MEDICAL SAVINGS ACCOUNT BALANCE AND OUTPATIENT UTILIZATION:
A MULTIVARIATE ANALYSIS ON THE IMPACT OF THE MEDICAL SAVINGS ACCOUNT IN CHINA

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A Multivariate Analysis on the Impact of the Medical Savings Account in China

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CERTIFICATE OF ORIGINALITY

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ABSTRACT

The objective of this study is to examine the impact of the Medical Savings Account (MSA) balance on outpatient utilization, and to evaluate whether the MSA can achieve its intended functions of “Cost-containment”, “Savings for the future”, and “Enabling for utilization” in China. A two-part model (logistic + OLS) is employed to estimate the effect of the MSA balance on (1) the probability of outpatient service usage and (2) the level of outpatient expenditure.

This study shows that the MSA balance significantly affects the probability of outpatient usage as well as the incurred level of expenditure. For general cases, the relationship between the MSA balance and outpatient expenditure is U-shaped. Both income level and the presence of chronic conditions can affect the nonlinear balance-expenditure relationship. In general, the MSA has achieved its three intended functions of “Cost-containment”, “Savings for the future”, and “Enabling for utilization” for the majority of its enrollees, with the exception of certain special cases.

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CHAPTER1 INTRODUCTION

1.1 MSA: An Innovative Healthcare Financing Instrument

The Medical Savings Account (MSA), an innovative healthcare financing instrument, is designed to prevent consumer moral hazard problems and to achieve medical cost-containment from the demand side. Generally speaking, the MSA is an individual personal savings account from which funds can be used to pay for healthcare expenditure. Each enrollee under the MSA program is required to save up a certain percentage of regular income in his/her personal medical savings account. The MSA encourages individuals to be more judicious in their use of healthcare services by using money from their personal accounts, and this helps to instill in them a sense of self-responsibility for health. It also enables individuals to build up over time a healthcare reserve fund of their own to pay for their future medical needs, which might address the problem of the ageing population and the intergenerational equity question.

China is currently implementing MSA programs in nearly all urban areas. According to the "Decision About Establishing the Basic Medical Insurance for Employees (BMIE) in Urban China", promulgated in 1998, all urban employees and retirees are required to participate in the citywide insurance program, which comprises the Medical Savings Account (MSA) and the Social Risk-pooling Fund (SRF). The objectives of reforming the urban health financing system for China's

urban population are to contain healthcare costs and to improve each individual's access to basic healthcare. The MSA, under the urban healthcare system in China, has three functions: (1) "Cost-containment": Contain costs, by restricting an individual's health behavior and by controlling medical expenditure due to a sense of self-responsibility; (2) "Savings for the future": Save unused funds in a person's account for future medical needs; (3) "Enabling for utilization": Paying for personal qualified health expenditure. Therefore, this study is to examine the impact of the MSA balance on outpatient utilization, in order to evaluate whether in fact the MSA can achieve its three intended functions in China.

1.2 Objectives of the Study and Research Questions

In this study, the first objective is to examine how the MSA balance affects outpatient utilization among all enrollees, employed enrollees, and retired enrollees respectively. The second objective is to examine whether the impact of the MSA balance on outpatient utilization is different among different income groups. The third objective is to examine whether the needs of MSA enrollees with chronic conditions are adequately met under the MSA program.

This research attempts to answer the following research questions:

Research Question 1: Do different balances of the MSA have an impact on outpatient service utilization, and is the impact of the MSA balance different between the employed group and the retired group?

Research Question 2: Is the impact of the MSA balance on outpatient utilization different among various income groups?

Research Question 3: Are the needs of MSA enrollees with chronic conditions adequately met under the MSA program?

This study first analyzes the effect of the MSA balance among: (a) all enrollees, (b) employed enrollees, and (c) retired enrollees. A two-part model (logistic + OLS) is employed to estimate the effect of the balance on (1) the probability of outpatient service usage and (2) the level of expenditure. In order to determine whether income affects the relationship between the balance and expenditure, employed enrollees are then further divided into four income sub-groups. The same two-part model is used to analyze the impact of the balance within each income group. Finally, the balance-expenditure relationship is examined alongside with the need factor, which is measured by the presence of chronic conditions as the moderator.

1.3 Significance of the Study

The Medical Savings Account (MSA) has been recognized as an innovative, alternative appealing and sustainable healthcare financing instrument. Nowadays, many countries, such as the United States and South Africa, plan to introduce the MSA program into their healthcare financing system. The Hong Kong government is also interested in the MSA plan as one feasible option for providing supplementary financing under the new healthcare system reform. As a result, the

experiences gained from implementing the MSA program in China can provide useful information for other countries that are presently contemplating the implementation of an MSA policy.

China has, for over ten years now, implemented the MSA in many of its cities under its urban healthcare financing system. However, at the present time many scholars question the effectiveness of the MSA program in China. Some people even suggest that the MSA policy should be abolished, and that the money currently put into the MSA should instead be integrated into the Social Risk-pooling Fund. Therefore, this discussion and its empirical findings will be of interest to health policy officials in improving the MSA policy in China. The experiences gained whilst implementing the MSA program in the city of Guangzhou can also provide important lessons for other cities of China.

1.4 Organization of the Report

The remainder of the report is organized as follows. The second chapter reviews some literature relevant to this research. The third chapter introduces the conceptual framework and hypotheses of this study. The fourth chapter presents the methodology, and the fifth chapter reports and analyzes the results. Discussions on the research findings, limitations of the study and future research directions are presented in the sixth chapter. Finally, conclusions and recommendations are made in the seventh chapter.

CHAPTER2 LITERATURE REVIEW

This chapter first introduces previous arguments and studies on the Medical Savings Account (MSA) in general. Then the literature is reviewed in three main categories, according to the MSA's three intended functions of "Cost-containment", "Savings for the future", and "Enabling for utilization". Finally, in the section that follows this, previous studies focusing on the balance of the MSA are analyzed.

2.1 Medical Savings Account (MSA)

The Medical Savings Account (MSA), as part of the health sector reform strategy, has been considered as an alternative appealing and sustainable healthcare financing mean, (Hanvoravongchai, 2002). It has also been labeled as an innovative health financing instrument (Prescott, 1998; Schieber, 1997).

The MSA has been defined as "a personal savings account in which money is contributed by both employees and their employers, where the savings are used for medical expenses or for the purchase of medical insurance" (Law, 2005). The MSA can also be defined as "the voluntary or compulsory contribution of payments by individuals, households or firms into a personalized savings account that serves to spread the financial risk of poor health over time" (Dixon, 2002). The MSA is designed to have three functions: (1) "Cost-containment": The MSA is regarded as a demand-side cost-containment strategy to reduce moral hazards. Individuals having an MSA are likely to be more cost-conscious and to make more prudent healthcare

spending decisions, thereby restraining the escalation in healthcare expenditures (Moser, 2005); (2) "Savings for the future": The MSA pools the financial risk of illness intertemporally over many years of one's life cycle (Bauhinia, 2007). The anticipated amount of funds in the MSA are saved up ex-ante by each individual for future medical needs (Schreyogg, 2004); and (3) "Enabling": The MSA is a private bank account earmarked exclusively for spending on healthcare (Byrne & Rathwell, 2005). As pointed out by Hanvoravongchai (2002), three reasons are frequently introduced for implementing an MSA: To empower health consumers and enlist them in controlling their own health expenditures; to encourage savings for the expected future high health costs; to mobilize additional funds for the healthcare system.

2.1.1 Controversies about the MSA

The emergence of the MSA has provided policy makers, employers and employees a new avenue for healthcare financing. Some of the main arguments about the MSA are discussed in this part. These opinions refer to different types of MSA plans, and are judged on the basis of diversified contexts.

Proponents think that the MSA has three major advantages. First, the MSA can achieve medical cost-containment and reduce moral hazards. Individuals with an MSA have incentives to use the health service more wisely, and to reduce unnecessary medical service utilization (Beam & Tacchino, 1997; Bond, Heshizer, & Hrivnak, 1996a; Byrne & Rathwell, 2005; Forget, Deber, & Roos, 2002; Massaro

& Wong, 1995; Scott, 1996). The MSA provides the necessary incentives to cut medical spending, by reducing covered health insurance expenditures and the moral hazard problem (Bonetto, 2006). Under an MSA program, enrollees are made to purchase healthcare at full price, so there is no incentive to participate in risky behavior and thus over-consume services (Dixon, 2002). As pointed out by Bond and Knapp (2001), individuals are more likely to scrutinize their healthcare choices carefully, because they are spending their own money and the funds remaining in the MSA belong to them. By forcing consumers to become the executors of the bulk of their healthcare expenditures, moral hazard is reduced, as are heath care costs (Scheffler & Yu, 1998). Increased consumer awareness of the cost can deter unnecessary consumption (Pauly & Goodman, 1995).

Second, MSA enrollees may benefit from a greater choice of healthcare providers. One potential benefit of the MSA is that they provide individuals more freedom of choice in making medical decisions (Bond & Knapp, 2001). Participants under the MSA program have complete choice as to the doctor or healthcare provider they wish to use (Query, 2000). The MSA gives patients incentives to shop around and obtain lower prices (Scheffler & Yu, 1998).

Third, an MSA enables individuals to build up a healthcare reserve fund of their own over time in order to pay for their future medical needs, and this could mitigate the problem of the ageing population and the intergenerational equity question. Long term savings in the MSA provide resources for individual health spending in later years of life, which lowers the burden on the young and employed,

especially in a rapidly ageing society (Hanvoravongchai, 2002). The MSA can force enrollees to accumulate reserves for later use, and the young are able to "subsidize themselves" by prepaying anticipated expenditures (Massaro & Wong, 1995). It also encourages pre-funding to pay for future healthcare needs and "spread the risk of ill health over a lifetime, from periods of health to illness and periods of wealth to poverty" (Dixon, 2002). In addition, the balances in the MSA are portable, and can be rolled over year by year. The MSA allows unused funds to roll over to the next year, discouraging inefficient usage of medical services (Query, 2000).

Opponents argue that the MSA also has disadvantages. Firstly, the MSA may not control healthcare costs, and can even encourage enrollees to indulge in immediate spending on unnecessary health services (Bond, Heshizer, & Hrivnak, 1996b; Hsiao, 1995; J. Hurley, 2000; Saltman, 1998; Scott, 1996). The skewed distribution of health expenditure has the limitation of trying to control health costs (Deber, Forget, & Roos, 2004). Since an MSA is often combined with catastrophic health insurance, the effect of cost-containment on moral hazard and utilization is limited (Dixon, 2002). The MSA may actually not save money, but instead lead to an increase in spending on the healthiest members of the population (Forget et al., 2002). In addition, unsophisticated consumers may have difficulty making decision on health services, and thus might invite providers to order unnecessary tests and procedures (Bond & Knapp, 2001). Healthcare providers would even compete by recruiting the best-known doctors with higher pay, and by having the most sophisticated expensive technology, which together results in inflated costs (Hsiao,

2001). Higher long-term overall costs are associated with co-payments from an MSA, since it may discourage the use of cost-effective preventive services (Major, 1997).

Secondly, MSA plans can reduce equity and deter the use of needed healthcare for those having limited savings and those with chronic diseases, which may even worsen health status (Saltman, 1998; Scott, 1996). The MSA disproportionately benefits the healthy and wealthy, stranding high-cost patients with a shortfall. Low and moderate-income people would be less likely to benefit, and would benefit to a lesser extent (Minicozzi, 2006). Unless the MSA is offered within the context of a multi-layered funding program for health services, it is reasonable to assume that the elderly, chronically ill, working-poor, and the poor will be marginalized under currently designed MSA plans (Byrne & Rathwell, 2005). Additionally, the MSA compromises equity by transferring resources from the sick to the healthy and from the poor to the relatively better off, and may not be feasible when applied to those with chronic poor health (Forget et al., 2002).

Thirdly, if implemented voluntarily with comprehensive insurance schemes in a non-universal setting, people who are healthy can be attracted selectively by an MSA plan. This phenomenon is known as "adverse selection" (Bond et al., 1996a, 1996b; Bond & Knapp, 2001; Grimaldi, 1996; Pauly & Goodman, 1995; Scott, 1996). The MSA may thus create adverse selection within the healthcare marketplace, placing an additional burden on those individuals who are most vulnerable (McCanne, 2003). Biased enrollment into an MSA with catastrophic

health plans might leave only high-risk individuals in traditional comprehensive plans, possibly leading to spiraling premiums that could cause the demise of traditional plans (Zabinski, Selden, Moeller, & Banthin, 1999). The MSA may promote adverse selection in the sense that healthy individuals would gravitate towards the MSA with a health plan where they receive a financial incentive, whereas less healthy people have an incentive to stay in the traditional health plan with lower out-of-pocket costs (Scheffler & Yu, 1998).

2.1.2 Existing MSA Plans Around the World

Several countries around the world have experimented with MSA plans as a means for financing healthcare. Singapore, a few decades ago, is the first country to implement a compulsory nationwide MSA program. MSA plans have also been implemented recently in a few other countries, such as the United States and South Africa, but on a voluntary basis and on a rather small scale. China, after initiating a pilot plan in the cities of Zhenjiang and Jiujiang in 1994, also implements an MSA program nationwide for urban employees.

MSA plan in Singapore

Many studies make reference to the MSA in Singapore, because Singapore was the precursor and leader in experimenting with the MSA program (Barr, 2001; Bonetto, 2006; Chia & Tsui, 2005; Hanvoravongchai, 2002; Hsiao, 1995; Law, 2005; Massaro & Wong, 1995; Reisman, 2006; Schreyogg, 2004). Since 1984, a

compulsory individual MSA plan, namely Medisave, has been introduced to finance personal medical expenditures in Singapore (Bonetto, 2006). Medisave helps individuals put aside part of their salaries into personal medical savings accounts to meet their future personal or immediate family's hospitalization, day surgery and certain outpatient expenses. Working Singaporeans and their employers contribute a part of the monthly wages into an MSA to save up for their future medical needs, and this is portable across jobs and after retirement.

Promoting individual responsibility for healthy living and medical expenses, and affordable healthcare for all, are the twin financing philosophies of Singapore's healthcare system (Singapore, 2011).

The rates of contribution to an MSA are based on a percentage of the wage in four tiers, with the rates increasing according to different age groups. Employees are mandated to contribute a portion (6.5% for those aged 35 and below; 7.5% for those aged 36 to 45; 8.5% for those aged 46 to 60; and 9% for those aged 61 and over) of their monthly wages to their Medisave accounts (Singapore, 2011). Contributions to the Medisave account are subject to a Medisave Contribution Ceiling (MCC), which is the maximum balance a member may have in his Medisave Account. The current maximum balance for a Medisave account (with effect from 1 July 2010) is set at SG$39,500 (Singapore, 2011). There is also a Medisave minimum balance that must be kept in the account. When an enrollee withdraws his MSA at or after age 55, he/she needs to set aside a minimum of SG$34,500 in his Medisave account (with effect from 1 July 2010) or the actual Medisave account balance, whichever is lower,

as the Medisave Minimum Sum (MMS) (Singapore, 2011). He is able to withdraw amounts which exceed this minimum balance.

An important issue about the utilization of an MSA is setting the limits on the amount which can be withdrawn (Chia & Tsui, 2005). If the MSA withdrawal limits are set too low, patients would have to pay large medical expenditures out of their own pockets. If they are set too high, it may create incentives for patients to choose a more comfortable class of wards, or to choose top-of-the-range physicians, at the expense of conserving their accounts for future medical needs, especially during old age. Since 1 January 2004, the Diagnosis-Related Group (DRG) has been used for Medisave withdrawal limits to cover hospitalization, day surgery and certain outpatient cases (Chia & Tsui, 2005). Different DRGs requiring various resources to treat would have different claimable limits. The utilization of savings is now on a resources used basis, rather than depending on the length of stay.

In terms of coverage, funds in Medisave can be used to pay for hospitalization and day surgery expenses incurred in government hospitals, restructured hospitals, community hospitals and approved Singaporean private hospitals (Reisman, 2006). Medisave is also allowed to be used for a few relatively expensive outpatient services, such as hepatitis B vaccinations, assisted conception procedures, maternity pre-delivery expenses, renal dialysis, HIV anti-retroviral drugs, thalassaemia treatment, chemotherapy and radiotherapy (Reisman, 2006).

MSA plan in the U.S.

Since the implementation of the MSA in the United States, there have been a lot of studies analyzing it in detail (Beam & Tacchino, 1997; Bond et al., 1996a, 1996b; Bond & Knapp, 2001; Bonetto, 2006; Grimaldi, 1996; Hanvoravongchai, 2002; Jampel, 1997; Law, 2005; Minicozzi, 2006; Pauly & Goodman, 1995; Pauly & Herring, 2000; Pauly, Percy, Rosenbloom, & Shih, 2000; Query, 2000; Schreyogg, 2004; Scott, 1996; Zabinski et al., 1999). Under the Health Insurance Portability and Accountability Act (HIPAA) in 1996, an MSA in the U.S. is defined as a personal tax-preferred savings account, which is established by private insurance companies as a possible way to finance high deductibles in connection with a health insurance plan. In the United States, participating in an MSA plan is voluntary. However, eligible people must be either employees or self-employed persons who are enrolled in private health insurance with a high deductible.

Contributions can be made to an MSA either by the employee or the employer, but not by both within any given year. Employees' contributions to the MSA are deductible for income tax purposes, while contributions made by employers are in addition to their wages. The total annual amount contributed into an MSA cannot exceed 65 percent of the deductible for covering medical expenditures of individuals, and 75 percent for family coverage (Schreyogg, 2004). Only if individuals previously had coverage under high-deductible health insurance, and no other comprehensive coverage, may tax-preferred contributions to an MSA be permitted (Minicozzi, 2006). Earnings accumulating in the MSA are tax-free.

MSA balances which have not been distributed can be rolled over each and every year.

There are also restrictions on the MSA in the United States. To encourage cost-consciousness, an upper limit is placed on the deductible for qualified health insurance, the annual restricted deductible being between $1,700 and $2,600 for single individuals, and between $3,450 and $5,150 for families (Bonetto, 2006). In addition, a maximum out-of-pocket expense is set to protect people who experienced catastrophic events. The total expenditures of a high-deductible health plan paid out of one's own pocket cannot exceed $3,450 for individual coverage and $6,300 for family coverage (Bonetto, 2006).

Funds in an MSA can be used to pay for routine medical services up to a deductible. The MSA program in the United States consists of traditional medical insurance with a uniform deductible across all benefits, and the expenses below this deductible can be covered by MSA funds (Matisonn, 2000).

MSA plan in South Africa

South Africa has incorporated the concept of an MSA in a different way from both Singapore and the United States. Recently, only a few studies have mentioned the MSA plan in South Africa (Benko, 2000; Hanvoravongchai, 2002; Matisonn, 2000; Schreyogg, 2004; M. Smith, 2001). After deregulation of the private insurance market in 1994, insurance companies start to offer many types of health insurance plans in South Africa, including an MSA plan (M. Smith, 2001). Since its

introduction into the private sector, the MSA has already captured more than half the market share of the private insurance market (Benko, 2000).

In South Africa, contributions are allowed to be made by the employee, the employer, or a combination of the two. Two-thirds of any employee MSA contribution can be made with pretax funds, and two-thirds of any employer MSA deposit is excluded from the employee's taxable income (Matisonn, 2000). There is no maximum annual contribution, and enrollees can contribute any amount of funds to their personal MSA to cover expenditures below the deductible. In reality, most people choose an MSA deposit equal to 100 percent of the deductible ($1,100), and the average annual MSA contribution is $685 (Matisonn, 2000). On the other hand, individuals and their employers make a decision about the contribution rate at the beginning of each year, and then they make monthly deposits into the MSA. Enrollees in this MSA plan can even repay loans from their future contributions, because the plan allow members to borrow up to 12 months of projected deposits for healthcare claims at any time during the year (Matisonn, 2000). Under the new policy with regard to an unused MSA balance, insurers are able to distribute the remaining MSA balance to account holders at the end of each year.

The coverage of the MSA in South Africa includes medical expenditures that are equal to or less than the deductible amount specified in the medical insurance policy, as well as for certain types of health services which are not covered by insurance (M. Smith, 2001). For outpatient services that are often referred to as "discretionary expenses", the insurer requires enrollees to pay a deductible of about

$1,100 (Matisonn, 2000). Only an amount exceeding this deductible can be reimbursed by insurance. Therefore, the purpose of the MSA in South Africa is to give account holders the incentive to directly control medical expenditures that are covered by insurance, but are less than the deductible. Insured people can finance the deductible either in part or totally by means of their MSA. In addition, certain health services that are not traditionally covered by third-party insurance can also be paid by the MSA, such as corrective eye surgery (Matisonn, 2000).

MSA plan in China

At the present time, China is implementing an ingenious urban health financing program that is patterned after the Singapore MSA but with major modifications. Since its inception, a number of studies have been conducted to discuss this MSA plan in China (Dong, 2006; Hanvoravongchai, 2002; Huang, 2007; Law, 2005; Lee & Cai, 2001; G. G. Liu et al., 1999; G. G. Liu, Zhao, Cai, Yamada, & Yamada, 2002; Yip & Hsiao, 1997).

Before the reform, about half of the 350 million urban people in China are covered by either the Government Insurance Scheme (GIS) or the Labor Insurance Scheme (LIS) (Yip & Hsiao, 1997). These two schemes are third-party insurance which provides comprehensive benefits with minimal cost-sharing. Enrollees under these two schemes can receive almost free outpatient and inpatient services, and they often seek health services from public hospitals that are reimbursed on a fee-for service basis according to the government's set fee schedule. As a result, little cost-

sharing on the demand side coupled with a fee-for-service payment method on the supply side have created inefficient incentives for health services utilization and cost-inflation (Yip & Hsiao, 1997). In order to deal with these problems, a new insurance scheme which includes Medical Savings Account (MSA) and Social Risk-pooling Fund (SRF) replaces the two old systems since 1994.

According to the "Decision About Establishing the Basic Medical Insurance for Employees (BMIE) in Urban China", promulgated in 1998, all employees and retirees in urban areas should participate in their citywide insurance program, which consists of the Medical Savings Account (MSA) and the Social Risk-pooling Fund (SRF) (Guowuyuan, 1995). China has two main objectives in reforming the healthcare financing scheme for its urban population: Containing costs, and establishing an affordable basic medical insurance system (Huang, 2007; Yip & Hsiao, 1997). The MSA mode is described as a risk sharing mechanism on a "vertical" dimension, namely, the effects of risks of contingency are being spread over many years of one's life cycle. The SRF mode is similar to a risk sharing mechanism on a "horizontal" dimension, which means that all of the employed population throughout society make a contribution to the SRF in a contemporary time span, and that each employee is eligible for reimbursement from the SRF (Lee & Cai, 2001). Medical insurance institutions belonging to the local governments are in charge of the administration of the MSA and SRF.

