	-.025	
		(.138)	(.134)	(.14)	(.151)	(.131)	
_cons	5.269***	2.978***	3.672***	2.738***	2.539***	3.182***	3.183***
	(.083)	(.562)	(.224)	(.568)	(.617)	(.566)	(.541)
Observations	399	399	399	399	399	399	399
R-squared	.008	.312	.309	.287	.163	.293	.309

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1

Source: Author's own based on CHARLS, 2011, 2013, 2015, 2018.

Regression results for groups 1996-2000

	(1) Y	(2) Y	(3) Y	(4) Y	(5) Y	(6) Y	(7) Y
Gender	-.275***	-.228**	-.122	-.28**	-.231*	-.19*	-.236**
	(.1)	(.113)	(.104)	(.111)	(.121)	(.113)	(.113)
Retirement age		-.026**		-.018*	-.023*	-.027**	-.021**
		(.011)		(.011)	(.012)	(.011)	(.011)
Working experience		.017**	.01		.017**	.017**	.019**
		(.008)	(.008)		(.009)	(.008)	(.008)
Pre-retirement salary		0***	0***	0***		0***	0***
		(0)	(0)	(0)		(0)	(0)
Education		.029**	.029**	.028**	.043***		.036***
		(.011)	(.011)	(.011)	(.012)		(.01)
Occupation		.184	.103	.218*	.299**	.309***	
		(.121)	(.117)	(.121)	(.128)	(.111)	
_cons	6.418***	6.699***	5.482***	6.812***	6.629***	6.909***	6.385***
	(.071)	(.59)	(.277)	(.591)	(.632)	(.59)	(.554)
Observations	283	283	283	283	283	283	283
R-squared	.026	.261	.247	.25	.149	.244	.255

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

Source: Author's own based on CHARLS, 2011, 2013, 2015, 2018

Regression results for groups 2001-2005

	(1) Y	(2) Y	(3) Y	(4) Y	(5) Y	(6) Y	(7) Y
Gender	-.338***	-.115	-.069	-.208**	-.134	-.08	-.123
	(.081)	(.098)	(.086)	(.097)	(.105)	(.1)	(.098)
Retirement age		-.009		.004	-.002	-.014	-.006
		(.01)		(.009)	(.011)	(.01)	(.01)
Working experience		.024***	.022***		.022***	.028***	.024***
		(.006)	(.006)		(.007)	(.007)	(.006)
Pre-retirement salary		0***	0***	0***		0***	0***
		(0)	(0)	(0)		(0)	(0)
Education		.036***	.037***	.042***	.051***		.042***
		(.01)	(.009)	(.01)	(.01)		(.009)
Occupation		.161*	.145	.17*	.233**	.277***	
		(.092)	(.09)	(.094)	(.097)	(.089)	
_cons	6.629***	5.728***	5.266***	5.776***	5.427***	6.111***	5.542***
	(.058)	(.534)	(.22)	(.544)	(.568)	(.535)	(.525)
Observations	326	326	326	326	326	326	326
R-squared	.051	.321	.319	.292	.223	.29	.314

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

Source: Author's own based on CHARLS, 2011, 2013, 2015, 2018

Regression results for groups 2006-2010

	(1) Y	(2) Y	(3) Y	(4) Y	(5) Y	(6) Y	(7) Y
Gender	-.247***	.079	.063	-.064	.069	.092	.098
	(.061)	(.075)	(.062)	(.074)	(.079)	(.076)	(.076)
Retirement age		.003		.013	.009	-.003	.011
		(.008)		(.008)	(.008)	(.008)	(.008)
Working experience		.024***	.024***		.024***	.027***	.025***
		(.004)	(.004)		(.004)	(.004)	(.004)
Pre-retirement salary		0***	0***	0***		0***	0***
		(0)	(0)	(0)		(0)	(0)
Education		.024***	.023***	.033***	.036***		.035***
		(.007)	(.007)	(.007)	(.007)		(.007)
Occupation		.289***	.296***	.309***	.321***	.373***	
		(.07)	(.067)	(.072)	(.073)	(.066)	
_cons	7.111***	5.61***	5.769***	5.825***	5.259***	6.053***	5.059***
	(.04)	(.445)	(.148)	(.463)	(.469)	(.431)	(.434)
Observations	384	384	384	384	384	384	384
R-squared	.042	.383	.383	.327	.306	.365	.355

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

Source: Author's own based on CHARLS, 2011, 2013, 2015, 2018

Regression results for groups 2011-2018

	(1) Y	(2) Y	(3) Y	(4) Y	(5) Y	(6) Y	(7) Y
Gender	-.573***	.025	.185	-.555*	-.004	0	-.025
	(.212)	(.297)	(.231)	(.295)	(.307)	(.296)	(.299)
Retirement age		-.019		-.03	-.018	-.012	-.014
		(.022)		(.025)	(.023)	(.021)	(.022)
Working experience		.045***	.046***		.051***	.043***	.047***
		(.011)	(.011)		(.011)	(.011)	(.011)
Pre-retirement salary		0**	0**	0***		0**	0**
		(0)	(0)	(0)		(0)	(0)
Education		-.03	-.023	-.01	-.024		-.018
		(.03)	(.028)	(.033)	(.031)		(.029)
Occupation		.441	.402	.595*	.415	.36	
		(.288)	(.284)	(.324)	(.298)	(.277)	
_cons	7.341***	6.725***	5.502***	8.722***	6.684***	6.169***	6.325***
	(.142)	(1.491)	(.417)	(1.594)	(1.543)	(1.39)	(1.486)
Observations	60	60	60	60	60	60	60
R-squared	.112	.456	.449	.289	.406	.445	.432

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

Source: Author's own based on CHARLS, 2011, 2013, 2015, 2018

Abbreviations

CFPS	China Family Panel Studies
CHARLS	China Health and Retirement Longitudinal Study
CHIP	Chinese Household Income Project
DB	Defined Benefit
DC	Defined Contribution
ILO	International Labour Organisation
NDC	Notional Defined Contribution
NRSPP	New Rural Social Pension Programme
NSSF	National Social Security Fund
ORSPP	Old Rural Social Pension Programme
PAYG	Pay-As-You- Go
RPS	Residents' Pension Scheme
SOE	State-owned enterprises
UEPS	Urban Employees' Pension Scheme
URPS	Urban Residents' Pension Scheme
WB	World Bank

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