Contributions to the MSA and SRF are made by both employers and employees. Employers must contribute about 6 percent of the total wage bill, while

in the initial stages each employee must contribute about 2 percent of their previous year's monthly salary. All of an employee's contributions and about 30 percent of the employer's contributions are put into a personal MSA; an SRF is then formed based on the residual 70 percent contributions received from the employers (Huang, 2007). Because each city in China is faced with different situations, the particular percentages mentioned above are adjusted by the local authorities. In China, there is no maximum or minimum requirement for the balance of an MSA. However, any remaining funds in an MSA at the end of the year can be rolled over to the next year, and unspent funds are inheritable.

There are two MSA models existing in urban China, these being the "Tongdao" model and the "Bankuai" model. They regulate different benefit coverage for the MSA and SRF. For the "Tongdao" model, medical expenses are financed by three tiers. An enrollee's health spending is deducted from his personal MSA at the beginning (first tier). When funds in his MSA are exhausted, an account holder is required to pay no more than a fixed percentage of the local average annual salary out of his own pocket as a deductible (second tier). If this is still not enough, the SRF can partly reimburse the inadequate catastrophic expenses, with the enrollee paying a decreasing rate of co-insurance as his medical expenditures rise (third tier) (Huang, 2007). For the "Bankuai" model, the MSA and SRF are saved, administered and used separately. Even if an account holders exhausts his MSA, he cannot use the money deposited into the SRF, and has to pay deductibles (Law, 2005). A personal MSA can only be used to pay for outpatient medical expenditures. For inpatient

services, medical expenses exceeding the deductible are subsidized by the SRF, but enrollees have to make a co-payment. For the city-based MSA plan in China, the choice of MSA model depends on the city's history and current institutions, and the trade-offs in objectives that the city is willing to achieve.

This study focuses on the MSA plan in the city of Guangzhou, which adopts the "Bankuai" MSA model. In December 2001, the "Bankuai" model is initiated in Guangzhou for employees and retirees of enterprises and social organizations. Contributions to the MSA and SRF are made by both employers and employees. On a monthly basis for the employee, employers must contribute 8 percent of the previous year's average monthly wage bill, part of which is put into an individual MSA, and the other part of which goes toward forming an SRF for the whole of society (GuangzhouGovernment, 2001). The percentage part put into an individual MSA varies according to the age of account holders (1% for those aged below 35; 2% for those aged between 35 and 44; and 2.8% for those aged between 45 and retirement). Each employee is required to contribute 2 percent of his previous year's average monthly salary to his personal MSA (GuangzhouGovernment, 2001). Due to retirees having no income, the regulation of their contributions is different from those of employed enrollees. For retired enrollees, their employers should contribute 7.5 percent of the average monthly salary of all employees in Guangzhou in the previous year. Out of this percentage, 5.1 percent is deposited into the personal MSA, and the remainder is put into the SRF. In terms of coverage, funds in the MSA can only be used to pay for outpatient services (GuangzhouGovernment,

2001). When funds in the MSA are exhausted, account holders must pay any excess expenditure out of their own pockets. For hospitalization, the expenses are subsidized by the SRF with a deductible, but enrollees have to make a co-payment.

MSA plan in Hong Kong

Although Hong Kong has still not implemented the MSA, the government has been considering incorporating the idea of an MSA into the healthcare financing system of Hong Kong for almost ten years. Since 1999, there have been five government study reports and consultation documents with respect to the recommendation of an MSA plan in Hong Kong.

First, the Hong Kong government, in 1997, commissions a team from Harvard University to conduct a comprehensive assessment of the current system, and to propose alternative options to improve the financing and delivery of healthcare (The Harvard Team, 1999). In its study report published in April 1999, the Harvard consultants report that the long-term financial sustainability of the current healthcare system is highly questionable. They recommend establishing separate personal savings accounts, called MEDISAGE, with contributions from individuals at the rate of 1% of wages, to purchase long-term care insurance upon retirement or disability. However, since the release of the Harvard report, there has not been much support for this option.

Second, with regard to the outcome of the above consultation exercise, in 2001 the Hong Kong Government issues a consultation document entitled “Lifelong

Investment in Health", and proposed to establish Health Protection Accounts (HPA) (HKSARG, 2001). The Health Protection Account (HPA) is a form of the MSA, which is introduced to reduce the burden on next generations, and to strengthen the long-term financial sustainability of the public healthcare system. The proposed HPA is a self-insurance scheme of mandatory savings designed to assist individuals to continue to pay for their healthcare expenditures after their retirement. The highly restrictive nature of this plan does not receive support from the general public or other stakeholders. There are also doubts about whether the one percent of wages contribution to the MSA by ordinary working persons would be able to make any meaningful difference to the overall healthcare financing picture.

Third, to further consult the public, a healthcare financing study group commissioned by the Hong Kong government is formed to examine the merits or otherwise of an HPA scheme, and its feasibility for application in Hong Kong (HKSARG, 2004). In this report, a focus group study is conducted to elicit the public's views on the concept of an MSA program. Participants give their views about several desirable and undesirable features of an MSA plan. In addition, an actuarial study on the balance of savings accounts in relation to different income levels and starting ages of contributions is also conducted to assess the extent of protection for the HPA contributors for their post-retirement healthcare spending. The simulation illustration demonstrates that if contributions begin early at age 20-29, then the overall HPA account balance would be positive, and the amount of HPA savings would be enough to cover the whole post-retirement healthcare spending for

most contributors (HKSARG, 2004). This feasibility study of an MSA program in Hong Kong has not been well received by the Legislative Council, and the government promises to conduct further studies on an HPA.

Fourth, the Bauhinia Foundation Research Centre publishes a report on the development and financing of Hong Kong's future healthcare in 2007, and proposes again that a mandatory MSA should be considered as a supplemental financing scheme to be added to Hong Kong's successful tax-based financing system (HKSARG, 2007). This report suggests that all Hong Kong residents are eligible to participate in an MSA program, and that it should be mandatory for those in employment, subject to a minimum qualifying income. A new healthcare model with a three pillar framework is proposed. Funds in an MSA could be used to pay for fees and charges under Pillar 1, involving essential healthcare services that are provided in the public system with high government subsidies ranging from 85 to 100 percent. Enrollees could also use an MSA to pay for subsidized services under Pillar 2, which includes wellness promotion and health screening and prevention (these services are not currently subsidized). An MSA could also be used to purchase Pillar 3 services after the age of 65, these being private sector services not subsidized by the government. There is also not much support for this report.

Fifth, the Hong Kong government publishes a healthcare reform consultation document entitled "Your Health Your Life" in March 2008, in which it proposes to reform the healthcare system and its financing arrangements (HKSARG, 2008). In line with the experiences of overseas countries, the document examines six different

options for providing supplementary financing for healthcare in Hong Kong. Among these, the MSA is discussed in option three, and the document indicates that the MSA plan involving savings alone might not be an adequate source of supplementary financing, due to the very different healthcare utilization patterns among different individuals. In addition, option six is about the Personal Healthcare Reserve (PHR), this being a combination of an MSA and regulated private health insurance. The basic concept of a PHR is to require those above a certain income level in the working population to deposit a fixed percentage of their income to their own PHR account for the purpose of financing their own healthcare (HKSARG, 2008). This document shows that the PHR scheme is a worthwhile concept to address the need for supplementary financing, as well as to drive the market structure reform of the healthcare system. However, this MSA option has not been well received by the public.

2.1.3 Previous Research on the MSA

Prior studies of the MSA can be divided into four categories: Economic simulation analyses, theoretical arguments (including commentaries and reviews), surveys (descriptive reports and primary data) and empirical studies (secondary data).

First, many studies use economic simulation methods to predict MSA issues (Chia & Tsui, 2005; Dana P. Goldman, Buchanan, & Keeler, 2000; Keeler, Malkin, Goldman, & Buchanan, 1996; Kendix & Lubitz, 1999; Pauly & Herring, 2000; Query, 2000; Thorpe, 1995; Zabinski et al., 1999). Keeler et al. (1996) conduct the

first simulation to analyze the impact of an MSA on the health expenditures of non-elderly people in the United States. The findings show that an MSA has little influence on containing the healthcare costs of Americans with employer-provided insurance, but might reduce waste from the excessive use of generously insured care. Another simulation conducted by Pauly and Herring (2000) has similar results, and suggests that the efficiency gains from adding an MSA with a catastrophic health plan to the employer is positive but small. Zabinski et al. (1999) also simulate the results of widespread MSA usage. However, this research differs from others because it focuses on the potential impact of adverse selection. They reveal that if an MSA combined with catastrophic health plans is offered alongside traditional comprehensive plans, healthier individuals are more likely to select an MSA plan, which would lead to spiraling premiums and even the driving out of comprehensive coverage. When considering Medicare beneficiaries only, one simulation study models the effect of introducing the MSA on Medicare expenditures. It finds that the deferral of treatment by patients due to out-of-pocket expenses may subsequently lead to higher overall Medicare expenditures (Kendix & Lubitz, 1999).

Second, theoretical arguments over the MSA, including commentaries and reviews, prevail in the literature. Supporters of the MSA program in Singapore usually emphasize its low percentage of GDP spent on healthcare, implying a positive force in controlling costs. Massaro and Wong (1995) allege that with the MSA being a key element of its strategy, Singapore has developed a sophisticated healthcare system at much less cost than the world market price. Pauly (2001) also

agrees that the low level of spending in Singapore, coupled with apparently decent health outcomes and few complaints about access to care, is a good result. However, some researchers argue that the MSA program might not contain healthcare costs efficiently. Hsiao (1995) indicates that per capita healthcare costs continue to rise after the introduction of the MSA in 1984, driven by the increased use of expensive technology in hospitals and rising provider charges. He also contends that the MSA as a demand-side strategy fails to curb health expenditure and contain cost inflation in Singapore (Hsiao, 2001). Comparing Singapore's GDP on healthcare with other countries is misleading, because Singapore does not follow OECD standards in measuring health expenditures (Barr, 2001). Barr (2001) argues that although the MSA program is proposed in order to restrain health costs, it is not the major reason for the success of the Singapore health system. Instead, keeping health costs low is attributable primarily to heavy-handed government control of inputs and outputs, and to the strict rationing of health services based on wealth. Regarding the MSA plan in the U.S., Rabinowitz (1997) believes that necessary or preventive services may be neglected in the interests of cost savings by some individuals, leading to increased costs later to treat worsened conditions. After reviewing actual experiences of the MSA, some other countries where an MSA plan has not yet been implemented are also considering integrating the MSA into their own healthcare system. Some Canadian researchers think that an MSA program should not be considered as a policy alternative for Canada's current system of healthcare financing, because the MSA can lead to reduced system efficiency, reduced equity

and increased public healthcare expenditures (Byrne & Rathwell, 2005; Jeremiah Hurley, 2002; Shortt, 2002). Nevertheless, Gratzer (2002) disagrees with them, and suggests that Canada should experiment with an MSA program in order to learn whether the MSA is the right fit for Canada. In addition, studies on integrating the MSA into the European healthcare system have also been conducted. Dixon (2002) indicates that the MSA is not feasible in Central and Eastern European countries with a low average income, low savings rates and high unemployment rates, because funds in an MSA may not be enough to cover medical costs. But Schreyogg (2004) concludes that it could be feasible to integrate certain elements of the MSA program into the healthcare systems of European countries, since healthcare expenditures are expected to reduce significantly.

Third, researchers conduct different kinds of surveys to investigate various aspects of the MSA. Pauly et al. (2000) conduct a mail survey on the opinions of offering an MSA plan in medium and large companies. The attitudes of the majority of respondents are positive for the combination of an MSA with a high-deductible catastrophic health plan. Bonetto (2006) surveys the U. S. state legislators' knowledge and perceptions of the MSA and the U.S. healthcare system, so as to identify potential future compromises in healthcare reform. The findings show significant differences between Republican and Democratic state legislators in their attitudes towards the MSA, and show that Republican state legislators are 24 times more likely to support the MSA than Democrats. As well as surveys conducted in the United States, one study also focuses on Hong Kong. Law (2005) uses a focus

group, in-depth interview and Delphi technique to identify factors affecting the support for an MSA program in Hong Kong. He reveals that citizenship, horizontal equity, intergenerational equity and employment can best predict the support for an MSA plan.

. Fourth, limited empirical studies have been conducted on the impact of the MSA in different countries. In China, a preliminary empirical study conducted by Yip and Hsiao (1997) suggests that the MSA program in China holds promise as a viable model of urban healthcare financing for containing health cost inflation, but with some side effects such as risk selection, cost shifting and reduction in equity. Huang (2007) empirically examines how the adoption of two MSA models affects an enrollee's equity in access to healthcare. She concludes that the "Bankuai" MSA model contributes more to improved equity in access, and that the "Tongdao" MSA arrangement might induce overuse and even moral hazard in the transfer of outpatient services to inpatient services. In the United States, Minicozzi (2006) uses data from the U.S. Treasury Department to find that higher-income individuals have a stronger demand for an MSA, and that middle-aged people are more likely to open an MSA than their younger counterparts. This is the first empirical analysis of the MSA in the United States. Besides China and the United States, South Africa and Canada have also conducted empirical studies to discuss the influence of an MSA program. One project in South Africa empirically finds that an MSA saves money, and that the average MSA account holder spends about half as much on outpatient services plus drugs as do people in traditional plans (Matisonn, 2000). There is no

evidence that MSA enrollees skimp on primary care in a way that leads to higher inpatient costs. In Canada, Forget, Deber and Roos (2002) use the Manitoba population health research data to assess costs for physician visits and admissions to hospital between 1997-1999. They find that the MSA cannot save money, but instead would increase spending on the healthiest members of the population. Another empirical study, also from Manitoba, Canada, reveals that the MSA can substantially increase both public expenditures and out-of-pocket costs for those most ill, because expenditures for physicians and hospital services are highly skewed in all age groups (Deber et al., 2004). The authors show that this empirical distribution of health expenses restricts the potential impact of 'demand-based' strategies on cost control, and concludes that an MSA program is not suitable for a system with universal coverage.

Therefore, past researches into MSA programs are deficient, as they are mainly focused on assessing individuals' attitudes towards MSA implementation, and on analyzing whether they can control healthcare costs or not. Most previous studies of the MSA are based on theoretical arguments, economic simulations and surveys. Very few empirical studies examining the effect of existing MSA programs on healthcare utilization have previously been conducted. Thus, there are very few empirical studies that analyze the effect of existing MSA programs on healthcare utilization.

2.2 MSA "Cost-containment" Function

2.2.1 Cost-sharing and Moral Hazard

In the current literatures, the MSA is frequently discussed with respect to its cost-containment aspect. Behind the effect of this concept lies one important economic theory – moral hazard. As discussed earlier, one important argument in favor of the MSA is to reduce the moral hazard problem that usually exists in medical insurance systems with comprehensive health plans.

An MSA is an individual personal account, and the funds in this MSA are used to pay for medical expenditures. The MSA is designed to address the problem of moral hazard, because account holders bear a certain financial burden for medical care now, and the payment for medical expenses is borne by themselves, not by a third party. Therefore, the MSA is proposed as a way of restricting an individual's own medical behavior, and provides incentives to deter unnecessary healthcare consumption in order to contain costs. MSA account holders must finance a portion of their own medical expenditures by funds that have been accumulated in a personal MSA. Therefore, the moral hazard problem can be reduced by the introduction of cost-sharing, and a higher degree of cost consciousness is therefore achieved (Schreyogg, 2004).

The MSA is regarded as one of the demand-side strategies for containing cost. Prominent among cost-containment strategies for reducing healthcare cost is cost-sharing. Increasing patient cost-sharing is one cost-containment tool that is designed to keep utilization rates and costs down, by making consumers think twice before

using additional costly services (Rice & Kominski, 2007). This strategy reduces the incentive to seek medical care by making individuals pay a portion of their own medical bills. Supporters of cost-sharing suggest that savings can be achieved by reducing unnecessary care, while critics argue that this cost-containment strategy is also a barrier to needed care and may adversely affect health (Shapiro, Ware, & Sherbourne, 1986). There are often three ways in which insured individuals can share in the cost of the services they use: Deductibles (the amount paid out of pocket before insurance benefits kick in); co-payments (a fixed amount paid per covered service); and co-insurance (a percentage of cost paid per service) (Rice & Kominski, 2007) (p.148). Many researches have shown that patient cost-sharing requirements result in a substantially lower utilization rate, the most notable of which is the RAND Health Insurance Experiment in the United States.

Many studies have investigated the impact of cost-sharing on the demand for medical services. One of the best known studies is the RAND health insurance experiment. This randomized controlled experiment of cost-sharing for health insurance is conducted by the RAND Organization between 1974 and 1982, and is designed to examine how demand responds to insurance-induced changes in price (Manning, Newhouse, Duan, Keeler, & Leibowitz, 1987; Newhouse, 1993). Because this classic experiment is not designed to test the MSA, a number of the design decisions which are appropriate for that study might limit the ability to generalize its results (Deber et al., 2004). Several issues affecting the generalizability of these RAND results exist. For example, physicians may react to widespread cost-sharing

by changing their practice patterns. As pointed out by Hanvoravongchai (2002), studying the effectiveness of an MSA in addressing moral hazard should be "comprehensive and very well-planned in order to capture not only household responses but also responses by providers and other players in the market". However, this kind of research is very complicated, and beyond the scope of this research. Therefore, "supplier induced demand" will not be discussed in this study.

The effect of the MSA on healthcare utilization is usually considered as similar to the response from cost-sharing in the RAND experiment. In general, this RAND health insurance experiment suggests that higher cost-sharing among fee-for-service patients results in lower utilization of health services in the United States (Newhouse, 1993). MSA supporters often allege that higher cost-sharing among patients results in lower utilization of health services according to the RAND results, but the RAND study actually reveals that the reduction varies considerably by type of care. According to the seriousness of the diagnosis and the need for immediate care, the RAND study divides diagnostic categories into the "more urgent" one and the "less urgent" one. The RAND researchers find an overall 23% drop for the more urgent diagnoses, but a 47% drop for the less urgent ones (Newhouse, 1993) (p.156). Hence, the effect of cost-sharing has a much greater influence on the utilization of "less urgent" health services.

It is felt that outpatient services can be considered as less urgent than hospitalization. Clearly, an individual going to an outpatient department for the sniffles and a cough is likely to be less urgent than a person who is brought into the

inpatient department because of a serious traffic accident. Therefore, it is more appropriate to examine the impact of the MSA on the cost-sharing effectiveness in preventing consumer moral hazard with regard to outpatient service utilization.

2.2.2 Empirical Evidence on Cost-sharing and Health Services Use

Significant effects of insurance with patient cost-sharing on the demand for health services have been found in the literatures. Most studies show that the utilization of medical services will decrease when introducing or increasing cost-sharing strategies, which is consistent with economic theory and with the RAND health insurance experiment. In contrast, there are some studies revealing that patient cost-sharing strategies may have no impact at all, or instead even have the unintended impact of increasing overall health utilization. Furthermore, some studies also indicate that the influence of cost-sharing varies considerably by type of care. As mentioned by Sapelli and Vial (2003), moral hazard is negligible in the case of hospitalization, but for medical visits it is quantitatively important. The price elasticity of demand for outpatient services is higher than for hospitalization. Therefore, some studies reveal that, when compared with inpatient services, the cost-sharing strategy has much more impact on outpatient services or physician visits. In addition, many studies analyze the effect of cost-sharing on drug demand, which studies involve the average use of all drugs, or the utilization of specific drugs or drug categories. Because the use of prescription drugs accounts for a large portion of healthcare costs in outpatient services, studies addressing the impact of cost-sharing

on drug demand can also have important implications for the utilization of outpatient services.

First, after introducing or increasing cost-sharing strategies, the utilization of health services will decrease, which implies a negative relationship. Increasing a patient's share of the medical bills appears to be effective in curbing an increase in health service utilization. Shapiro et al. (1986) analyze the effect of cost-sharing on seeking care for both serious symptoms and minor symptoms, and use some of the data from the RAND experiment. They find that when enrollees have minor symptoms, the cost-sharing group is nearly one third less likely to see a physician. However, when symptoms are serious, the cost-sharing group and the free-care group do not differ significantly in seeking care, showing that cost-sharing has a greater effect on minor symptom decisions. Nakatani and Kondo (2003) find that after introducing a small amount of cost-sharing by the patients into the Special Disease Program in Japan, a sharp decline in medical service utilization under this program is observed. Nakatani (2000) also points out that the decline is more apparent in outpatient services (13.26%) than that in inpatient services (6.59%). In the United States, a study examining the impact of increasing cost-sharing levels on the utilization of formal substance abuse (SA) treatment services among a privately insured population is conducted by Stein and Zhang (2003). They conclude that, compared to people with lower cost-sharing plans, individuals in plans with higher levels of cost-sharing have lower rates of both residential SA treatment and specialty SA outpatient treatment. On the other hand, abolishing the cost-sharing strategy, in

contrast to introducing it, may also imply a negative association between cost-sharing and medical utilization. Nabyonga et al. (2005) reveal that the abolition of cost-sharing results in a marked increase in the utilization of health services by all population groups in Uganda. Their findings also show that the substantial increase in outpatient visits induced by the abolition of user fees does not translate into a corresponding increase in inpatient services.

Second, among the utilization of all health services, a large number of studies focus particularly on drug utilization in response to cost-sharing strategies, and these also demonstrate the negative relationship between cost-sharing strategies and utilization. Blais et al. (2003) investigate whether the consumption of three classes of medications for chronic diseases is affected by the introduction of a cost-sharing drug plan in the Canadian province of Quebec. The results report that for individuals using one class of medications for the treatment of asthma, a statistically significant decrease of 37% of the monthly consumption occurs after the implementation of the new drug insurance plan, and that another two classes of medication display a non significant decrease of 9% and 10%. Another Canadian research in British Columbia assesses the impact of two drug cost-sharing policies on the use of inhaled medications, these policies being a co-payment policy and a co-insurance plus deductible policy (Dormuth et al., 2006). The findings suggest that these two drug cost-sharing policies are associated with significant reduction in the use of inhaled medications, mostly due to decreased initiation and increased cessation rates compared with the full coverage plan. In addition, many studies analyze the effect of

cost-sharing changes, especially the co-payment, on the average use of all drugs in specific populations, such as the elderly, Medicaid recipients (Johnson, Goodman, Hornbrook, & Eldredge, 1997; Lillard, Rogowski, & Kington, 1999; Nelson, Reeder, & Dickson, 1984; Stuart & Grana, 1998; Tamblyn et al., 2001; Thomas, Wallack, Lee, & Ritter, 2003) or commercially insured patients who receive coverage through a few large employers (Fairman, Motheral, & Henderson, 2003; Dana P. Goldman et al., 2004; Huskamp et al., 2003; Joyce, Escarce, Solomon, & Goldman, 2002; Rector, Finch, Danzon, Pauly, & Manda, 2003; D. G. Smith, 1993). They generally find that a higher proportion of out-of-pocket cost-sharing leads beneficiaries or enrollees to reduce their prescription drug utilization. However, among them, few studies systematically discuss the impact of co-payment changes on the utilization of specific drugs. One latest research does specifically address the effect of co-payment on the utilization of "statins", which is a drug for chronically ill patients with hyperlipidemia (Thiebaud, Patel, & Nichol, 2008). The results confirm that higher co-payment lowers statin use, but that heavy or regular statin users, who are the most compliant patients, less readily respond to higher out-of-pocket costs by reducing their use.

Third, patient cost-sharing strategies may have no impact at all, or may even have the unintended impact of increasing medical utilization. One study on outpatient mental health utilization demonstrates that $20/visit co-payments are associated with a 16% decrease in the likelihood of service use but no change in the visit rate, while increasing the co-payment to $30/visit results in no significant

change in the likelihood of use, but is associated with a 9% decrease in visits per year (Simon, Grothaus, Durham, VonKorff, & Pabiniak, 1996). They think that the level of co-payment is very important, because lower levels of cost-sharing might not be sufficient to deter unnecessary use, and higher levels of cost-sharing will exclude patients in great need. Apart from mental health services use, a growing amount of research has been conducted to analyze the effect of cost-sharing on drug utilization. Tamblyn et al. (2001) describe that the imposition of cost-sharing for drugs in Quebec decreases the use of "essential" drugs among the elderly and among welfare recipients by 15-22%, but leads to an approximate doubling of serious adverse events, these being defined as hospitalization, nursing home admission or death, as well as to an increase in emergency department visits. Although they do not report on cost data, the magnitude of the increase in serious adverse events means it is possible that total costs increase. Liu and Romeis (2004) discuss changes in drug utilization following an outpatient prescription drug cost-sharing program for persons over 65 years old in Taiwan. They reveal that the rate of average prescription costs increase in both the cost-sharing and non cost-sharing groups, and that the elderly with non-chronic diseases are more sensitive to the drug cost-sharing program when compared with those with chronic diseases. However, after exceeding the upper bound of the cost-sharing schedule, a significantly higher increase in the number of prescriptions, as well as drug costs, is observed. Furthermore, Li et al. (2007) evaluate the impact of cost-sharing policy changes for prescription drugs on the utilization of both drugs and physician visits by the elderly. The findings indicate

that when cost-sharing for prescription drugs increases, the demand for prescription drugs decreases but the demand for physician visits increases. It is possible that the increase in cost-sharing of prescription drugs worsens seniors' symptoms due to fewer medications being taken, and this therefore triggers them to see physicians more frequently, which implies a positive relationship, contrary to most literatures (Li et al., 2007)

Therefore, empirical evidences suggest that the cost-sharing strategy might not reduce the utilization of health services, which is not always consistent with economic theory. Some studies have revealed that after introducing patient cost-sharing strategies, health services utilization does not change, and that healthcare demand, as well as costs, can even increase. According to the prior reviews, different levels of cost-sharing and different types of health services may incur opposite results. Hence, the level of cost-sharing and the type of health services play a very important part in reducing unnecessary utilization and then containing medical costs efficiently.

2.3 MSA "Savings for the Future" Function

2.3.1 The "Savings" Arguments

An MSA enables individuals to build up a healthcare reserve fund of their own over time to pay for their future medical needs, which can address the problem of an ageing population and the intergenerational equity question. The anticipated amount of funds in an MSA are saved up ex ante by each individual (Schreyogg,

2004), and thus, from a risk pooling standpoint, pool the financial risk of illness intertemporally over many years of one's life cycle (Bauhinia, 2007). Dixon (2002) states that the MSA enables pre-funding to pay for future healthcare needs, and "spread the risk of ill health over a lifetime, from periods of health to illness and periods of wealth to poverty". In addition, Massaro and Wong (1995) indicate that the MSA can force enrollees to accumulate reserves for later use, and that the young are able to "subsidize themselves" by prepaying anticipated expenditures.

As pointed out by Hanvoravongchai (2002), an MSA encourages savings for future medical needs, pools over time, and emerges from the general observation of a person's life-cycle saving capacity and health spending pattern. Average income and capability for a person to save are often high through the working years compared to retirement. However, the average level of health expenditure is usually low at younger ages and becomes higher in later years of life. It is therefore considered an attractive way to encourage individuals to save during economically active years for later health expenditure, thus assuring adequate funds for healthcare in the future. As a result, long term savings in an MSA provide resources for individual health expenditure in later years of life, which lowers the burden on the young and employed, especially in a rapidly ageing society. In addition, these individual savings can also allow people to accumulate resources during good times that can be drawn upon during subsequent bad times, such as during an economic downturn or if made redundant.

In China, some scholars question the savings effect of the MSA. For example, the savings function is difficult to make effective in the city of Zhenjiang, because payments from the MSA increase every year as balances in the account increase (F. Lin, 2004). Wang (2005) alleges that the primary and most important MSA function in China is "Enabling for utilization", not "Savings for the future". In addition, a commentary on MSA functions states that its savings function is minor; when accumulating funds in an MSA, the payment ability of the Social Risk-pooling Fund can be weakened (G. G. Liu, Dong, Meng, & Yan, 2006). Furthermore, Liu (2007) suggests that the MSA in China should not emphasize its savings function. The reason is that large amounts of unspent funds are left in the MSA, which is not good for the social risk-pooling ability of health insurance.

2.3.2 Previous Studies on "Savings"

Two economic simulation studies and one empirical study that analyze the savings aspect of the MSA is reviewed in this part.

First, Query (2000) simulates the MSA final balance upon retirement in the United States, and indicates that an MSA can be a feasible supplement to retirement savings, but that emphasis should not be put on its savings functions. The findings suggest that the MSA is a feasible personal savings instrument for 90% of the better-off population, but cannot accumulate savings for the 10% of people who have a worse health status and incur a much larger proportion of their total U.S. health

expenditures. Therefore, future health status is the primary determinant of the success of the MSA as an effective savings tool.

Second, another simulation study in Singapore investigates the adequacy of the government-decreed minimum savings accumulated in an MSA, by estimating the present value of lifetime healthcare expenditures (PVHE) under various scenarios. The simulation results show that the decreed minimum balance in an MSA of SG$25,000 for year 2003 is adequate for both the less well-off male and female elderly in three-room public housing at 4% medical cost growth and at 4% or higher discount rates (Chia & Tsui, 2005). It is also adequate for the better-off male elderly in the bigger four-and five-room flats, but not so for the female elderly.

Third, one preliminary empirical study based on certain descriptive statistics analyzes the savings function of the MSA in China under both the "Tongdao" and "Bankuai" Models (D. Liu, Liu, & Lin, 2009). Three main findings are shown in this study: (1) The average savings rate from 2001 to 2006 is not obviously different for these two types of MSA model: 21.85% under the "Tongdao" Model and 21.14% under the "Bankuai" Model, but healthy enrollees under the "Bankuai" Model are more likely to accumulate savings in their accounts; (2) Savings for males in the MSA are higher than for females under both types of MSA model; (3) It is more difficult for retirees to accumulate savings under the "Bankuai" Model than under the "Tongdao" Model.

2.4 MSA "Enabling for Utilization" Function

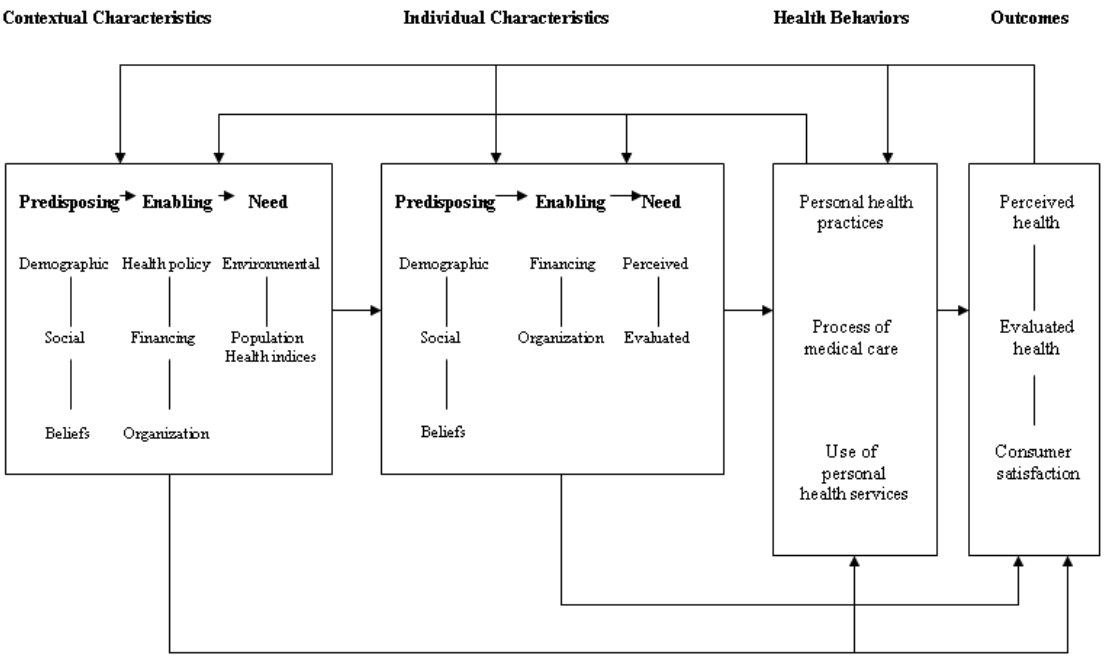
2.4 1 Introduction of Andersen's Behavioral Model of Health Services Use

Since its inception in 1968, Andersen's behavioral model of health services use has been extensively used and revised to explain health services use and access. Access is defined as "actual use of personal health services and everything that facilitates or impedes their use", and it is the link between health service systems and the populations they serve (Andersen & Davidson, 2007). Andersen and Davidson (2007) point out that conceptualizing and measuring access is the key to understanding and making health policy in a number of ways: (1) Predicting the use of health services; (2) promoting social justice; and (3) improving effectiveness and efficiency of health service delivery.

The latest version of Andersen's behavioral model of health service use emphasizes contextual as well as individual determinants of access to medical care (Andersen & Davidson, 2007). This model is shown in Figure 2.1 below. In contrast to the individual level, contextual factors are measured at certain aggregate levels, which range from units as small as the family to those as large as a national healthcare system. Individuals are related to these units through membership and residence. The model indicates that the major components of contextual and individual characteristics are both divided in the same way: (1) Predisposing factors – existing conditions which predispose individuals to use or not use services, even though these conditions are not directly responsible for use; (2) Enabling factors – enabling conditions that facilitate or impede the use of services; and (3) Need factors

– needs that lay people or healthcare providers recognize as requiring medical treatment (Andersen, 1995; Andersen & Davidson, 2007). Although the model mentions contextual factors in recognition of the importance of the community, the ultimate focus is on individuals' health behavior, especially their use of health services, together with the resulting outcomes with regard to their health and their satisfaction with the services.

Figure 2.1: A Behavioral Model of Health Services Use Including Contextual and Individual Characteristics (Andersen & Davidson, 2007)



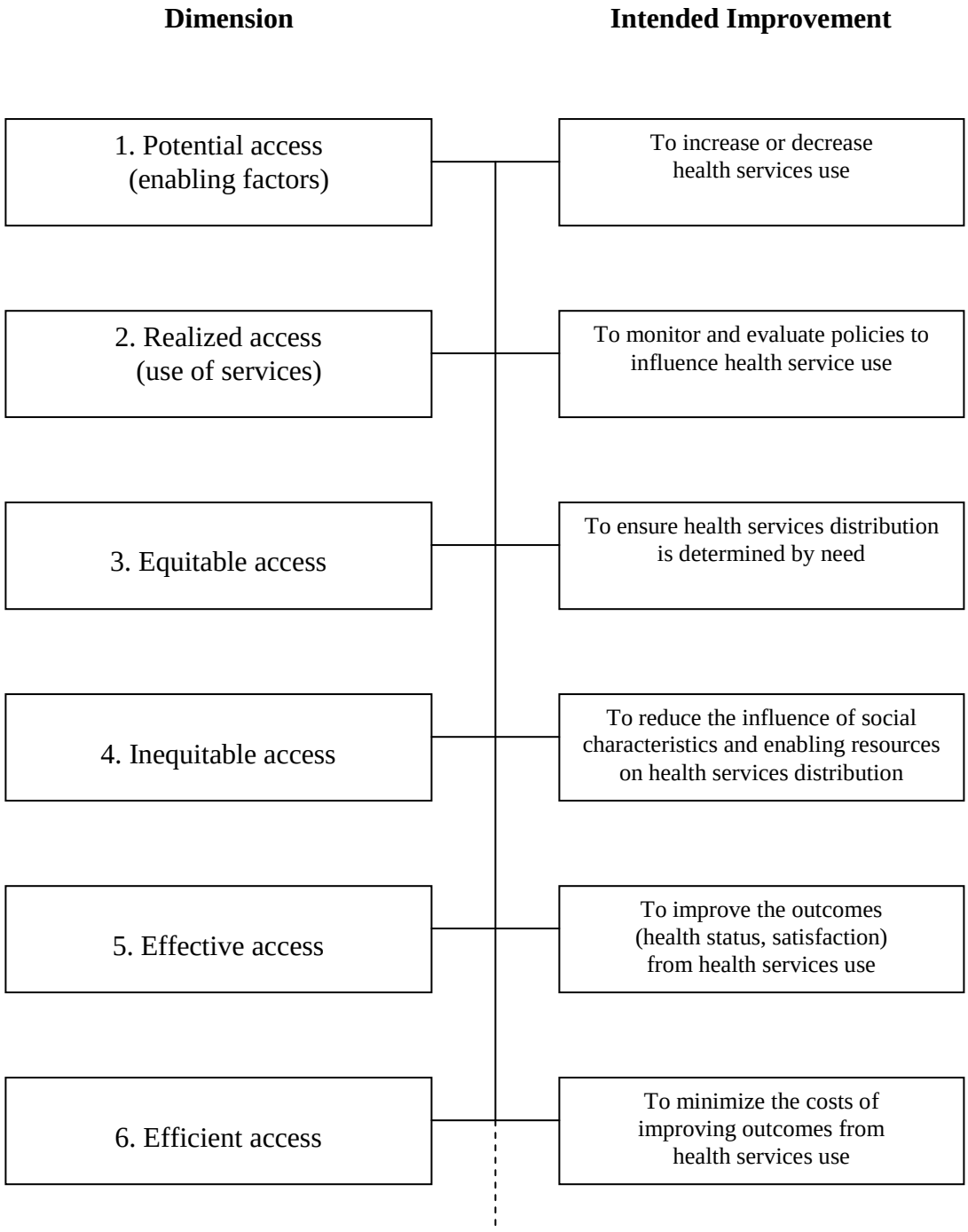
The purpose of this original Andersen's behavioral model is initially designed to explain the use of formal personal health services (Andersen, 1995), measured as units of physician ambulatory care, hospital inpatient services, and dental care visits.

Hence, “use of personal health services” is the essential component of the “Health Behaviors” part in the comprehensive model of access to care. Andersen (1968) hypothesizes that predisposing, enabling, and need factors have a differential ability to explain use depending on what type of service is examined. Hospital services used in response to more serious problems are mainly explained by demographic characteristics from predisposing factors and need factors, but not from enabling factors, whereas dental services considered more discretionary are more likely to be explained by social influences and beliefs from predisposing factors and enabling resources (Andersen & Davidson, 2007). It is felt that outpatient service utilization belongs to ambulatory physician use as discussed in this model. Andersen and Davidson (2007) “expects all the components of the model to explain ambulatory physician use, because the conditions simulating care seeking would generally be viewed as less serious and demanding than those resulting in inpatient care, but more serious than those leading to dental care” (p.9). The utilization of outpatient services can be explained by all predisposing, enabling, and need factors, whereas hospital inpatient services are not explained by all three factors, as they exclude enabling characteristics. Balances in an MSA are personal resources that enable the use of health services. In this way, the MSA can be considered as one new measure of individual enabling factors. Therefore, in order to examine how the enabling factor measured by an MSA balance affects health services use more efficiently, choosing outpatient utilization as a measure of use is more appropriate.

In this research, two individual predisposing factors of the Andersen model are adopted, these being each MSA enrollee's "Age" and "Gender". For the individual enabling factor, the "MSA balance" is employed to analyze the difference in the utilization of outpatient services in response to different levels of funding in the MSA. The individual need factor is measured by "Presence of doctor-diagnosed chronic conditions". In addition, among the three parts of health behaviors in the model, this study only focuses on the use of personal health services. "Outpatient utilization" is employed to measure the health behaviors in this Andersen's behavioral model. Finally, the outcome component is excluded in this study, because using secondary data to measure perceived health status, evaluated health status, and consumer satisfaction is difficult and unrealistic.

Access to healthcare is a relatively complex multidimensional phenomenon, and this behavioral model has been used as a tool to help define and differentiate these dimensions (Andersen & Davidson, 2007). All dimensions of access and how access can be improved through health policy and delivery system intervention are presented in Figure 2.2 below.

Figure 2.2: The Policy Purposes of Access Measures (Andersen & Davidson, 2007)



This research focuses on the first dimension, "Potential access", and the second dimension, "Realized access". First, "Potential access" is measured by "the enabling variables of the behavioral model at both the contextual (health policy, financing) and individual (regular source of care, health insurance, income) levels" (Andersen & Davidson, 2007) (p.10). At the contextual level, the Chinese government is implementing the health policy of establishing the Urban Employee Basic Medical Insurance (UEBMI), consisting of the Medical Savings Account (MSA) and the Social Risk-pooling Fund (SRF). Under this health policy, all enrollees have individual medical savings accounts, which can be used to pay for personal health expenditures. The MSA balance can be regarded as a measure of individual enabling factors. The amounts of enabling resources constitute the means for use, and increase or decrease the likelihood that it will take place (Andersen & Davidson, 2007). Consequently, the level of an MSA balance determines the increase or decrease in health services use.

Second, "Realized access" is the actual use of health services, the indicators of which include utilization of a physician, hospital, and dental or other health services (Andersen & Davidson, 2007). In this study, the indicator of realized access is measured by the utilization of outpatient services. Andersen and Davidson (2007) mention that realized access measures are employed to monitor and evaluate policies designed to influence health services use. In China, the MSA policy has three main objectives: "Cost-containment", "Savings for the future", and "Enabling for utilization". Therefore, outpatient service utilization, which is one of the realized

access measures, can be employed to monitor and evaluate the effect of the MSA policy in China.

Individual enabling characteristics are the personal resources available to an individual which either enable or impede the use of health services (Andersen & Newman, 1973). Even though people may be predisposed to use health services, some means must be available for them to do so. A condition that permits a person to satisfy a need regarding health service utilization is defined as an enabling factor (De Boer, Wijker, & De Haes, 1997). "Financing" and "Organization" are two broad categories of individual enabling characteristics. "Financing" of health services involves personal income, wealth, and the effective price of healthcare to the patient, which is determined by having insurance and cost-sharing requirements (Andersen & Davidson, 2007). "Organization" of health services describes whether or not the person has a regular source of care, and the nature of that source, such as private doctor, community clinic, emergency room, means of transportation, reported travel time to and waiting time for care (Andersen & Davidson, 2007).

This study examines the balance of the MSA, which can be regarded as one new measure of individual enabling factors in the "Financing" part. Therefore, previous literatures referring to the financing part of individual enabling characteristics will be reviewed in the following part.

2.4.2 Empirical Evidence on Enabling Factors and Health Services Use

Previous studies employing Andersen's model as the framework can be divided into two main streams: Examining all predisposing, enabling, and need factors together; and focusing on enabling components only.

Application of Andersen's Model for all three factors

Many prior studies have examined the effect of general individual predictors on health services utilization, including all the predisposing, enabling and need factors. For example, a study assesses predisposing and enabling characteristics, plus a variety of health risks, for their association with the use of primary care, and measures the enabling variables to finance their utilization by "the poor and uninsured" (Broyles, Narine, Brandt, & Biard-Holmes, 2000). The findings show that the poor and uninsured use significantly few preventive or early detection services. Another study on predictors of Canadian adolescents' healthcare utilization believes that income plays a differential role in utilization, depending on whether it reflects health status or socio-economic status (Vingilis, Wade, & Seeley, 2007). Canadians have universal physician and hospital care, but not universal dental care; thus, income is not expected to be a barrier for the use of both physician and non-physician services, but would be a barrier to dental care. The results show that lower income makes it more likely to use physician and non-physician services, due to poorer health status and higher healthcare needs, while higher income is positively associated with dental utilization. In addition, Elhai et al. (2007) examine the predisposing, enabling and need components of outpatient medical and mental

healthcare utilization among a national sample of US veterans, and use present or absent health insurance possession to measure enabling factors. They discover that veterans lacking private health insurance are significantly related to outpatient service use offered by the Veterans Affairs. In addition, a study uses the Andersen's behavioral model to examine predictors of Western physician utilization for immigrant Chinese elders who reside in Boston, and for Chinese elders who reside in Shanghai, measuring enabling factors by income and insurance status (Miltiades & Wu, 2008). The results show that insurance status is the significantly positive predictor of enabling resources for the Boston sample, while for the Shanghai sample, neither enabling factors play an important role in predicting physician utilization.

Application of Andersen's Model for enabling factors

Health insurance status, which is one important individual enabling component of healthcare utilization, has received much attention on the basis of Andersen's model. In Hong Kong, Wong et al. (2006) use Andersen's model as the framework to analyze the presence of moral hazard among those covered by medical benefits and insurance coverage, and propose that the observations mostly reflect realized access in meeting genuine health needs, rather than inappropriate overuse of services. They demonstrate that individuals with insurance or medical benefits have a higher probability of hospitalization and outpatient visits, but that they do not incur more bed-days or consume more episodes for either the public or private sectors.

Another study examines the association between changes in health insurance status and healthcare expenditures for four insurance categories: Continuously uninsured persons, continuously insured persons, persons in transition from no insurance to insurance, and vice versa, given the differences in predisposing and need characteristics (Ward & Franks, 2007). They suggest that expenditures are higher during insured than during uninsured years, and that expenditures for newly insured persons are similar to those for continuously insured persons. Similarly, Pagan et al. (2007) mention the relationships between health insurance coverage and the use of preventive health services in Mexico, and reveal that lack of health insurance significantly diminishes access to some preventive services in Mexico, even after controlling for contextual factors, individual predisposing factors, other enabling factors, and the perceived need for services. Another empirical study conducted in Mexico also concludes that health insurance coverage consistently emerges as the most important enabling factor for explaining medication use with large and statistically significant positive effects on take-up (Maurer, 2007).

Consequently, Andersen's behavioral model of health services use has been extensively employed to explain the use of health services and predict access to care. When discussing enabling factors in the model, they often use "Income" and "Health insurance status" to measure individual enabling factors in the "Financing" part.

2.5 Previous Studies on the MSA Balance

Recently, two preliminary empirical studies examining the MSA program have started to focus on the balance of the MSA. In China, the "Tongdao" and "Bankuai" Models are two different types of city-based MSA models coexisting in the urban healthcare system, with different benefits coverage. The choice of which MSA model to use depends on the city's history, its current situations, and the trade-offs in objectives that the city plans to achieve. According to the MSA policy in China, the "Tongdao" Model finances health expenditure through three tiers: The MSA itself, out-of-pocket spending in the form of deductibles, and the Social Risk-pooling Fund; enrollees pay for all of their health spending until the funds in their personal MSA have been spent. However, under the "Bankuai" Model, funds in each enrollee's MSA can only be used to pay for outpatient expenditure. As a result, the impact of its balance on health service utilization is different under these two types of MSA model.

First, a study under the "Tongdao" MSA model in Zhenjiang city is estimated by fixed effect models using eight years panel data from 2000 to 2007 (G. G. Liu, Tang, & Lei, 2009). This is the first rigorous analysis investigating the effect of the MSA balance on health expenditure in China. The value of the MSA balance used in this study is the initial value of funds in the account at the beginning of each year. Five different types of expenditure are examined as dependent variables respectively: Payments from the MSA, expenditures under deductibles, expenditure from the Social Risk-pooling Fund (SRF), expenditure from the insurance fund (the sum of

the MSA and SRF), and total annual health expenditure. There is a total number of 110,174 MSA enrollees in the analysis, including 71,055 employees and 39,119 retirees. The results suggest that the MSA balance is positively associated with payments from the MSA and the total annual health expenditure. In addition, this result is consistent for all samples: Employed samples aged below 35; and employed samples aged above 45, respectively. The positive relationship between the MSA balance and health expenditure can be due to the design of the "Tongdao" model, which finances healthcare through three tiers: The MSA, out-of-pocket spending in the form of deductibles, and the Social Risk-pooling Fund. Only when the funds in a personal MSA are exhausted can enrollees' health expenditure be paid out of the Social Risk-pooling Fund, albeit with some deductibles and coinsurance. Accordingly, MSA enrollees under the "Tongdao" model with greater balances in their accounts tend to have much higher payments from their MSA, in order that their health spending can be reimbursed by the whole city's Social Risk-pooling Fund. Also, total annual health expenditure not only includes payments from the MSA, but also consists of expenditure from the Social Risk-pooling Fund and out-of-pocket spending in the form of deductibles and coinsurance. Therefore, the impact of the MSA balance on payments from the MSA and on total annual health expenditure is weak under the "Tongdao" model. Furthermore, the majority of cities in China do not implement this "Tongdao" MSA model, so the findings in this study about the MSA balance cannot be applied to other cities. As a result, examining how

the account balance affects healthcare utilization is not appropriate under this MSA model.

Second, regarding the "Bankuai" model, another quantitative study examining the impact of the MSA balance on health expenditure for employed outpatient patients and retired outpatient patients respectively from 2002 to 2006 is conducted using fixed effect models in the city of Nanjing (G. G. Liu, Tang, & Liu, 2009). The MSA balance is measured by the amount of funds accumulated in the accounts at the beginning of each year. This research analyzes four types of health expenditure in the outpatient sector: Outpatient payments from the MSA, expenditure from the Social Risk-pooling Fund, expenses out of their own pockets, and the total annual outpatient expenditure. The first three expenditures constitute the last one, namely, the total annual outpatient expenditure. The two main findings are shown as follows: (1) Enrollees who have a higher balance in their MSA incur higher payments from the MSA in the outpatient sector, this being consistent for both employees and retirees. This is because both the employed samples and retired samples used in this study are outpatient patients who have previously used health services in the outpatient sector. They use funds from the MSA to pay for their needed outpatient expenditures, which leads to this positive relationship between balance in and payment from the MSA. Consequently, this study does not include MSA enrollees who are non-users of the health service, as it is not possible to find out whether the balance will have an effect on the probability of outpatient usage under the "Bankuai" model. (2) The effect of the MSA balance on total annual

outpatient expenditure is different for the employed group and the retired group. For the employed group, the effect on total expenditure is not significant, because enrollees' outpatient expenditure is more likely to be affected by their health status or other factors, so for them the impact of their MSA balance will be limited. However, for the retired group, the relationship between the MSA balance and total annual outpatient expenditure is significantly negative at 1% significant level. With respect to those retirees having a better health status, they will incur a lower level of total expenditure, so that more unspent funds will accumulate in their personal MSA. In contrast, those less well-off retirees will have higher outpatient spending, because they are frequent users of the health service and often in a poorer health status. In this case, less money can be saved in their personal MSA. As a result, the health status of MSA enrollees should be considered when examining the impact of balance on health expenditure under the "Bankuai" model.

Therefore, these two empirical studies suggest that the linear relationship between MSA balance and total health expenditure is inconsistent: Positive under the "Tongdao" Model and negative under the "Bankuai" Model. The impact of the MSA balance on health service utilization is different under these two types of MSA models.

2.6 Summary

Previous studies on the MSA have mainly focused on individual attitudes toward MSA implementation, and on whether it has helped to control healthcare cost

escalation. Most are theoretical arguments, economic simulations and surveys. Very few empirical studies examining the effect of existing MSA programs on healthcare utilization have been previously conducted. Moreover, there are limited empirical studies focusing on the balance of the MSA, and the evidences with regard to its impact are even scarcer. Recently, two empirical studies on the impact of the MSA balance have been conducted in China, and the findings under the two different types of MSA model are inconsistent. The linear relationship between the MSA balance and total health expenditure is positive under the "Tongdao" Model but negative under the "Bankuai" Model. Under the "Tongdao" MSA model, the effect of the balance is weak, due to the design of this particular MSA model. So examining how the MSA balance affects healthcare expenditure is more appropriate under the "Bankuai" Model. However, a previous empirical study of the balance under this more popular MSA model also has its limitations, as it does not include MSA enrollees who are non-users of the health service, and therefore cannot determine the effect of the balance on the probability of outpatient usage. Furthermore, this study does not consider the health status of account-holders when analyzing the impact of the MSA balance on health expenditure under the "Bankuai" Model.

CHAPTER3 THEORETICAL FRAMEWORK

Based on a comprehensive review of the literature mentioned in the last chapter, the reasons for the framework construction are shown first. Next, this section presents the conceptual framework used in the analysis. In the final part of this section, several hypotheses relating to the three research questions are proposed.

3.1 Proposed Framework

The theoretical framework used in this study is Andersen's behavioral model of health services use (Andersen & Davidson, 2007), which has been frequently used to explain the use of health services and access to medical care. As mentioned in the review section, the latest version of Andersen's behavioral model describes contextual as well as individual determinants of access to healthcare.

Access to care is a rather complex multidimensional phenomenon, including the six different dimensions shown in the last chapter. These dimensions of access can be defined and differentiated by this behavioral model, and can be improved through health policy and delivery system intervention. Among the six dimensions of access to care based on Andersen's model, "Potential access" and "Realized access" are analyzed in this study to see how access can be improved through health policy. Enabling factors are used to measure "Potential access". "Realized access" is the actual use of health services, and discussing "Realized access" will emphasize the use of personal health services in Andersen's model. Therefore, the proposed

conceptual framework of this research, shown in Figure 3.1, which discusses these two access dimensions, is derived from Andersen's behavioral model.

First, the policy purpose of "Potential access" is to increase or decrease the use of health services. As suggested by Andersen and Davidson (2007), "Potential access" is measured by the behavioral model's enabling variables at both the contextual (health policy) and individual (financing) levels. At the contextual level, the Chinese government is implementing the health policy of establishing the Basic Medical Insurance for Employees (BMIE), consisting of the Medical Savings Account (MSA) and the Social Risk-pooling Fund (SRF). Under this health policy, all enrollees have their personal MSA, which can be used to pay for their medical expenditures. In addition, individual enabling characteristics are the personal resources available to an individual which enable or impede the use of health services (Andersen & Newman, 1973). Hence, the MSA balance is included as a measure of the individual enabling factor, because the accumulated funds in an MSA enable account holders to afford more or less services. The amounts of the MSA balance will constitute the means for use, and determine whether there is an increase or decrease in the use of health services.

Second, "Realized access" is the actual use of health services, the indicators of which include utilization of a physician, hospital, and dental or other health services (Andersen & Davidson, 2007). In this study, the indicator of realized access is measured by the utilization of outpatient services. Andersen and Davidson (2007) mention that realized access measures are employed to monitor and evaluate policies

designed to influence health services use for policy purposes. In China, the MSA policy has three main objectives: “Cost-containment”, “Savings for the future”, and “Enabling for utilization”. Therefore, outpatient service utilization, which is one of the realized access measures, can be employed to monitor and evaluate the effect of China’s MSA policy.

Third, Andersen (1968) believes that predisposing, enabling and need factors have differential ability to explain use depending on the type of service, which has already been mentioned in the review chapter. Hospital services used in response to more serious problems are mainly explained by demographic characteristics from predisposing factors and need factors, while dental services, considered more discretionary, are more likely to be explained by social influences and beliefs from predisposing factors and enabling resources (Andersen & Davidson, 2007). As a result, the use of hospital services is less likely to be determined by individual enabling factors. Furthermore, Andersen and Davidson (2007) expect that all three factors of the model can explain ambulatory outpatient use, because the conditions simulating care seeking are generally viewed as less serious and demanding than those resulting in inpatient care, but more serious than those leading to dental care. Accordingly, predisposing, enabling, and need factors can better explain the utilization of outpatient services rather than inpatient services. In addition, the effect of an MSA on healthcare utilization is usually considered to be similar to the response from cost-sharing in the cost-containment strategies. As discussed in the literature review, some cost-sharing studies indicate that the influence of cost-

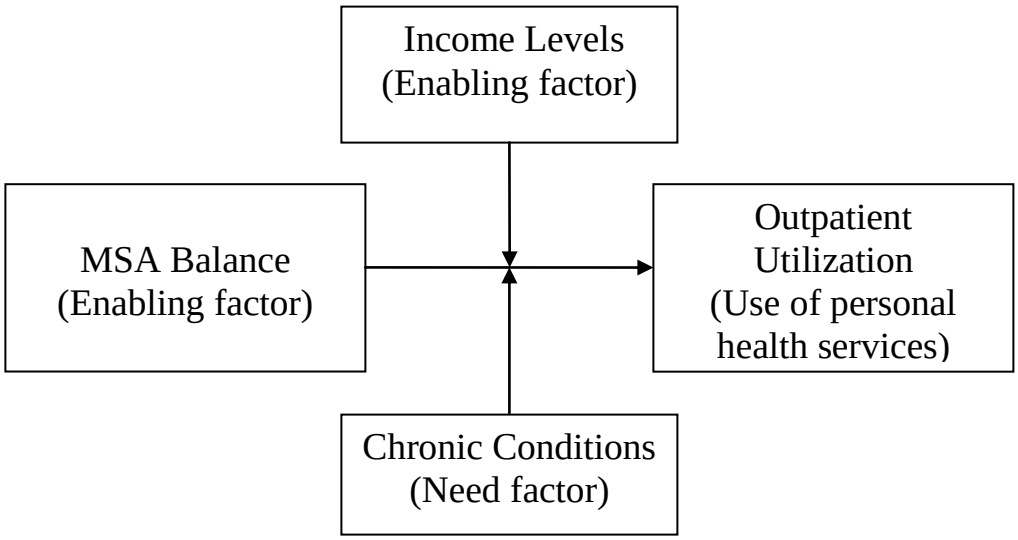
sharing varies considerably by type of care. Outpatient services are generally considered discretionary and relating to less serious health problems, so patients are more price conscious about outpatient services than for hospitalization. The price elasticity of demand for outpatient services is higher than for hospitalization. The MSA program, which is regarded as a cost-sharing strategy, will have much more of an impact on outpatient services in comparison with inpatient services. Consequently, the utilization of outpatient services will be adopted in this study.

Fourth, drawing on the theoretical framework of Andersen's behavioral model of health services use, this study investigates the individual enabling factor, as measured by the MSA balance, to evaluate the health policy in China, which is implementing an MSA program as part of its health insurance reform. In this study, how the MSA balance affects outpatient utilization is examined first. Then, income level is controlled to examine the effect of the MSA balance on outpatient utilization, by dividing employed MSA enrollees into four different income sub-groups. Furthermore, the moderating effect of chronic conditions on the relationship between the MSA balance and outpatient utilization is also conducted, in order to see whether the needs of patients with chronic conditions are adequately met under the MSA program. Therefore, the proposed conceptual framework of this study is presented in Figure 3.1 below.

Fifth, a possible weakness in this conceptual framework is that it does not consider other companion policy factors, such as the time-varing changes in co-

payment, deductible, Social Risk-pooling Fund, and cap policies, which might have important impact on utilization.

Figure 3.1: Proposed Conceptual Framework



3.2 Hypotheses Development

3.2.1 Enabling Factor—MSA Balance

This study focuses on the MSA balance, and tries to predict the relationship between the MSA balance and outpatient utilization in three aspects.

First, the MSA is regarded as a cost-sharing strategy, and the effect of the MSA on healthcare utilization is usually considered as being similar to the response from cost-sharing in the cost-containment strategies. In the previous literature

review section, many empirical evidences on the relationship between cost-sharing strategies and health services utilization have already been reviewed. In particular, the use of outpatient services and prescription drugs are focused on among all health services. Some studies reveal that the cost-sharing strategy will have much more of an impact on outpatient services and physician visits when compared with inpatient services, because the price elasticity of demand for outpatient services is higher than for hospitalization. Given that outpatient services are generally considered discretionary and related to less serious health problems, patients will be more price-sensitive with regard to outpatient services than to hospitalization. In addition, studies addressing the impact of cost-sharing on drug demand will also have important implications for outpatient service utilization, because the use of prescription drugs accounts for a large proportion of healthcare costs in the outpatient sector. Thus, these empirical findings on the effect of cost-sharing strategies on the demand for outpatient services and prescription drugs can have useful implications with regard to the impact of the MSA balance.

According to the prior literatures, most studies show that the utilization of health services decreases when introducing or increasing cost-sharing strategies (Blais et al., 2003; Dormuth et al., 2006; Nabyonga et al., 2005; Nakatani, 2000; Nakatani & Kondo, 2003; Shapiro et al., 1986; Stein & Zhang, 2003; Thiebaud et al., 2008). With respect to drug utilization, many studies find that a cost-sharing drug plan leads enrollees to reduce their prescription drug utilization (Fairman et al., 2003; Dana P. Goldman et al., 2004; Huskamp et al., 2003; Joyce et al., 2002; Rector et al.,

2003; Tamblyn et al., 2001; Thomas et al., 2003). Nevertheless, some empirical evidences suggest that these cost-sharing strategies may not reduce the utilization of health services, which is not always consistent with economic theory. Some studies reveal that, after introducing patient cost-sharing strategies, health services utilization does not change, and that healthcare demand, as well as costs, could even increase (Hansen et al., 2005; Li et al., 2007; Tamblyn et al., 2001). Furthermore, different levels of cost-sharing can incur opposite results, and can lead to varying effects on health services utilization (S. Z. Liu & Romeis, 2004; Simon et al., 1996). Therefore, the relationship between cost-sharing strategies and health services utilization may be positive or negative, and the level of cost-sharing will influence the use of health services.

Second, some evidences on healthcare expenditure after the introduction of an MSA plan have conflicting findings. On the one hand, after urban healthcare reform, including the MSA program in China, healthcare expenditures can be controlled in terms of individual health expenditure, total health expenses, hospital revenues, and average expenditure per visit, as suggested by some empirical findings in China. The city of Zhenjiang, as a pilot experiment, implements the new urban healthcare finance reform in December 1994. Preliminary evidences in the first year after the reform show that each enrollee's personal health expenditure, and the city's total health spending, decline by 27 percent and 24.6 percent respectively, due to reduced use of high-tech diagnostic tests and expensive non-domestic drugs (Yip & Hsiao, 1997). Although this study only reports on one year's data after the introduction of

the MSA program, it suggests that the MSA has the potential to reduce cost inflation and achieve cost containment. Liu et al. (1999) also assess the impact of this urban healthcare reform in Zhenjiang, China, based on the first post-reform survey in 1995, by comparing health expenditure in the year 1994, which is prior to this reform. They find that healthcare expenditures for those who have previously used services decrease by about 18 percent and the overall expenditure decline by 8 percent among all enrollees, including both users and non-users, which indicates significant total cost savings as a result of the reform. In addition, another empirical study examining this reform in Zhenjiang city has similar results. Zheng et al. (2004) demonstrate that, before the reform, total health expenditures in Zhenjiang city grow at an average annual rate of 33.40%, but the growth rate reduces to 12.00% yearly after the reform. When using hospital revenue to indicate medical expenditure, a study also conducted in Zhenjiang city points out that annual hospital revenue in the first year after implementing the new system increases by only 5.2%, which is 26.04% less than the growth rate before the reform (G. Zheng, 1997). Besides empirical studies in Zhenjiang city, other cities in China also have evidence in support of controlling health expenditure under this new system that includes the MSA program. For example, Shen (1996) finds that average monthly outpatient expenditures and outpatient visit times decrease dramatically after the reform in the city of Shenzhen. Moreover, some preliminary findings in another city, Nantong, report that compared with employees under the old system, enrollees under the new

urban health system incur lower average expenditure per visit in both outpatient and inpatient sectors (J. Chen, Shu, Yu, Huang, & Tang, 2001).

On the other hand, there is considerable evidence that individuals use more health services after joining an MSA program, suggesting that the MSA cannot curb increasing healthcare expenditure. For example, a study discussing MSA experiences in Singapore shows that the per capita cost of healthcare increases after initiating the MSA program, and health expenditure per capita increases 2 percent points more than the average before the reform (Hsiao, 1995). In Canada, Forget, Deber and Roos (2002) use the Manitoba population health research data to assess costs between 1997-1999, and describe that the average cost per resident is US$730 each year. They find that the MSA would not save the province money in terms of current costs, but would instead lead to a 54% increase in physician and hospital costs, due to higher government spending on those people who are healthy. Another empirical study, also from Manitoba, Canada, finds that the MSA could increase both government spending and out-of-pocket costs for the sickest individuals, because medical expenditures are highly skewed in all age categories (Deber et al., 2004). The authors think that this empirical distribution of health expenses restricts the potential effect of demand-side strategies on controlling health costs, and conclude that an MSA program is unsuited to a system with universal coverage. Recently, a few empirical studies of the MSA program in China also reveal similar findings. A study in the city of Shanghai reports that, since the implementation of the MSA program, healthcare expenditure has increased at an average annual rate of

around 15.4%, indicating that the MSA fails to prevent expenditure from escalating (Dong, 2008). Consequently, some empirical studies suggest that the MSA can constrain the growth rate of health expenditure, but some contend that the MSA cannot lead to effective expenditure control.

Third, two preliminary quantitative studies on the impact of the MSA balance on total healthcare expenditure in China also indicate mixed results. A study under the "Tongdao" MSA model in Zhenjiang city is estimated by fixed effect models using eight years panel data from 2000 to 2007 (G. G. Liu, T. T. Tang et al., 2009). This is the first rigorous analysis investigating the effect of MSA balances on health expenditure in China. The value of the MSA balance used in this study is the initial value of the funds in the account at the beginning of each year. The results suggest that the MSA balance is positively associated with total annual health expenditure, and this result is consistent for all samples, employed samples aged below 35, and employed samples aged above 45, respectively. Regarding the "Bankuai" model, another quantitative study in the city of Nanjing, examining the impact of MSA balances on health expenditure for employed outpatient patients and retired outpatient patients respectively from 2002 to 2006, is conducted using fixed effect models (G. G. Liu, Y. Tang et al., 2009). The MSA balance is measured by the amount of funds accumulated in the accounts at the beginning of each year. The findings reveal that the MSA balance is negatively related to total annual outpatient expenditure. However, this negative relationship is only significant for retired enrollees, not for employed enrollees. Thus, the effect of the MSA balance on total

healthcare expenditure is inconclusive based on these two preliminary empirical studies, which show either a positive relationship or a negative relationship.

In summary, the relationship between the MSA balance and health utilization is proposed based on four aspects. Firstly, the MSA balance is considered as a new measure of the individual enabling factor, and the empirical findings on the relationship between enabling factors (Health insurance status and Income) and use of health services are mixed. Secondly, the effect of the MSA on health utilization is usually regarded as similar to the response from cost-sharing in the cost-containment strategies, and the relationship between cost-sharing strategies and health services utilization can be positive or negative. Thirdly, evidences on health expenditure after the introduction of MSA programs have conflicting findings. Some empirical studies suggest that the MSA can constrain the growth rate of health expenditure, but some argue that the MSA cannot lead to effective expenditure control. Fourthly, two preliminary quantitative studies analyzing the impact of the MSA balance on total healthcare expenditure also have inconsistent findings: a positive relationship or a negative relationship. Therefore, the relationship between the MSA balance and healthcare expenditure may not be linear, suggesting both the positive and negative effects of the balance.

As a result, it is hypothesized that the MSA balance will affect outpatient service utilization significantly, but that the relationship between the MSA balance and outpatient expenditure is nonlinear.

Hypothesis 1-1a: The MSA balance will have an effect on the probability of using any outpatient service.

Hypothesis 1-1b: The relationship between the MSA balance and outpatient expenditure is nonlinear.

Under the new urban healthcare system in China, the MSA program covers both employees and retirees of enterprises and social organizations. Since the health status of retired enrollees is different from employed enrollees, these two sub-groups out of all MSA enrollees are analyzed separately. Therefore, the following hypotheses for employed MSA enrollees and retired MSA enrollees are proposed.

Hypothesis 1-2a: For employed MSA enrollees, the MSA balance will have an effect on the probability of using any outpatient service.

Hypothesis 1-2b: For employed MSA enrollees, the relationship between the MSA balance and outpatient expenditure is nonlinear.

Hypothesis 1-3a: For retired MSA enrollees, the MSA balance will have an effect on the probability of using any outpatient service.

Hypothesis 1-3b: For retired MSA enrollees, the relationship between the MSA balance and outpatient expenditure is nonlinear.

3.2.2 Enabling Factor—Income Levels

Income is one of the most important measures frequently used to analyze individual enabling factors. This study focuses on the MSA balance, which is considered as a new measure of enabling factors. For those employed MSA enrollees, contributions to the account are income-related, because they are determined by a certain percentage of enrollees' personal average salary. As a result, the income factor may affect the relationship between the MSA balance and outpatient utilization.

Some people argue that the MSA plan may compromise the pursuit of equity, and even reduce equity. Hurley (2002) states that the MSA program, as one of the demand-side controls, is incompatible with equity in the financing and utilization of healthcare services. Scott (1996) proposes that the MSA can affect lower income groups adversely, due to the relative burden of medical costs on their available resources. Hanvoravongchai (2002) points out that the MSA model is less equitable than comprehensive benefit systems, because it limits risk pooling between the rich and the poor. Moreover, lower-income MSA enrollees can be excluded from receiving necessary health services due to their lacking enough funds in the accounts to purchase health services (Saltman, 1998). However, these statements on the MSA are only based on theoretical arguments. Limited empirical evidence is available concerning the impact of the MSA program across different income groups.

Two empirical studies concerning income effect under the "Tongdao" MSA model are discussed as follows. A study examining the impact of new urban

healthcare reform funded by an individual MSA combined with a Social Risk-pooling Fund on vertical equity in healthcare financing is conducted using annual survey data in China's Zhenjiang city from 1993 to 1999 (Yi, Maynard, Liu, Xiong, & Lin, 2005). This research estimates changes in the distribution of financial burden among enrollees before and after the reform by a concentration index based measure, the Kakwani progressivity index. The empirical results suggest that higher-income MSA enrollees can have higher available balances in their accounts, whereas lower-income enrollees will have a greater financial burden because they are in a poorer health status and use more health services. This indicates that the adoption of an MSA model has a negative effect on equity in healthcare financing. The Kakwani indices for contributions to the MSA indicate that higher-income enrollees contribute more than lower-income groups, since contributions are income-related; the indices for payments from the MSA imply that higher-income account-holders use less health services, because the higher-income group has better health status and incurs relatively lower expenditures. Based on the value of contributions to and expenditure from the MSA each year, the MSA balance can be calculated, and the Kakwani indices of it show that the distribution of account balance is highly concentrated in higher-income enrollees. However, this study is only based on the estimated MSA balance each year, making it impossible to distinguish the previous year's balances from the current year's contributions. Although this study does not analyze the effect of the MSA on health expenditure directly, the empirical findings measuring insured people's healthcare financial burdens under the current new urban

healthcare system demonstrate that income levels actually affect MSA contributions, MSA payments, and the balance value estimated from them.

With respect to horizontal equity in access to healthcare, Liu et al. (2002) investigate changes in access to various health services across different income groups before and after the new urban healthcare reform, based on multi-year survey data between 1993 and 1996 conducted in Zhenjiang city. This study defines three relative income levels within each year, in line with the following criteria: Bottom 20% quantile as low-income enrollees, middle 20%-80% quantile as middle-income enrollees, and top 20% quantile as high-income enrollees. The findings reveal that before the reform higher income individuals are more likely to use outpatient services, suggesting inequitable access to outpatient care. Nevertheless, the new urban healthcare system makes lower income enrollees increase outpatient service utilization, improving horizontal equity in access to outpatient services between enrollees with different income levels. Among the four types of health services examined, lower income enrollees still have a lower likelihood of using expensive and advanced diagnostic procedures, because these kinds of services are usually paid out of individuals' own pockets; while the lower income group is more likely to use emergency care and inpatient services due to their worse health status. This study examines the income effect on health service utilization under the urban healthcare system as a whole, but does not focus on the MSA effect. But it still shows that health service utilization is significantly different across various income groups after

initiating this new urban healthcare reform consisting of the MSA and the Social Risk-pooling Fund.

Huang (2007) conducts an empirical study to evaluate participants' access and equity in access to healthcare under both the "Tongdao" and "Bankuai" MSA models in China, based on the cross-city survey data in Zhenjiang and Hefei cities. She divides it into low income group, medium income group and high income group in each city, according to the quantile of the whole sample she achieves. Although the direct effect of income and the interaction effects of income and the MSA arrangement are not statistically significant in this study, the sign of coefficients can still give some implications for those MSA enrollees' health behaviors. When examining the direct effect of income on the probability of visiting, it found that high income participants have a greater chance of using outpatient services when controlling the MSA arrangement effects. Additionally, compared with enrollees under the "Bankuai" MSA model, the "Tongdong" MSA model decreases the probability of using outpatient services for both low income and middle income enrollees, but has a positive effect for high income enrollees. This indicates that the "Tongdao" MSA arrangement can benefit high income enrollees the most, and enlarge the inequity in access to outpatient services. Therefore, the "Bankuai" MSA model contributes more to improving horizontal equity in access to outpatient services in China.

Recently, two empirical studies investigating how the MSA balance has an impact on health expenditure also include account holders' income level as a control

variable in the regression models under both the “Tongdao” and “Bankuai” MSA models respectively. With respect to the “Tongdao” MSA model in the city of Zhenjiang, Gordon, G. Liu, Tang and Lei (2009) conduct fixed effect models using eight years panel data between 2000 and 2007 to evaluate five categories of health expenditures: Payments from the MSA, expenditure under deductibles, expenditure from the SRF, expenditure from insurance funds, and total annual health expenditure. Among the total samples, consisting of 71,055 employed MSA enrollees and 39,119 retired MSA enrollees, account-holders’ annual income is significantly positively related to all five types of expenditures mentioned above. In the year 2002, Zhenjiang government reduces the MSA’s contribution rate by one percent for those employed enrollees aged below 35 and employed enrollees aged over 45. Among these two sub-samples, whose contribution rate changes during the eight years, this study also analyzes the effect of the MSA balance on health expenditure when controlling account-holders’ annual income. Within the employed sub-samples aged below 35, income shows a negative relationship to expenditure from both the MSA and total annual health expenditure, but this relationship is not significant. For those employed enrollees aged over 45, income level has a positive effect on expenditure from both the MSA and total annual health expenditure, at a 1% significant level.

Another empirical study in China, conducted by Gordon G. Liu, Tang and Liu (2009) examines the relationship between the MSA balance and health expenditure under the “Bankuai” MSA model in another city, Nanjing, based on the 2002-2006 panel data of employed outpatient patients and retired outpatient patients.

For those employed MSA enrollees using any health service in the outpatient sector, annual income has a significantly positive impact on all types of health expenditures examined: Outpatient expenditure from the MSA, expenditure from the SRF, own out of pocket expenses, and total annual outpatient expenditures. Since the contributions of insured employees are income-related, the payment ability of an MSA is also correlated to individual income levels. However, regarding those retired MSA enrollees who have used outpatient services during the previous five years, the results report that various categories of health expenditures are not affected by retired MSA enrollees' annual income level. This is because retirees' MSA contributions are determined by a certain percentage of the average yearly income of all employees in the whole city, this being lower than for many employed MSA participants. In addition, health expenditures for retirees are often higher than for employees, so retired enrollees' income levels do not significantly affect health expenditure.

As a result, the income effect should be controlled when examining the effect of the MSA balance on outpatient utilization, by dividing employed MSA enrollees into four income groups. Thus, hypotheses on the impact of the MSA balance in each income sub-group are presented below.

Hypothesis 2-1a: For MSA enrollees in the lowest income group, the MSA balance will have an effect on the probability of using any outpatient service.

Hypothesis 2-1b: For MSA enrollees in the lowest income group, the relationship between MSA balance and outpatient expenditure is nonlinear.

Hypothesis 2-2a: For MSA enrollees in the medium low income group (below social average salary), the MSA balance will have an effect on the probability of using any outpatient service.

Hypothesis 2-2b: For MSA enrollees in the medium low income group (below social average salary), the relationship between the MSA balance and outpatient expenditure is nonlinear.

Hypothesis 2-3a: For MSA enrollees in the medium high income group (above social average salary), the MSA balance will have an effect on the probability of using any outpatient service.

Hypothesis 2-3b: For MSA enrollees in the medium high income group (above social average salary), the relationship between the MSA balance and outpatient expenditure is nonlinear.

Hypothesis 2-4a: For MSA enrollees in the highest income group, the MSA balance will have an effect on the probability of using any outpatient service.

Hypothesis 2-4b: For MSA enrollees in the highest income group, the relationship between the MSA balance and outpatient expenditure is nonlinear.

3.2.3 Need Factor—Chronic Conditions

As suggested by Andersen's behavioral model, individual need factors, including both perceived and evaluated needs, are significant predictors of health service utilization. "Perceived need" is how people view their own general health and functional states, while "Evaluated need" represents a professional judgment and objective measurement about a patient's physical status and need for medical care (Andersen & Davidson, 2007). In the current study, the presence of chronic conditions is included as the evaluated need factor to explain outpatient utilization.

Health status in terms of chronic conditions has often been specified as a need factor in the Andersen's behavioral model by researchers studying the use of outpatient services. For example, a study in Beijing shows that Chinese seniors having certain chronic conditions such as stroke, heart disease, liver disease and respiratory distress are more likely to visit Western physicians (Foreman, Yu, Barley, & Chen, 1998). In addition, Wong et al. (2006) conclude that individuals suffering from a chronic disease are more likely to consult a Western medical practitioner and use more of such services in both the public and private sectors of Hong Kong. Additionally, disease burden, which is a count of responses to prompts for nine chronic diseases, is a significant need factor for predicting annual healthcare expenditure in the United States (Ward & Franks, 2007). Moreover, a study conducted by Miltiades and Wu (2008) reveals that Chinese seniors in Shanghai who have chronic conditions are significantly associated with increased visits to Western

physicians. Hence, previous studies using Andersen's behavioral model demonstrate that increased outpatient utilization occurs for individuals with chronic conditions.

Among the three components of individual characteristics in Andersen's model, the need factor is thought to be the most important predictor of health services utilization (Andersen & Newman, 1973; Kaplan, Pamuk, Lynch, Cohen, & Balfour, 1996; G. G. Liu et al., 2002). In order to study the relationship between enabling factors and health service use, the need factor should be carefully considered, because it may even change the effect of enabling factors on the use of health services in opposite directions.

Previous arguments about the MSA have often stated that it would reduce equity and deter the use of needed healthcare for those with chronic conditions, which could even worsen a person's health status (Saltman, 1998; Scott, 1996). This is because people having chronic diseases are very unlikely to accumulate enough savings in their accounts (Hanvoravongchai, 2002). Forget et al. (2002) think that the MSA compromises equity by transferring resources from the sick to the healthy, and may not be feasible when applied to individuals suffering from chronic illnesses. They also point out that the MSA would make the sickest group forgo some medically necessary treatment due to inappropriate cost-consciousness, which may even increase the burden of catastrophic coverage later. Similarly, Hurley (2002) alleges that healthy people can benefit more from an MSA, but that ill people are no better off and may even be worse off. Specifically, MSA enrollees with chronic

diseases are usually thought to be unable to have enough funds in their accounts for necessary care (Dong, 2008).

Very few prior empirical studies on the MSA include information about health status in their analyses. But some studies evaluating urban healthcare reforms that include an MSA have some findings on the effect of chronic disease status on health service use. For example, Liu et al. (2002) demonstrate that the measure of vertical equity in access to care can be maintained by this new urban healthcare system across enrollees with different health conditions, and reveal that chronic diseases status is the most significant determinant of health service utilization. They find that before the reform individuals having chronic diseases are more likely to use outpatient services than those without chronic conditions, and that chronic enrollees become even more likely to visit the outpatient sector after the reform. This indicates that individuals with great needs are ensured relatively greater health utilization. In addition, Huang (2007) follows the same method of using chronic conditions to measure the health factor, and shows that MSA enrollees who suffer from chronic illnesses under the "Tongdao" model are less likely to visit the outpatient sector than those without any chronic disease, when compared with people under the "Bankuai" MSA program. Although the coefficients are not statistically significant, the findings suggest that, compared to the "Bankuai" MSA model, the "Tongdao" arrangement does not benefit the less healthy group, and can actually enlarge the vertical inequity in access to outpatient services. More recently, Gordon G. Liu et al. conduct two quantitative studies to examine the relationship between the MSA balance and health

expenditure under the two types of MSA models (G. G. Liu, T. T. Tang et al., 2009; G. G. Liu, Y. Tang et al., 2009). However, these two preliminary empirical studies on the MSA balance do not include the health status of all account holders, and cannot control the need factor when examining the effect of enabling factors on the use of health services.

The presence of chronic conditions plays two important roles in this study. First, when examining the impact of the MSA balance on outpatient utilization and its impact within different income sub-groups, it is included as a control for individuals' health status. Second, it is also used as a moderator to evaluate whether chronic conditions will affect the relationship between the MSA balance and outpatient utilization.

Hypothesis 3-1a: Chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.

Hypothesis 3-1b: Chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.

Hypothesis 3-2a: For employed MSA enrollees, chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.

Hypothesis 3-2b: For employed MSA enrollees, chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.

Hypothesis 3-3a: For retired MSA enrollees, chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.

Hypothesis 3-3b: For retired MSA enrollees, chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.

Hypothesis 3-4a: For MSA enrollees in the medium low income group (below social average salary), chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.

Hypothesis 3-4b: For MSA enrollees in the medium low income group (below social average salary), chronic conditions will moderate the U-shaped curvilinear relationship between the MSA balance and outpatient expenditure for users.

Hypothesis 3-5a: For MSA enrollees in the medium high income group (above social average salary), chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.

Hypothesis 3-5b: For MSA enrollees in the medium high income group (above social average salary), chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.

Finally, all hypotheses are summarized in Table 3.1 below.

Table 3.1 All Hypotheses in This Study

RQ1: Do different balances of the MSA have an impact on outpatient service utilization?	***Hypothesis 1-1a**: The MSA balance will have an effect on the probability of using any outpatient service.* ***Hypothesis 1-1b**: The relationship between the MSA balance and outpatient expenditure is nonlinear.*
	***Hypothesis 1-2a**: For employed MSA enrollees, the MSA balance will have an effect on the probability of using any outpatient service.* ***Hypothesis 1-2b**: For employed MSA enrollees, the relationship between the MSA balance and outpatient expenditure is nonlinear.*
	***Hypothesis 1-3a**: For retired MSA enrollees, the MSA balance will have an effect on the probability of using any outpatient service.* ***Hypothesis 1-3b**: For retired MSA enrollees, the relationship between the MSA balance and outpatient expenditure is nonlinear.*
RQ2: Is the impact of the MSA balance on outpatient utilization different among various income groups?	***Hypothesis 2-1a**: For MSA enrollees in the lowest income group, the MSA balance will have an effect on the probability of using any outpatient service.* ***Hypothesis 2-1b**: For MSA enrollees in the lowest income group, the relationship between the MSA balance and outpatient expenditure is nonlinear.*
	***Hypothesis 2-2a**: For MSA enrollee in the medium low income group (below social average salary), the MSA balance will have an effect on the probability of using any outpatient service.* ***Hypothesis 2-2b**: For MSA enrollees in the medium low income group (below social average salary), the relationship between the MSA balance and outpatient expenditure is nonlinear.*
	***Hypothesis 2-3a**: For MSA enrollees in the medium high income group (above social average salary), the MSA balance will have an effect on the probability of using any outpatient service.* ***Hypothesis 2-3b**: For MSA enrollees in the medium high income group (above social average salary), the relationship between the MSA balance and outpatient expenditure is nonlinear.*
	***Hypothesis 2-4a**: For MSA enrollees in the highest income group, the MSA balance will have an effect on the probability of using any outpatient service.* ***Hypothesis 2-4b**: For MSA enrollees in the highest income group, the relationship between the MSA balance and outpatient expenditure is nonlinear.*

RQ3: Are the needs of MSA enrollees with chronic conditions adequately met under the MSA program?	***Hypothesis 3-1a****: Chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.* ***Hypothesis 3-1b****: Chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.*
	Hypothesis 3-2a*: For employed MSA enrollees, chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.* ***Hypothesis 3-2b****: For employed MSA enrollees, chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.*
	Hypothesis 3-3a*: For retired MSA enrollees, chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.* ***Hypothesis 3-3b****: For retired MSA enrollees, chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.*
	Hypothesis 3-4a*: For MSA enrollees in the medium low income group (below social average salary), chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.* ***Hypothesis 3-4b****: For MSA enrollees in the medium low income group (below social average salary), chronic conditions will moderate the U-shaped curvilinear relationship between the MSA balance and outpatient expenditure for users.*
	Hypothesis 3-5a*: For MSA enrollees in the medium high income group (above social average salary), chronic conditions will moderate the effect of the MSA balance on the probability of using any outpatient service.* ***Hypothesis 3-5b****: For MSA enrollees in the medium high income group (above social average salary), chronic conditions will moderate the nonlinear relationship between the MSA balance and outpatient expenditure.*

CHAPTER4 METHODOLOGY

In this chapter, an explanation about data source and a secondary database is given first. Then, in the following part, the operationalization of constructs in the conceptual framework is discussed. Finally, this section introduces the two-part regression models used in the analysis.

4.1 Sources of Data

This study uses data from the city of Guangzhou to evaluate the MSA policy in China. Guangzhou is a typical, large city in the southern part of China, and it is representative with respects to population size, age structure and income levels. In December 2001, Guangzhou government decided to implement an MSA program for employees and retirees paying qualified medical expenses in the outpatient sector. The first group of MSA enrollees who registered in December 2001 numbers 290,000. Since then, each year sees many new enrollees creating their accounts. Up to the end of 2007, the total number of MSA account holders in Guangzhou reaches 2,647,963. However, their accounts have been created at different times, so in order to examine MSA balances that have accumulated over the same period of time, this study confines itself to that first group of MSA account holders. Therefore, the samples used in this study are selected based on their enrollment time. Only those MSA account holders who are enrolled under the MSA program in December 2001

could be selected for this study. Therefore, samples used in this study have the same enrollment period under the MSA program. Each MSA balance has accumulated from January 2002 to December 2006, a total of five years. This first group of enrollees creates their accounts in the China Everbright Bank, and each owns a unique MSA card which is similar to a credit card. The transaction records of each MSA card are stored in the bank's database.

The dataset used for this study is a combination of four different raw data files. Three of them, the ones containing the MSA records, are provided by China Everbright Bank. The first data file describes the basic information about each MSA account-holder, such as his/her unique MSA card number, name, citizen identity card number, year of birth and gender. The second data file contains the unique MSA card number of each account holder, together with the MSA card transaction records from January 2002 to December 2004. The third data file also includes the unique MSA card numbers, along with the transaction records from January 2005 to December 2007. Based on each unique MSA card number, these three data files are merged together, and then a complete dataset is generated containing MSA monthly information from January 2002 to December 2007. The fourth data file, containing the enrollees' health information, is provided by Guangzhou Medical Insurance Bureau, which is the official institution in charge of the MSA program in Guangzhou. In July 2007, a new Outpatient Chronic Disease Program is launched for all MSA account holders in Guangzhou. This program lists seven common chronic diseases, including Hypertension (Disease1), Coronary heart disease

(Disease2), Schizophrenia (Disease3), Rheumatoid Arthritis (RA) (Disease4), Parkinson's Disease (PD) (Disease5), Diabetes (Disease6), and Systemic Lupus Erythematosus (SLE) (Disease7) (GuangzhouGovernment, 2007c). Enrollees having one or two of these chronic diseases can receive some subsidies each month in the outpatient sector. This data file contains the name, citizen identity card number, and chronic disease name associated with all qualified MSA account holders who have registered for this chronic disease program prior to the end of December 2007. The previous MSA information dataset is merged with this chronic disease data file based on the enrollees' citizen identity card number. Then a new dataset is generated that includes all the variables for this study.

Initially, this dataset is a monthly database including the following variables: Unique MSA card number, citizen identity card number, ID number, year, month, age, gender, Disease1, Disease2, Disease3, Disease4, Disease5, Disease6, Disease7, monthly contribution, monthly balance, and monthly expenditure. In order to conduct a yearly analysis in this study, this monthly dataset is changed to a yearly dataset and given two more yearly variables: Annual contribution and annual expenditure. Also generated is one new variable in each year's observation called "lag balance", which is an amount equal to the previous year's MSA balance at the end of December. As a result, an original dataset containing the first group of MSA enrollees' yearly information from 2002 to 2007 is ready to analyze.

4.2 Database Description

The objective of this study is to examine how the MSA balance in the previous year affects outpatient utilization in the following year. The MSA program was started in 2002. The original dataset containing the 2003-2007 yearly information includes 859,486 observations. After going through the process of data cleaning, 162,700 problematic samples are excluded from the original number of samples (18.9% = 162,700/859,486).

First, this study focuses on those of the first group of enrollees whose accounts are still active in 2007. During the five years from 2003 to 2007, a small number of account holders quit the MSA program prior to the year 2007. They do not have any contributions made to the MSA after leaving the program. Their accounts do not accumulate over this same period when compared with other account holders used in this study, and as a result they are not qualified samples for this study. According to the policy, annual contributions from 2003 to 2007 include RMB100 "base money" for each qualified MSA account holder (GuangzhouGovernment, 2001). This "base money" is provided by the Social Risk-pooling Fund to ensure that each MSA has enough money in it in the early years. Therefore, the minimum annual contribution each year for all qualified enrollees who are still participating in the MSA program should be over RMB100. According to this criterion, a total of 29,075 (3.38%=29,075/859,486) unqualified employed and retired samples over the five years are excluded.

Second, some outliers are excluded from the original dataset due to making extremely large annual contributions over the five years. According to the policy rules, the maximum annual contribution each year for employed MSA enrollees, even if their personal annual salary exceeds it, is based on 300% of the average yearly salary of all of Guangzhou's employees. This average yearly salary figure that is used to calculate the contribution is announced by the government each year. In 2003, it is RMB 25,104 (GuangzhouGovernment, 2003); in 2004, it is RMB 28,236 (GuangzhouGovernment, 2004); in 2005, it is RMB 31,020 (GuangzhouGovernment, 2005); in 2006, it is RMB 33,840 (GuangzhouGovernment, 2006); and in 2007 it is RMB 36,324 (GuangzhouGovernment, 2007a). After making simple calculations, these numbers can be used to detect certain outliers. Taking the year 2007 as an example, the average yearly salary of all employees in 2007 is RMB 36,324. Contributions to the employees' MSA are made by both employees and employers. Each employee, irrespective of age group, contributes 2%, but the percentage contributed by employers varies according to the age of MSA account holders (1% for those aged below 35; 2% for those aged between 35 and 44; and 2.8% for those aged between 45 and retirement). According to the calculations made, if an employee contributes 2%, and his/her employer contributes the maximum 2.8%, then the total maximum contribution to the MSA allowed in 2007 is: (36,324*300%*2%)*4.8%/2% = RMB 5,230.656. After adding the RMB 100 "base money", the specified maximum total contribution without interest is RMB 5,330.656. After checking with China Everbright Bank, who is managing the MSA,

the highest interest rate for an MSA balance between January 2002 and December 2007 is 3.33%. Therefore, the specified maximum contribution for employed MSA account holders in 2007 is 5330.656*(1+3.33%) = RMB 5,508.1668. Employed samples whose annual contribution in 2007 exceeds RMB 5,508.1668 are considered as outliers. Using the same method for the other four years, the proposed maximum contributions for employed MSA enrollees are RMB 3,838.6847 in 2003; RMB 4,304.7112 in 2004; RMB 4,718.9571 in 2005; and RMB 5,138.5595 in 2006. Accordingly, 3,333 employed samples over the five years are excluded as outliers (0.39%=3,333/859,486).

Third, some outliers in employed samples are also excluded from the original dataset based on an unreasonable balance value over the five years. For example, the MSA balance in December 2006 is used to analyze outpatient utilization in 2007. All employed samples in this study have their first contributions in January 2002. If they do not have any outpatient expense from their accounts since the MSA program begins, the maximum value of the MSA balance that has accumulated up to December 2006 should be equal to a total of five years annual contributions, plus RMB 500 "base money", plus interest. The same interest rate of 3.33% as mentioned before is also used here. In the same way, the maximum values of MSA balances in December 2005, December 2004, December 2003 and December 2002 are used to find any outliers. Based on this criteria, 6,268 employed samples having unreasonable MSA balances over the period of five years are excluded as outliers (0.73%=6,268/859,486).

Fourth, this study only uses retired enrollees, ones who have been retired ever since the MSA was created in 2002. During 2003-2007, there are some samples changing their work status from being employed to being retired. This special group may confuse the actual health behaviors of retired samples with respect to having different MSA balances, because they can have large balance values compared to other retirees. So those who are employed at the start of joining the MSA program, but then retire during any one of the subsequent five years are excluded. This means that 112,266 samples in the original dataset are excluded from this study (13.06%=112,266/859,486).

Fifth, among the remaining retired samples a few unreasonable values with respect to contributions and balances are also found during these five years. As a result, 11,758 problematic retired samples are dropped as outliers (1.37%=11,758/859,486).

Sixth, only samples having all five years' data are used in this study. In the original dataset, observations are not equally split in all years. Some of the original samples have missing records. In addition, if a sample is dropped as an outlier in one year, based on the previous criteria, then this sample should also be excluded from the other four years. Therefore, MSA enrollees with incomplete records for any one year are excluded from the original dataset, thus 123,501 observations are dropped (14.37%=123,501/859,486).

Finally, a balanced panel dataset comprising data from 2003 to 2007 is ready to be analyzed in this study. This final dataset has 573,285 observations and 114,657

samples over the five years. The final sample size is 114,657 MSA enrollees, and this sample size is the same for all years (114,657*5=573,285). Among the 114,657 total samples, 68,251 samples are employed MSA account holders, and 46,406 are retired account holders.

This study only uses data from one year of the above dataset, examining the effect of the MSA balance in December 2006 on outpatient expenditure in the latest year 2007. The reasons for conducting a cross-sectional analysis of the 2007 data are presented as follows: (1) It can solve the problem of reverse causality to a certain extent, using time lag. The dependent variable "Outpatient expenditure" is incurred during the year 2007 only. But the independent variable "MSA balance" in December 2006 is affected by expenditure prior to 2007, and does not include expenditure incurred in 2007. (2) The need factor used in this study only includes chronic condition information for the year 2007, because it is identified by another dataset, the disease dataset of the Outpatient Chronic Disease Program, which started on 1 July 2007. The health status of account holders from 2002 to 2006 cannot be known. (3) When an MSA is implemented in the early years, funds accumulating in the account are limited and thus not large enough to obviously affect an enrollee's health behavior. (4) Enrollees are not familiar with the new MSA policy in the early years, but it can be expected that after five years' implementation they are proficient in its use. Therefore, the effect of the balance on health utilization can be clearly seen in the latest year.

4.3 Operationalization of Constructs

4.3.1 Outpatient Utilization

In this study, the interest lies in identifying the balance of an MSA in a previous year that contributes to explaining the use of outpatient services under the MSA program in the following year. Outpatient services in this study are not exactly the same as services in hospital outpatient departments (OPD) are generally considered. In China, outpatient services can be recognized as the ambulatory care defined in the U.S. health system. "Ambulatory care comprises healthcare services that do not require overnight hospitalization" (Sultz & Young, 2009). Ambulatory care covers a wide range of health services provided by primary care physicians (General practitioners and family practitioners), primary care specialists, hospital outpatient departments, hospital specialty departments, hospital emergency departments, clinical laboratories, dentists, community health centers, and ambulatory surgery centers for the provision of outpatient surgery (Barsukiewicz, Raffel, & Raffel, 2010). These ambulatory services listed above, and Traditional Chinese Medicine (TCM) services in some hospitals for diagnosis and treatment, are all qualified outpatient services paid for by the MSA in Guangzhou. In addition, expenses for filling prescriptions at the hospital's outpatient pharmacy and qualified drug retailers can also be paid by the MSA. So, in this study, consumption of any of the items just mentioned is considered as outpatient utilization.

Outpatient utilization is measured in two aspects: the probability of any outpatient usage and the level of outpatient utilization. The amount of outpatient

expenditure is used to measure the level of outpatient utilization. This research mainly conducts a cross-sectional analysis focusing on outpatient expenditure in the year 2007. Outpatient expenditure during 2007 is approximated by using MSA payments in the year 2007. The reasons are stated as follows. First, only the value of MSA payments for all samples is included in the available dataset, as it contains only the transaction records of each enrollee's MSA. The total amount of expenses paid by the MSA is clearly shown in the dataset. But it is not known whether enrollees pay for any expenditure out of their own pockets, or how much they pay out instead of using their MSA. Second, for the majority of samples the total amounts of MSA payments in 2007 are almost equal to their actual total outpatient spending. According to the data provided by the Bureau of Health in Guangzhou, the total number of outpatient visits to all hospitals is 50,642,154 in 2007 (Guangzhou, 2007b). Guangzhou population officially registered in the same year is 7,701,900 (GuangzhouStatisticsBureau, 2008). So the average number of outpatient visits for the whole population of Guangzhou is 6.58 times (50,642,154/7,701,900=6.58) in the year 2007. In addition, the Bureau of Health also publishes that in 2007 the average outpatient expenditure per visit in Guangzhou is RMB 153 (Guangzhou, 2007a). As a result, it is seen that a Guangzhou citizen's actual outpatient spending in 2007 is on average equal to RMB 1,006.74 (6.58*153=1006.74). In this study, most of the MSA balances of the samples should be enough to cover actual outpatient spending in general. By 2007 the MSA has been accumulating for five years since its creation at the beginning of 2002. The average MSA balance, as at

December 2006, of all the samples used in this study attains to RMB 4,145.694. The value of the MSA balance (December 2006) in 10% percentile is RMB 1,181.99. Thus, more than 90% of the samples' MSA balances are larger than the actual outpatient spending of RMB 1,006.74 as calculated previously. Third, one study demonstrates that enrollees are going to use money in their MSA first, not money from their own pockets, to pay for medical spending when funds in their MSA are sufficient (G. G. Liu, Y. Tang et al., 2009). Therefore, outpatient expenditure 2007, as used in this study, refers to payments out of the MSA in the year 2007.

In this research, the dependent variable is outpatient utilization, which includes whether any outpatient service is used and what the amount of expenditure is on these services for users only. Firstly, one dummy variable "Outpatient Use", indicating whether enrollees use their MSA to pay for any outpatient service, is generated as a dependent variable in the first part. "1" indicates a positive expense from an MSA in 2007, while "0" indicates no use at all of the MSA in 2007. Secondly, "Outpatient Expenditure", indicating the total expenses paid by the MSA in 2007, is included as the dependent variable for positive users, but only in the second part. Since the value of medical expenditure usually has a skewed distribution, the natural logarithm of outpatient expenditure for all samples is used in this study (H. Wang, Yip, Zhang, Wang, & Hsiao, 2005). Outpatient expenditure used in the analysis is a continuous variable, and the period used to analyze it is within the year 2007 for the cross-sectional analysis.

4.3.2 MSA Balance

MSA balance "*BAL*" is the key independent variable in this study to measure the enabling component. When examining the impact on outpatient expenditure, the quadratic term of MSA balance "BAL^2" is also included in the model in order to capture the nonlinear relationship. One year time lag of balance is used in this study, so the value of the MSA balance in the previous year is used in the analysis.

In this 2007 cross-sectional analysis, the value of the MSA balance in December 2006 is employed to measure this key independent variable, which is the balance accumulated since the MSA was created at the beginning of 2002 up until the end of December 2006. All samples in this study accumulate money in their accounts over this same period, a total of five years from 2002 to 2006.

The objective of this research is to examine the impact of the MSA balance at the end of the previous year on outpatient usage and expenditure in the following year. This study focuses on the cross-sectional analysis in the latest year 2007, and it employs in the model the MSA balance in December 2006. The reasons are described below. First, it can, to a certain extent, solve the problem of reverse causality, using time lag. The intensity of outpatient utilization is measured by outpatient expenditure incurred within the year 2007. But the value of the MSA balance in December 2006 is related to expenditure prior to 2007, thus not including 2007 expenditure. Second, except for the year 2007, which the dependent variable uses, using the value of the MSA balance in the latest year can be better to capture the effect on the dependent variable. When the MSA accumulates in the early years,

the funds in the account are limited, and are not enough to obviously affect the enrollee's health behavior in the outpatient sessions. Third, enrollees are not familiar with the new MSA policy at the initial implementation stage, so in the early years they may not use the MSA appropriately. But after five years, we expect that all enrollees can be proficient in using their MSA. Fourth, as far as is known, no one uses the MSA balance as an enabling measurement in English papers prior to this one. But two Chinese papers previously mention the MSA balance. They use the initial funds in the MSA at the beginning of each year as the value of the MSA balance in the analysis (G. G. Liu, T. T. Tang et al., 2009; G. G. Liu, Y. Tang et al., 2009). It is understood that the value of the previous year's final balance is almost the same as the current year's starting value. This also confirms that the balance value used in this study is appropriate.

"MSA balance" is a continuous variable, and its range among the samples is extremely large. The original unit of the MSA balance is one yuan (RMB 1). With regard to the balance value in December 2006, the minimum value is only RMB 0.6, while the maximum value reaches RMB 20,143.73. Therefore, the units of measurement of the MSA balance are changed by dividing the RMB 1,000, so that the MSA balance is measured in thousands of RMB. The unit of measurement of the MSA balance used in the analysis is RMB 1,000 (around US$128).

4.3.3 Chronic Conditions

The presence of doctor-diagnosed chronic conditions is employed to measure the need factor in the model. A dummy variable "CHRONIC" indicating whether the sample has any doctor-diagnosed chronic condition in 2007 is constructed. This indicator variable takes on a value of one if the account-holders have records under at least one of the following seven chronic diseases in the dataset, and is zero otherwise. These chronic diseases, regulated by Outpatient Chronic Disease Program in Guangzhou, are Hypertension (Disease1), Coronary heart disease (Disease2), Schizophrenia (Disease3), Rheumatoid Arthritis (RA) (Disease4), Parkinson's disease (PD) (Disease5), Diabetes (Disease6), and Systemic Lupus Erythematosus (SLE) (Disease7). Samples having one of these chronic diseases are diagnosed by professional doctors in the hospitals. Only when MSA enrollees have a doctor's certificate can they join this Outpatient Chronic Disease Program (GuangzhouGovernment, 2007c). Accordingly, this variable measures the evaluated need characteristics, not the perceived need factors. It indicates professional judgment and objective measurement about the samples' physical status and need for healthcare. Since this chronic disease program only starts in July 2007, the dataset only contains the record of chronic conditions in the year 2007.

4.3.4 Control Variables

Age

The actual age of all MSA enrollees is shown in the dataset. In this study, enrollees are also categorized into four age groups, using four age dummy variables,

consistent with the regulation as to different contribution rates put into the MSA. "AGE1" is coded as one if the sample's age is under 35, zero otherwise. If the age is between 35 and 45, "AGE2" equals one and zero otherwise. If a sample's age is above 45 but does not yet reach his/her legal retirement age, then he/she belongs to the group "AGE3". In China, the retirement age for female employees and male employees is not the same. Women retire at 55, while men can retire at 60. "AGE4" is constructed to indicate the retired MSA enrollees in the total sample. If the age of a female sample is above 55, or the age of a male sample is above 60, this dummy variable "AGE4" is coded as one. Otherwise, it equals zero. Age dummy variables are included in all models except for retired samples. When conducting the analysis for retired MSA enrollees, the samples' actual age "AGE" is used in the model as a control variable.

Gender

Gender is also entered as a dummy variable "FEMALE". If MSA enrollees are females, then this variable is defined as one. If MSA enrollees are males, then this variable is coded as zero.

4.4 Empirical Models

4.4.1 Introduction of Two-Part Model

A Two-part model (Duan, Manning, Morris, & Newhouse, 1983; Manning, Duan, & Rogers, 1987; Manning, Newhouse et al., 1987) is used to empirically assess the impact of the MSA balance on outpatient utilization as measured by

outpatient expenditure in this study. A central argument with the Two-part model is based on the assumption that healthcare users and non-users will follow different distributions (G. G. Liu et al., 1999). People often model healthcare use in a two-step process using a two-equation model: One for the likelihood of any use, and the other for the level of use given that one is using care. Accordingly, the model will decide the probability of having any use in the first part of the model. Then, in the second part, the model will decide on the level of expenditure for the users only. Manning, Duan and Rogers (1987) point out that data of medical care expenditure typically exhibits many observations clustered at zero, but that the rest of the observations are often positive and highly skewed. Without the first part of the model, the analysis may have the problem of potential sample selection bias, because the used sample would exclude individuals who do not report paying for medical care. As a result, this two-part model that separates health behavior into two stages is appropriate for analyzing medical expenditure: First a decision to have positive expenditure, and then a decision about the level of expenditure, conditional on its being positive (Duan et al., 1983). Furthermore, this study aims to examine the MSA system after it has been implemented. Diehr et al. (1999) suggests that when the study goal is to understand the system, the two-part model is recommended because "it permits the investigator to distinguish factors that affect the propensity to use any service from factors that affect volume of utilization once the person has entered the system". Therefore, a two-part model is used in this study to analyze the impact of the MSA balance on outpatient utilization.

The two-part model involves two parts of estimation. In the first part, a probability model is used to estimate the probability of having any use, which means incurring any medical expenditure. Then the second part examines the level of medical expenditure among users. Literatures on health services utilization measured by expenditure often adopt this two-part model (Bao, 2002; L. Chen, Yang, Lee, Chang, & Yeh, 2004; Hotchkiss, Hutchinson, Malaj, & Berruti, 2005; Huh, Rice, & Ettner, 2008; T. F. Lin, 2008; G. G. Liu et al., 1999; Mocan, Tekin, & Zax, 2004; Propper, Eachus, Chan, Pearson, & Davey Smith, 2005; Seshamani & Gray, 2004; H. Wang et al., 2005; Werblow, Felder, & Zweifel, 2007; Yip & Berman, 2001). In the first part of the model, previous studies usually employ a logit model or a probit model to measure whether or not to use health services. If it is assumed that the error term has a standard logistic distribution, the logit model will be used; if it is assumed that the error term has a standard normal distribution, the probit model will be used (Culyer & Newhouse, 2000). In the second part, the majority of studies estimate medical expenditure conditional on positive use using Ordinary Least Squares (OLS) linear regression. Since medical expenditure usually has a skewed distribution, the natural logarithm of medical expenditure is often used in this model (H. Wang et al., 2005). In addition, there are a few studies employing the Generalized Linear Model (GLM) in the second part of the model (Bao, 2002; T. F. Lin, 2008). Bao (2002) reports that the adoption of different approaches, especially that of the OLS-based and the GLM-based models, does not lead to significantly different results. Therefore, it suggests that results are insensitive to model selection.

4.4.2 Major Regression Models

Test how the MSA balance affects outpatient utilization among all enrollees, employed enrollees, and retired enrollees (Research Question 1)

At first, this study employs a two-part model to examine the impact of the MSA balance on outpatient expenditure for all samples. Then, all samples are categorized into two sub-samples, employed MSA enrollees and retired MSA enrollees, in order to see if the effect of the MSA balance is different between these two groups. Accordingly, the same two-part model is also applied separately to employed samples and retired samples. In this study, the two-part model first uses logistic regression to estimate the probability of having any outpatient usage in the year. Then the OLS model on the log scale is employed to examine how the MSA balance affects outpatient expenditure for those enrollees who are users only.

Part one: Using the logit model in this study, the first part of the two-part model can estimate the change in probability of MSA enrollees incurring any positive expenditure from their MSA in the year when their account balances change, holding other factors fixed. The dependent variable is a dummy variable "USE", suggesting whether an MSA enrollee has any outpatient use in the year. "USE=1" indicates the sample has positive expense from his MSA in the year, while "USE=0" indicates no outpatient use in the year. Based on the results of this logistic regression, the probability of any outpatient usage can be estimated.

$$\text{Logit}\left\{\text{P}(USE=1)\right\} = \alpha + \gamma X = \alpha + \gamma_1 BAL + \gamma_2 BAL^2 + \gamma_3 CHRONIC + \gamma_4 AGE + \gamma_5 FEMALE + \nu \quad (1)$$

$$\text{Probability}(USE = 1 \mid X) = \frac{\exp(\alpha + \gamma X)}{1 + \exp(\alpha + \gamma X)}$$

BAL = the value of the MSA balance in the previous year, and the unit of BAL in the analysis is RMB 1,000. In the 2007 cross-sectional analysis, it is the value of the MSA balance in December 2006.

BAL^2 = the quadratic term of the MSA balance in the previous year; equals BAL * BAL.

CHRONIC = a dummy variable for the presence of chronic conditions, equals 1 if having at least one of seven chronic diseases in 2007.

AGE = the real age of MSA enrollees in the current year

AGE1 = a dummy variable equals 1 if the sample's age <= 35, and 0 otherwise.

AGE2 = a dummy variable equals 1 if 35 < age <= 45, and 0 otherwise.

AGE3 = a dummy variable equals 1 if 45 < age <=Retirement age, and 0 otherwise. The retirement age for a male is 60, while retirement age for a female is 55.

AGE4 = a dummy variable equals 1 if the sample's age > Retirement age, and 0 otherwise. Samples belonging to this age category are retired MSA enrollees.

FEMALE = a dummy variable equals 1 if the MSA enrollee is female, and 0 otherwise.

Part two: Outpatient expenditure, conditional on using outpatient services, is then estimated in the second part using Ordinary Least Squares (OLS) regression. Since medical expenditure has a skewed distribution, the natural logarithm of outpatient expenditure is used in this model. The dependent variable in this part is "ln(EXP)", indicating the natural logarithm of outpatient expenditure from the MSA in the examined year. All independent variables in the part one model are also used in this part two model. Then, among outpatient users, the nonlinear relationship between the MSA balance and outpatient expenditure is analyzed using the regression below.

$$\ln(EXP \mid USE = 1) = \alpha + \beta_1 BAL + \beta_2 BAL^2 + \beta_3 CHRONIC + \beta_4 AGE + \beta_5 FEMALE + \varepsilon \quad (2)$$

All the independent variables follow the definitions given in model (1).

In order to test the nonlinear relationship between the MSA balance and outpatient expenditure, the first order term of MSA balance " BAL " and the quadratic term of balance " BAL^2 " are both included in the regression model. β_1 is the coefficient of the first order BAL, and β_2 is the coefficient of the quadratic term BAL^2. The coefficient β_1 indicates the overall linear trend (positive or negative) in the relationship between the MSA balance and outpatient expenditure across the observed data (Aiken & West, 1991). If the linear trend is predominantly positive, β_1 is positive; if the trend is predominantly negative, then β_1 is negative. On the other hand, the direction of curvature is suggested by the coefficient β_2 : if the

relationship is concave upward, then β_2 is positive; if the relationship is concave downward, then β_2 is negative (Aiken & West, 1991).

If the curvilinear relationship is detected, the marginal effect of the MSA balance "*BAL*" on expenditure is the first derivative of the curve with respect to *BAL*, evaluated at one value of *BAL*, when holding other factors fixed (Aiken & West, 1991). Therefore, the change in outpatient expenditure for one unit change in MSA balance depends upon the value of MSA balance.

The expression for this marginal effect of MSA balance is: $\beta_1 + 2\beta_2 BAL$

This study reports the marginal effect at five different points, when the value of "*BAL*" is equal to 5% percentile, 25% percentile, 50% percentile, 75% percentile, and 95% percentile. Depending on these five values of *BAL*, we can measure how the effect of the MSA balance on expenditure changes along the curve.

The minimum or maximum point of the curve can be calculated by the expression below. When β_2 is positive, this point is the value of MSA balance at which predicted expenditure (on the log scale) takes on its lowest value; when β_2 is negative, predicted expenditure (on the log scale) attains the highest value at this point (Aiken & West, 1991).

The expression for Minimum or Maximum point of the curve: $Min/Max = -\frac{\beta_1}{2\beta_2}$

This study focuses on the latest one year data, and conducts the cross-sectional analysis to examine the impact of the MSA balance on 2007 outpatient expenditure.

Test whether the impact of the MSA balance on outpatient utilization is different among different income groups (Research Question 2)

The sample for research question 2 is confined to those employed samples who are still working. In order to examine whether income level affects the relationship between MSA balance and outpatient utilization, employed samples are divided into four income sub-groups based on annual contribution to MSA.

The amount of annual contributions to the MSA in the year 2007 is used as a proxy for the samples' income levels, because it is computed using a certain percentage of the previous year's annual salary. For employees, contributions to the MSA are made by both employees themselves and their employers, based on the individual's previous year's annual salary. But for retirees, only their employers should make a contribution, and the basis for computation is the previous year's average yearly salary of all employees in the city. As a result, only employed enrollees' contribution to the MSA reflects their actual income levels.

This study mainly examines the effect on outpatient utilization in the latest year 2007, so the value of "Annual Contribution in 2007" is used as the criterion for dividing the employed samples into different income sub-groups. The method of three steps for categorizing these employed samples into four income groups based on the value of "Annual Contribution in 2007" is presented as follows.

First, the annual contribution of all employed samples in 2007 is divided up. The annual contribution to the MSA of employed enrollees includes two parts. One part is from the enrollees themselves, and the other part is from their employers.

According to the policy, the percentage put into the MSA varies according to the age of account holders (GuangzhouGovernment, 2001). But the base for the computation is the same, it being equal to each enrollee's annual salary for the previous year. Different percents constituting the annual contribution for all age groups are shown below.

Table 4.1 MSA Contribution Constitution by Age Groups for Employees

	MSA Annual Contribution Constitution	
	Employee Part (Personal Contribution)	Employer Part
Age<=35	2%	1%
35<Age<=45	2%	2%
45<Age<＝Retirement age	2%	2.8%

Note: For males, the retirement age is 60. For females, the retirement age is 55.
Source: (GuangzhouGovernment, 2001)

Second, referring to the different percentages regulated by the policy, the "Personal Contribution", which is made only by the employees themselves, is calculated. Here is the method used to generate the value of "Personal Contribution" for employed samples.

- If Age<=35, Personal Contribution=Annual Contribution * (2/3)
- If 35<Age<=45, Personal Contribution=Annual Contribution * (2/4)
- If 45<Age<=Retirement age, Personal Contribution=Annual Contribution * (2/4.8)

A male's retirement age is 60, while a female's retirement age is 55. According to the policy, each employed enrollee is required to contribute 2 percent of the previous year's annual salary to his/her personal MSA (GuangzhouGovernment, 2001). Thus, this 2 percent "Personal Contribution" indicates the actual income level of each employed enrollee in the year 2006.

Third, employed samples are divided into four income sub-groups, based on the value of their "Personal Contribution" calculated previously, using three boundaries. The annual contribution in 2007 is calculated according to the 2006 income information. In 2006, the average annual salary of all employees in Guangzhou is RMB 33,840, as published by the government (GuangzhouGovernment, 2006), and RMB 33,840 * 2% = RMB 676.8 is one boundary for dividing up the income groups. According to the policy, if enrollees' personal annual salary is lower than 60% of the average yearly salary of all employees in the city, then 60 percent should be used as the base to calculate the MSA contribution (GuangzhouGovernment, 2001). In this case the lower boundary is RMB 33,840 * 60% * 2% = RMB 406.08. The MSA also has a maximum contribution ceiling. If one's personal annual salary is higher than 300% of the average yearly salary of all employees in the city, then 300 percent should instead be used as the base for computation (GuangzhouGovernment, 2001). As a result, the higher boundary is RMB 33,840 * 300% * 2% = RMB 2,030.4. Based on these three boundaries, all employed samples are categorized into four income groups.

Table 4.2 Criteria for Dividing Employed Enrollees into Four Income Groups

Income 1	Personal Contribution <= Average Yearly Salary * 60% * 2%
(Lowest)	Personal Contribution <= RMB 406.08
Income 2	Average Yearly Salary * 60% * 2% < Personal Contribution <= Average Yearly Salary * 2%
(Medium Low)	RMB 406.08< Personal Contribution <= RMB 676.8
Income 3	Average Yearly Salary * 2% < Personal Contribution < Average Yearly Salary * 300% * 2%
(Medium High)	RMB 676.8 < Personal Contribution < RMB 2030.4
Income 4	Personal Contribution >= Average Yearly Salary * 300% * 2%
(Highest)	Personal Contribution >= RMB 2030.4

Note:
1. "Personal Contribution" is the 2% part of one's "Annual Contribution in 2007". A personal contribution is made only by employed samples themselves.
2. "Average Yearly Salary" is the average yearly salary of all employees in the city in 2006 as published by the government.

According to the criteria above, four income dummy variables are generated in the dataset. "Income 1" is recorded as "1" for the lowest income group, whose annual salary is around 60% of the society's average level. Otherwise, this variable is coded as "0". Employed samples' with an annual salary above 60% of the social level, but lower than the whole city's average salary level belong to the medium low income group "Income 2" and coded as "1" for this dummy variable. The medium high income group includes those employed samples whose salary exceeds the average level of all employees in the city, but is lower than three times that level. If the sample belongs to this medium high income group that is over the average income level, the dummy variable "Income 3" is recorded as "1" and "0" otherwise. "Income 4", coded as "1", represents the highest income group, whose salary is

equal to or more than three times the average yearly salary of all employees in the city. Many previous studies divide the different income groups using the quantile of the whole sample achieved. But this study divides into four income sub-groups, based on the actual income level of society in reality. So the number of employed samples in the four income sub-groups is not the same. The majority of employed samples fall into the two medium income groups “Income 2” and “Income 3”.

Thus, four sub-samples reflecting four different income levels are generated: the lowest income group (Income1), the medium low income group (Income2), the medium high income group (Income3), and the highest income group (Income4). In each income group, the same two-part model, including logit and OLS regressions, is used separately, and the methods for analyzing the impact of the MSA balance are the same as the method for testing all enrollees, employed enrollees and retired enrollees. So after comparing the results of these four income sub-groups, it can be seen whether the effect of the MSA balance on outpatient utilization is different among the different income groups.

Test whether the needs of MSA enrollees with chronic conditions are adequately met under the MSA program (Research Question 3)

The presence of chronic conditions is supposed to moderate the relationship between the MSA balance and outpatient utilization. Possible interaction effects between the chronic condition and the MSA balance are captured through two dummy variable interaction terms. Then the new two-part model is as shown below:

Part one:

$$\text{Logit}\{\text{P}(USE=1)\} = \alpha + \gamma_1 BAL + \gamma_2 BAL^2 + \gamma_3 CHRONIC + \gamma_4 BAL * CHRONIC + \gamma_5 BAL^2 * CHRONIC + \gamma_6 AGE + \gamma_7 FEMALE + \nu$$

(3)

The dummy variable "CHRONIC" indicates a sample's chronic condition.

(1) Logit Model: If having chronic diseases CHRONIC=1:

- The coefficient of first order term BAL is $(\gamma_1 + \gamma_4)$
- The coefficient of quadratic term BAL^2 is $(\gamma_2 + \gamma_5)$

(2) Logit Model: If no chronic diseases CHRONIC=0:

- The coefficient of first order term BAL is γ_1
- The coefficient of quadratic term BAL^2 is γ_2

Part two:

$$\ln(EXP \mid USE=1) = \alpha + \beta_1 BAL + \beta_2 BAL^2 + \beta_3 CHRONIC + \beta_4 BAL * CHRONIC + \beta_5 BAL^2 * CHRONIC + \beta_6 AGE + \beta_7 FEMALE + \varepsilon$$

(4)

The dummy variable "CHRONIC" indicates a sample's chronic condition.

(1) OLS Model: If having chronic diseases CHRONIC=1:

- The coefficient of first order term BAL is $(\beta_1 + \beta_4)$
- The coefficient of quadratic term BAL^2 is $(\beta_2 + \beta_5)$

(2) OLS Model: If no chronic diseases CHRONIC=0:

- The coefficient of first order term BAL is β_1
- The coefficient of quadratic term BAL^2 is β_2

All analyses are carried out using STATA version 10.

In the following part, this study first analyzes the effect of MSA balance among: (a) all enrollees, (b) employed enrollees, and (c) retired enrollees. A two-part model (logistic + OLS) is employed to estimate the effect of balance on (1) the probability of outpatient service usage and (2) the level of expenditure. In order to determine whether income affects the relationship between balance and expenditure, employed enrollees are then further divided into four income sub-groups. The same two-part model is used to analyze the impact of balance within each income group. Finally, the balance-expenditure relationship is examined alongside the need factor, which is measured by the presence of chronic conditions as the moderator.

CHAPTER5 RESULTS

This chapter initially shows the descriptive statistics of all variables included in the analysis. Then the regression results of the two-part model, which examines the effect of MSA balance on the probability of usage in the first part, and the effect on the incurred level of expenditure in the second part, are presented in three parts corresponding to the three research questions: (1) the impact of MSA balance on outpatient utilization among all enrollees, employed enrollees and retired enrollees, (2) the different effects of the balance on outpatient utilization among four income sub-groups, and (3) the moderating effect of chronic conditions on the relationship between MSA balance and outpatient utilization.

5.1 Descriptive Statistics

This study examines the impact of the MSA balance on outpatient utilization in 2007. Samples are the first group of MSA enrollees since the MSA program is initiated in January 2002. The total sample size is 114,657 MSA enrollees. Among them, 68,251 (59.5%) are employed enrollees, and 46,406 (40.5%) are retired enrollees. Table 5.1 describes the summary statistics of all variables for all samples in the year 2007. Regarding all samples, the mean outpatient expenditure from the MSA in 2007 is RMB 1081.049. Some people do not incur any expense, but one person can spend RMB 22,397.43 in a year. The value of the MSA balance used in the analysis is the balance accumulated from January 2002 until December 2006. The mean value of the MSA balance in December 2006 is RMB 4,145.694. The

minimum balance value of all samples is only RMB 0.6, while the maximum balance can reach RMB 20,143.73. The average age of all MSA enrollees is 57 years, and age is spread over a wide range: 7.9% are under 35, 14.8% are between 35 and 45, 36.8% are between 45 and retirement age, and 40.5% are above retirement age. In China, retirement age for females is 55, while retirement age for males is 60. In addition, gender is almost equally split between females and males.

In particular, in this study the number of samples having chronic conditions is relatively small. There are only 8.4% samples having at least one of seven designated chronic diseases in 2007. This is because the original MSA information dataset does not include the health status of each enrollee. This chronic disease information is identified by another chronic disease dataset from the Outpatient Chronic Disease Program initiated on 1 July 2007. Under this program, only MSA enrollees who have professional doctor's certificates demonstrating that they have one or two of seven regulated chronic diseases can be registered in this chronic disease dataset and be entitled to additional subsidies each month. It is possible that some chronic patients do not join this program because they cannot get the doctor's certificate, or they still do not know that they are eligible for this subsidized program due to its limited implementation period. In this case, these MSA enrollees with chronic conditions may be categorized into a non-chronic group, which can then underestimate the actual number of chronic patients in reality. In addition, only seven chronic diseases are included in this subsidized program. Maybe some

enrollees having other types of chronic diseases are also categorized into a non-chronic group.

Regarding the employed samples and retired samples, the mean outpatient expenditure in 2007 for retired samples is RMB 1,388.371, which is higher than the RMB 872.0913 for employed samples. But the maximum expenditure value for retired samples is RMB 9,991.93, only about half of the employed one's. At the end of December 2006, employees' balance value is higher than retirees'. The mean balance value is RMB 4,445.258 for employed ones, and RMB 3,705.115 for retired ones. The maximum value of retired people's balance attains RMB 7,904.21. In addition, employed samples have better health status than retired samples. Only 3.5% of employed samples report at least one of the seven chronic diseases, but 15.7% of the retired samples are chronic disease patients. The average age of retired samples is older than employed samples. Employed samples include more males, whereas retired samples have more females.

Within the employed samples, MSA enrollees are also divided into four income sub-groups: the lowest income group (Income1); the medium low income group (Income2); the medium high income group (Income3); and the highest income group (Income4). Summary statistics of these four income groups is presented in Table 5.2 below. The mean outpatient expenditure in 2007 for Income3 and Income4 are almost twice that of the lowest income group, Income1. The maximum expenditure for Income1 is only RMB 4,820.32, but the maximum expenditure value in the highest income group, Income4, is as high as RMB 22,397.43. Up to

December 2006, the higher income group has a higher mean MSA balance value. The mean balance value is RMB 2,542.007 for Income1, RMB 3,248.358 for Income2, RMB 5,110.035 for Income3 and RMB 10,421.93 for Income4. With respect to health status, the medium high income group, Income3, has the most chronic MSA enrollees among the four income groups, about 4.6% of enrollees in this income group having one of the seven chronic diseases. The age distribution is similar among all four income groups, and the mean age for all groups is around 45. Income3 includes slightly more female enrollees, but in the other three income groups male MSA enrollees number more than female ones.

Table 5.1 Statistical Summary of All Enrollees, Employed Enrollees and Retired Enrollees

	All Enrollees (n=114,657)	**Employed Enrollees (n=68,251)**	**Retired Enrollees (n=46,406)**
Dependent Variable			
Outpatient Expenditure in 2007			
Mean	RMB 1,081.049	RMB 872.0913	RMB 1,388.371
Std. Dev.	RMB 1,110.756	RMB 1,057.586	RMB 1,115.662
Minimum	RMB 0	RMB 0	RMB 0
Maximum	RMB 22,397.43	RMB 22,397.43	RMB 9,991.93
Independent Variable			
MSA Balance in December 2006			
Mean	RMB 4,145.694	RMB 4,445.258	RMB 3,705.115
Median	RMB 3,757.46	RMB 3,828.68	RMB 3,632.46
Std. Dev.	RMB 2,739.91	RMB 3,111.452	RMB 1,995.93
Minimum	RMB 0.6	RMB 1.45	RMB 0.6
Maximum	RMB 20,143.73	RMB 20,143.73	RMB 7,904.21
Chronic Conditions			
Yes	8.4%	3.5%	15.7%
No	91.6%	96.5%	84.3%
Age			
Mean	57	47	72
<=35	7.9%	13.3%	
35-45	14.8%	24.9%	
45-Retirement Age	36.8%	61.8%	
>Retirement Age	40.5%		
Gender			
Female	52.9%	48.6%	59.2%
Male	47.1%	51.4%	40.8%

Note: 1. Retirement Age: Male is 60, Female is 55.
2. All monetary values are in RMB. 1 US$=7.3047RMB (31Dec2007)

Table 5.2 Statistical Summary of the Four Income Groups within Employed Enrollees

	Income1 (Lowest) (n=5,002)	**Income2 (Medium Low) (n=26,876)**	**Income3 (Medium High) (n=33,077)**	**Income4 (Highest) (n=3,296)**
Dependent Variable				
Outpatient Expenditure in 2007				
Mean	RMB 567.9817	RMB 718.1713	RMB 1,028.299	RMB 1,021.071
Std. Dev.	RMB 681.2709	RMB 828.8071	RMB 1,164.045	RMB 1,630.247
Minimum	RMB 0	RMB 0	RMB 0	RMB 0
Maximum	RMB 4,820.32	RMB 7,830.34	RMB 16,908.33	RMB 22,397.43
Independent Variable				
MSA Balance in December 2006				
Mean	RMB 2,542.007	RMB 3,248.358	RMB 5,110.035	RMB 10,421.93
Median	RMB 2,659.705	RMB 3,225.96	RMB 4,661.75	RMB 10,572.41
Std. Dev.	RMB 1,238.142	RMB 1,600.494	RMB 3,047.192	RMB 5,171.755
Minimum	RMB 2.04	RMB 1.45	RMB 2.07	RMB 30.92
Maximum	RMB 4,690.6	RMB 7,477.17	RMB 20,043.74	RMB 20,143.73
Chronic Conditions				
Yes	1.1%	2.8%	4.6%	1.9%
No	98.9%	97.2%	95.4%	98.1%
Age				
Mean	45	47	47	42
<=35	13.6%	11.3%	13.6%	26.1%
35-45	30.6%	27.2%	20.9%	39.3%
45-Retirement Age	55.8%	61.5%	65.5%	34.6%
Gender				
Female	41.6%	43.8%	55.2%	31.1%
Male	58.4%	56.2%	44.8%	68.9%

Note: 1. Retirement Age: Male is 60, Female is 55.
2. All monetary values are in RMB. 1 US$=7.3047RMB (31Dec2007)

5.2 Regression Results for Impact of MSA Balance

In order to examine the impact of the MSA balance on outpatient expenditure in 2007, this study first conducts the two-part model for all MSA enrollees. Then all

samples are categorized into two different groups: employed MSA enrollees and retired MSA enrollees. The same two-part model is employed to study the effect of the MSA balance in these two groups separately.

5.2.1 Results for All MSA Enrollees

All Samples Part One Results:

MSA Balance:

A two-part model is conducted for all samples. In the first part, the logit model is used to examine how the MSA balance in the previous year affects the decision to use any outpatient service in the year 2007. The results are shown in Table 5.3 below. The first order term BAL (γ_1 = -0.4501, p<0.001) is significantly negative, while the quadratic term BAL^2 (γ_2 = 0.0176, p<0.001) is significantly positive. In order to more easily see the effect of the MSA balance on the decision to use any services, the predicted probability is plotted using the estimated coefficients from the logit model in Table 5.3 below. The predicted probability of using services can be obtained as a function of BAL and BAL^2 using the formula below, when holding all other variables at their mean,

$$\text{Probability}(USE = 1 \mid X) = \frac{\exp(\alpha + \gamma X)}{1 + \exp(\alpha + \gamma X)}$$

where $\alpha + \gamma X$ is the model (1) in the previous chapter.

Regarding all samples in this study, the MSA balance is measured in thousands of RMB (RMB1,000), and ranges from 0.0006 thousands of RMB to 20.14373

thousands of RMB. Therefore, Figure 5.1 below illustrates how the predicted probability changes as the MSA balance increases from 0 to 20.2 thousands of RMB. Generally, the probability of usage is predicted to decrease as the MSA balance increases. But after the balance accumulates to a large amount, MSA enrollees become more likely to use outpatient services. Among all 114,657 samples, there are 99,486 MSA account-holders (86.77%) using any outpatient service in the year 2007. So the probability of using outpatient services is high for all samples.

Figure 5.1: Effect of Balance on Probability of Usage Graph: All Enrollees

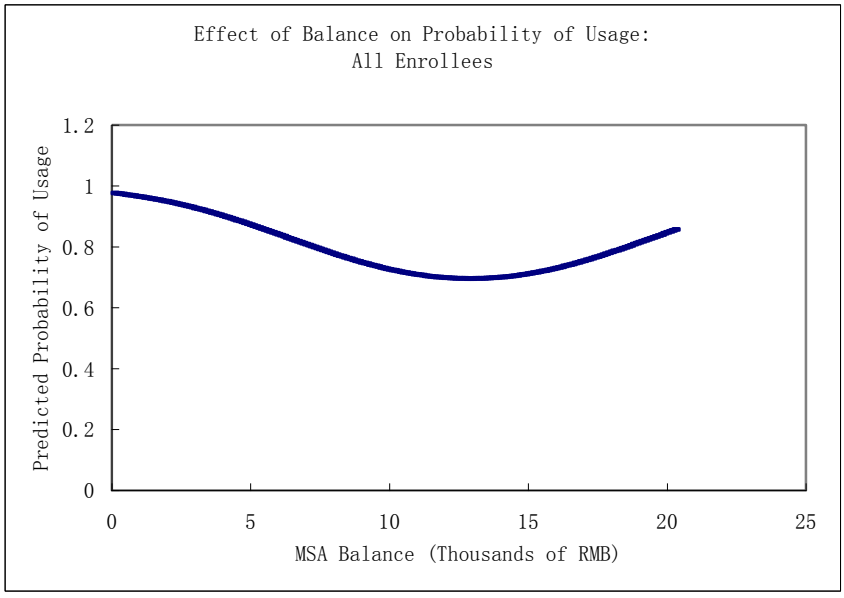


Table 5.3 Effect of Balance on Probability of Usage Result: All Enrollees

All Samples Part One: Probability of Use (Logit Model)		
	Coefficient	Odds Ratio
BAL	-0.4501 (0.0090)***	
BAL^2	0.0176 (0.0005)***	
CHRONIC	1.9003 (0.0937)***	6.6877
AGE1 (<=35)	-0.3383 (0.0318)***	0.713
AGE3 (45-55/60)	0.6264 (0.0241)***	1.8708
AGE4 (>55/60)	1.2165 (0.0275)***	3.3754
FEMALE	0.3512 (0.0190)***	1.4208
_cons	2.6652 (0.0361)***	
Pseudo R^2	0.1279	
N	114,657	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

All Samples Part One Results:

Control variables:

Except for the key variable "MSA balance", the coefficients of all other control variables are translated into odds ratio, in order to interpret them more easily. Odds ratio is defined as the ratio of the odds of an event occurring in one group to the odds of this event occurring in another group. An odds ratio equal to one

suggests that the event is equally likely to occur in both groups. If an odds ratio is larger than one, then the event is more likely to occur in the first group. If an odds ratio is smaller than one, then the event is less likely to occur in the first group. In the analysis for all samples, all control variables are statistically significant at 0.1% significant level. Among them, a chronic condition has a positive effect on the decision to use any service. The odds ratio of dummy variable CHRONIC (OR=6.6877, p=0.000) suggests that the odds of using services for MSA enrollees having one of seven chronic diseases are 6.6877 times that of those without chronic conditions, when holding all other variables constant. Therefore, the need factor is a very important predictor in determining use or non-use. In addition, four age dummy variables AGE1 (age<=35), AGE2 (35<age<=45), AGE3 (45<age<=Retirement age) and AGE4 (age>Retirement age) are included in the model to measure the age effect. The retirement age is 55 for female MSA enrollees and 60 for male enrollees. The dummy variable AGE2 is excluded as the reference group. Compared with those aged between 35 and 45 (AGE2), MSA enrollees aged below 35 (AGE1: OR=0.713, p=0.000) are less likely to use outpatient services, but enrollees aged between 45 and retirement age (AGE3: OR=1.8708, p=0.000) are more likely to use them. For AGE4 group, those retired MSA enrollees (AGE4: OR=3.3754, p=0.000), the odds of people in this age group using outpatient services are more than three times that of people in the AGE2 group. With respect to gender effect, the odds ratio of FEMALE (OR=1.4208, p=0.000) indicates that the odds of using outpatient services

for female MSA enrollees are 1.4208 times that of male enrollees, holding all other variables constant.

All Samples Part Two Results:

MSA Balance:

In the second part, a log linear regression including the first order term BAL and the quadratic term BAL^2 is used to analyze the nonlinear relationship between MSA balance and outpatient expenditure. The coefficient of BAL and BAL^2 are both very statistically significant. The coefficient of first order term BAL is negative ($\beta_1 = -0.1298$, p=0.000), while the coefficient of quadratic term BAL^2 is positive ($\beta_2 = 0.0075$, p=0.000). So the relationship between MSA balance (BAL) and the natural log of outpatient expenditure (ln(EXP)) for all samples is nonlinear. The trend is predominantly negative, and the relationship is concave upward. As mentioned in the method part, the marginal effect of MSA balance (BAL) depends upon the value of BAL at five different points. Regarding the samples who are outpatient users during the year, the marginal effect is presented in Table 5.17 below. When BAL is equal to RMB 650.31 (5% percentile), an RMB 1,000 increase in MSA balance results in a decrease in outpatient expenditure of approximately 12.0% (12.0%=100 * 0.120). At 25%, 50%, 75% and 95% percentiles of BAL value, when the MSA balance increases by RMB 1,000, then outpatient expenditure reduces by about 9.8%, 7.6%, 5.3% and 1.5% respectively.

Table 5.17: Marginal Effect of MSA Balance on Outpatient Expenditure: All Enrollees

Marginal Effect of MSA Balance on Outpatient Expenditure: All MSA Enrollees				
Total Sample	BAL Value (The units: RMB1)	BAL Value (The units: RMB 1,000)	Marginal Effect: $\beta_1 + 2\beta_2 BAL$	Percentage Change in Expenditure $100*(\beta_1 + 2\beta_2 BAL)$
5% percentiles	RMB 650.31	RMB 0.65031	-0.120	Decrease 12.0%
25% percentiles	RMB 2,150.76	RMB 2.15076	-0.098	Decrease 9.8%
50% percentiles	RMB 3,565.955	RMB 3.565955	-0.076	Decrease 7.6%
75% percentiles	RMB 5,150.06	RMB 5.15006	-0.053	Decrease 5.3%
95% percentiles	RMB 7654.47	RMB 7.65447	-0.015	Decrease 1.5%

Since the curvilinear relationship between the MSA balance and outpatient expenditure is detected, the turning point of the MSA balance can be calculated. Because the coefficient sign of quadratic term BAL^2 is positive, the curve has a minimum point. Then 8.658 ($Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.1298}{2*0.0075} = 8.653$) is the value of the MSA balance (the unit is RMB 1,000) at which the predicted outpatient expenditure takes on its lowest value. After changing the unit of the MSA balance back to RMB 1, the curve would change when the MSA balance attains RMB 8,653. The range of MSA balance for all samples in part two is from RMB 0.6 to RMB 20,143.73. So the turning point falls within the observed range of the MSA balance. For all samples, the relationship between MSA balance and outpatient expenditure is negative when the balance value is less than the turning point RMB 8,653. But after

exceeding this turning point, the relationship between MSA balance and outpatient expenditure becomes positive. People with a greater MSA balance spend more on outpatient services. The effect of the MSA balance on outpatient expenditure for users is plotted in Figure 5.2. This figure can help visualize the effect and give a better interpretation of the results. Using the estimated coefficients from the OLS model in Table 5.4 below, the predicted natural logarithm of outpatient expenditure is obtained using model (2) as a function of BAL and BAL^2 with a range from 0 to 20.2, and all other control variables taking the mean value. Then the predicted natural logarithm of outpatient expenditure is changed back to the original expenditure value using the formula: $Expenditure = \exp[\ln(Expenditure)]$. Therefore, how the MSA balance affects outpatient expenditure can be shown in Figure 5.2. Initially, people having a greater MSA balance would have lower expenditure. But after the turning point of RMB 8,653, people with a greater balance incur higher expenditure instead.

Figure 5.2: Effect of Balance on Outpatient Expenditure Graph: All Enrollees

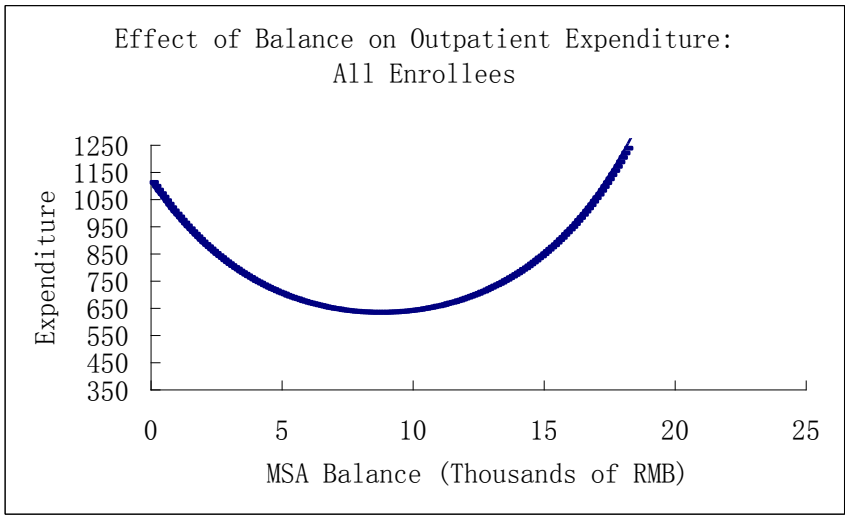


Table 5.4 Effect of Balance on Outpatient Expenditure Result: All Enrollees

All Samples Part Two: Expenditure (OLS Model)		
	Coefficient	Percentage Change
BAL	-0.1298	
	(0.0032)***	
BAL^2	0.0075	
	(0.0002)***	
CHRONIC	0.4767	61.08%
	(0.0118)***	
AGE1 (<=35)	-0.0797	-7.66%
	(0.0161)***	
AGE3 (45-55/60)	0.2790	32.18%
	(0.0108)***	
AGE4 (>55/60)	0.6353	88.76%
	(0.0108)***	
FEMALE	0.0333	3.39%
	(0.0068)***	
_cons	6.5769	
	(0.0128)***	

R^2	0.1018
N	99,486

Note: 1. * p<0.05; ** p<0.01; *** p<0.001

2. Standard Errors in parentheses.

All Samples Part Two Results:

Control variables:

Besides the key independent variable "MSA balance", other variables are also significantly associated with the level of outpatient expenditure among users. In this study, the natural logarithm of outpatient expenditure is used as the dependent variable in the part two OLS model. Normally in this case, the coefficient β can be interpreted as an approximate percentage change by multiplying by 100. But as the magnitude of this coefficient becomes larger and larger, this approximation $100*\beta$ becomes more and more inaccurate (Wooldridge, 2006) (p.198). Instead, we can use the formula $100*[\exp(\hat{\beta})-1]$ to compute the exact percentage difference in the predicted expenditure for each dummy variable when the dependent variable appears in logarithmic form (Wooldridge, 2006) (p.238). For all samples in this study, the estimated coefficient of chronic condition has a rather large magnitude (CHRONIC: β_3=0.4767, p=0.000), which suggests a large percentage change in expenditure. So the incurred outpatient expenditure is exactly $100*[\exp(\hat{\beta})-1]$=100*[exp (0.4767)-1] =61.08% higher for MSA account-holders having one of seven chronic diseases than for those without any chronic disease, holding other factors fixed. This formula

to calculate the exact percentage change is also used to interpret other control variables in the following part. Age effect is examined using four age dummy variables. The dummy variable AGE2 (35<age<=45) is omitted in the regression model as the reference group. Thus, the estimates on the other three dummy variables, AGE1 (age<=35), AGE3 (45<age<=Retirement age), and AGE4 (age>Retirement age), measure the proportionate difference in expenditure relative to AGE2. The coefficients of AGE1, AGE3 and AGE4 are all highly significant. The coefficient of AGE1 (AGE1: β =-0.0797, p=0.000) suggests that MSA enrollees aged below 35 (AGE1) are predicted to incur exactly 7.66% =100*[exp (0.0797)-1] less outpatient expenditure than those aged between 35 and 45 (AGE2). In addition, the incurred outpatient expenditure is 32.18% =100*[exp (0.2790)-1] higher for those aged above 45 but below retirement age (AGE3: β =0.2790, p=0.000), and even 88.76% =100*[exp (0.6353)-1] higher for the retired MSA enrollees (AGE4: β = 0.6353, p=0.000) than for those aged between 35 and 45 (AGE2). The estimation for gender variable (FEMALE: β_5 =0.0333, p=0.000) shows that female MSA enrollees have exactly 3.39% =100*[exp (0.0333)-1] higher expenditure in the outpatient sector than do male enrollees.

With respect to the age effect, for MSA account holders belonging to the older age categories the probability of usage and incurred expenditures are higher. This result is not surprising, since as one becomes older, one's chance of being sick increases due to worse health status. This finding can also verify the notion that health costs are obviously higher in the later years of one's life cycle, so the MSA

encouraging individuals to save during their younger years for later health spending is needed so as to ensure sufficient funds for healthcare in the future, and to mitigate the problem of the ageing population and the intergenerational equity question. Furthermore, the retired age group has a significantly higher probability of usage and expenditure than the other three age groups. This obvious difference also provides evidential reasons to divide all samples into two sub-groups, and to analyze the effect of the MSA balance within the employed enrollee and retired enrollee groups respectively, which is done in the following part.

5.2.2 Results for Employed and Retired MSA Enrollees

In order to see whether the effect of the MSA balance is different between the employed group and the retired group, a two-part model is also conducted on employed MSA enrollees and retired MSA enrollees respectively.

Employed and Retired Part One Results:

MSA Balance:

For both employed samples and retired samples, the first order term BAL and the quadratic term BAL^2 are both significantly correlated with the probability of using outpatient services. However, the sign of BAL and BAL^2 is opposite in these two sub-groups. On the one hand, the first order term BAL for employed samples (γ_1 = -0.3487, p=0.000) has a negative impact on the probability of usage, but BAL for retired samples (γ_1 =0.7023, p=0.000) has a positive effect on the probability instead. On the other hand, the quadratic term BAL^2 for employed

samples (γ_2 =0.0130, p=0.000) shows a positive impact on the probability, but BAL^2 for retired samples (γ_2 = -0.1450, p=0.000) indicates a negative effect on the probability of using any service. As a result, the impact of the MSA balance on outpatient utilization in 2007 is obviously different for employed MSA enrollees and retired MSA enrollees. Using the same method to get predicted probability as in all the previous sample analyses, it can be seen how probability would change as the balance increases. The curve of predicted probability for employed samples and the curve for retired samples are both presented in Figure 5.3 below. As can be seen, the two curves cross when the MSA balance is equal to around seven thousand yuan. For the retired samples, the 95% percentile of balance value is 7.09796. For the employed samples, the balance value is 7.88849 at 90% percentile. So the majority of both employed and retired samples fall within the range between zero and the crossing point. Within this range, it can be seen that retired MSA enrollees have a higher probability of incurring positive expenditure than employed enrollees. The predicted probability for retired people is very high and stable, and can attain more than 0.95. But when MSA balances larger than around five thousand yuan accumulate, the probability of usage for those retired employees is seen to decrease dramatically. With respect to employed MSA enrollees, the predicted probability of using any outpatient service decreases at first, and then increases a little after the balance value attains about fifteen thousand yuan. Within the 46,406 retired MSA enrollees in this study, there are 43,402 retirees incurring a positive expenditure in the year 2007, which accounts for 93.53% of the total retired samples. Among the

total of 68,251 employed samples, there are 56,084 employees (82.17%) who incur some outpatient use in the same year.

Figure 5.3: Effect of Balance on Probability of Usage Graph: Employed Enrollees and Retired Enrollees

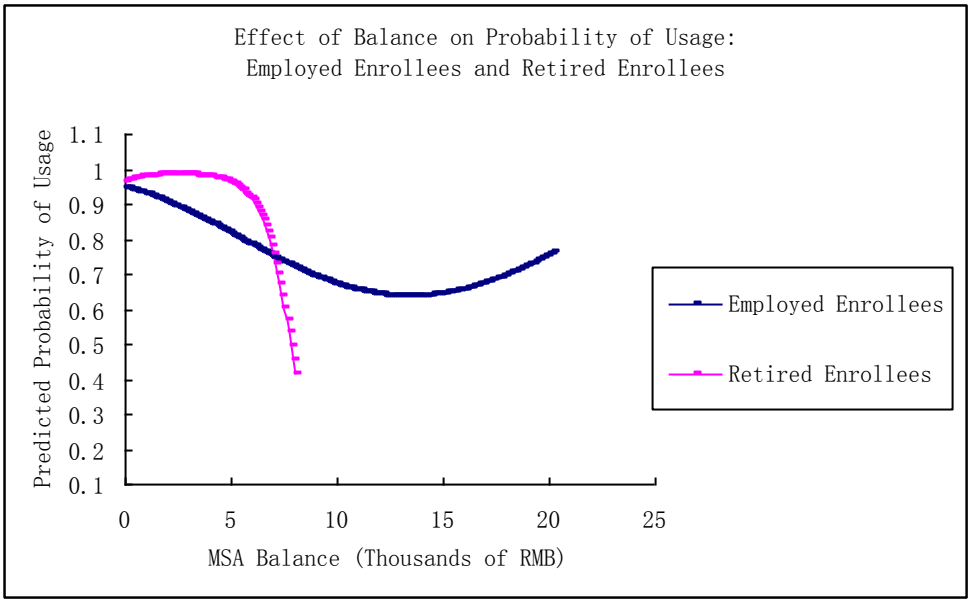


Table 5.5: Effect of Balance on Probability of Usage Result: Employed Enrollees and Retired Enrollees

Employed and Retired Sample Part One: Probability of Use (Logit Model)				
	Employed Sample		Retired Sample	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio
BAL	-0.3487		0.7023	
	(0.0096)***		(0.0468)***	
BAL^2	0.0130		-0.1450	
	(0.0006)***		(0.0052)***	

CHRONIC	2.112 (0.1503)***	8.2650	1.579 (0.1219)***	4.8499
AGE (real age)			-0.0117 (0.0032)***	0.9883
AGE1 (<=35)	-0.2896 (0.0314)***	0.7486		
AGE3 (45-55/60)	0.6145 (0.0239)***	1.8488		
FEMALE	0.4505 (0.0217)***	1.5691	0.0542 (0.0422)	1.0557
_cons	2.2589 (0.0378)***		3.8849 (0.2629)***	
Pseudo R^2	0.0837		0.2131	
N	68,251		46,406	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Employed and Retired Part One Results:

Control variables:

Similar to all the previous sample analyses, all other variables except the MSA balance are interpreted using an odds ratio. The odds ratio of CHRONIC for employed samples (Employed CHRONIC: OR=8.2650, p=0.000) is almost two times larger than the odds ratio for retired samples (Retired CHRONIC: OR=4.8499, p=0.000). This suggests that the presence of chronic conditions plays a greater role in using any service among employed MSA enrollees than among retired enrollees. With respect to the age effect, employed samples are divided into three age categories using three age dummy variables AGE1 (age<=35) AGE2 (35<age<=45) AGE3 (45<age<=Retirement age), while retired samples use a continuous variable

AGE (retirees' real age) in the model. Among employed enrollees, AGE2 (35<age<=45) is omitted in the logit model as the reference group. The odds ratio of AGE1 (Employed AGE1: OR = 0.7486, p=0.000) is less than 1, but the odds ratio of AGE3 (Employed AGE3: OR = 1.8488, p=0.000) is greater than 1. Compared to those aged between 35 and 45 (AGE2), MSA enrollees aged below 35 (AGE1) are less likely to use outpatient services, but enrollees aged between 45 and retirement age (AGE3) are more likely to use them. For retired MSA enrollees, the coefficient of continuous variable AGE (Retired AGE: γ_4 = -0.0117, OR=0.9883, p=0.000) is significantly negative, suggesting that retirees' real age negatively affects the decision to use any service. The older the retired MSA enrollees, the less likely they are to use any outpatient service. In addition, the effect of gender is different in these two sub-groups. Among the retired sub-samples, the gender variable FEMALE (Retired FEMALE: γ_5 = 0.0542, p=0.199) is not significant, indicating that gender does not show a difference in the probability of using services. However, the gender variable FEMALE (Employed FEMALE: OR=1.5691, p=0.000) is significant for those employed sub-samples. Among employed MSA enrollees, the odds of using outpatient services for female enrollees is1.5691 times that of male enrollees.

The age effect on the probability of usage is different between employed MSA account-holders and retired account-holders. With respect to the employed sub-group, the probability of outpatient service usage is obviously higher for those belonging to the older age categories. This result is reasonable and consistent with previous studies (Maguen et al., 2007; Wong et al., 2006). However, the effect of

age on the likelihood of any use is opposite for the retired samples. The older the retired MSA enrollees are, the less likely it is that they will use any outpatient service. This is because we do not control for the time remaining up to death, as suggested by Werblow et al.(2007). They find no or weak age effects on healthcare expenditure when proximity to death is controlled for. In this study, the average age of retired samples is 72 years, so they may have a shorter remaining time-to-death. Another study conducted by Seshamani and Gray (2004) analyzes the effect of proximity to death on hospital costs, using people who are aged 65 and over as of the end of 1970, and their general and psychiatric hospital and death records are tracked to 1999. This study suggests that proximity to death has significant effects on quarterly hospital costs, and an increasing likelihood of being hospitalized with a closer proximity to death. Therefore, the decreasing probability of outpatient service usage at the end of life in the oldest ages in this study may be due to the shift in care from outpatient care to hospitalization treatment later in life, which is not tracked in this data set. Then, older retired enrollees could have a higher probability of using inpatient services instead of outpatient usage.

Among the employed group, female employed enrollees are more likely to use health services in the outpatient sector, which is similar to previous studies (Broyles et al., 2000; Elhai et al., 2007; Maurer, 2008; Wong et al., 2006). For retired enrollees, gender does not show a difference in the probability of using any health service. This finding is similar to Seshamani and Gray (2004), who study individuals aged 65 and over as of the end of 1970 and their general and psychiatric

hospital and death records are tracked to 1999. They also find that gender is insignificant in its effects on the likelihood of being in hospital.

Employed and Retired Part Two Results:

MSA Balance:

Among employed samples, both the first order term *BAL* and the quadratic term BAL^2 are highly significant in the second part of the two-part model. Similar to the result of all samples, *BAL* is negatively correlated with the natural log of outpatient expenditure ($\beta_1 = -0.0828$, p=0.000), and BAL^2 is positively correlated ($\beta_2 = 0.0055$, p=0.000). Hence, the MSA balance has a U-shaped curvilinear relationship to outpatient expenditure for employed MSA enrollees. When the unit of MSA balance is RMB 1,000, the minimum point of this curve is equal to 7.527 ($Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.0828}{2*0.0055} = 7.527$). After changing the balance back to the original value, the minimum point of this curve is RMB 7,527. It is the value of MSA balance for employed samples at which predicted outpatient expenditure takes on its lowest value. After this turning point, RMB 7,527, the MSA balance is positively correlated with outpatient expenditure. The more balance in the MSA, the higher expenditure people incur. But before this turning point, the relationship between balance and expenditure is negative. This can also be illustrated by the marginal effect of the MSA balance at five different points, as shown in Table 5.18 below. When the balance equals the value of 5%, 25%, 50%, 75% percentile

separately, an increase of one unit of MSA balance (RMB 1,000) leads to a decrease in outpatient expenditure by 7.5% (0.075*100), 5.8% (0.058*100), 4.3% (0.043*100), and 2.5% (0.025*100). But when BAL is at the 95% percentile value, an increase of RMB 1,000 in the MSA balance results in increasing the expenditure by 2.5% (0.025*100=2.5%). The effect of the MSA balance on outpatient expenditure for employed enrollees is plotted in Figure 5.4.

Table 5.18: Marginal Effect of MSA Balance on Outpatient Expenditure: Employed Enrollees

Marginal Effect of MSA Balance on Outpatient Expenditure: Employed Enrollees				
Employed Sample	BAL Value (The units: RMB 1)	BAL Value (The units: RMB 1,000)	Marginal Effect: $\beta_1 + 2\beta_2 BAL$	Percentage Change in Expenditure $100*(\beta_1 + 2\beta_2 BAL)$
5% percentiles	RMB 733.97	RMB 0.73397	-0.075	Decrease 7.5%
25% percentiles	RMB 2,261.31	RMB 2.26131	-0.058	Decrease 5.8%
50% percentiles	RMB 3,616.235	RMB 3.616235	-0.043	Decrease 4.3%
75% percentiles	RMB 5,251.145	RMB 5.251145	-0.025	Decrease 2.5%
95% percentiles	RMB 9,804.91	RMB 9.80491	0.025	Increase 2.5%

With regard to retired samples, both the first order term BAL and the quadratic term BAL^2 are significant, but the sign of them is opposite to the employed samples and all samples. The coefficient of the first order term BAL is significantly positive ($\beta_1 = 0.0964$, p=0.000), while the coefficient of the quadratic term BAL^2 is significantly negative ($\beta_2 = -0.0305$, p=0.000). Different from

employed samples, the linear trend for retired samples is predominantly positive, and the relationship is concave downward. As a result, for retired MSA enrollees there is an inverted U-shaped relation between MSA balance and outpatient expenditure. The maximum point RMB 1,580 ($Max = -\frac{\beta_1}{2\beta_2} = -\frac{0.0964}{2*(-0.0305)} = 1.580$;1.580*1000=1,580) is the value of MSA balance at which predicted expenditure attains the highest value. When the balance value is less than RMB 1,580, those having more balances in their accounts incur higher outpatient expenditures. However, after the turning point, RMB 1,580, the relationship between balance and expenditure becomes negative. How the MSA balance affects outpatient expenditure for retired enrollees can be described in Figure 5.4. The marginal effect of MSA balance on outpatient expenditure for retired samples is presented in Table 5.19 below. When the balance value equals RMB 570.29 (5% percentiles), increasing the MSA balance by RMB 1,000 results in increasing outpatient expenditure by approximately 6.2% (0.062*100=6.2 percentage change). But at 25%, 50%, 75% and 95% percentiles of *BAL* value, when the MSA balance increases by RMB 1,000, outpatient expenditure reduces by about 2.6%, 11.6%, 21.2% and 31.8% respectively. So after the turning point, the MSA balance has a diminishing effect on the percentage change in expenditure.

Table 5.19: Marginal Effect of MSA Balance on Outpatient Expenditure: Retired Enrollees

Marginal Effect of MSA Balance on Outpatient Expenditure: Retired Enrollees				
Retired Sample	*BAL* Value (The units: RMB 1)	*BAL* Value (The units: RMB 1,000)	Marginal Effect: $\beta_1 + 2\beta_2 BAL$	Percentage Change in Expenditure about $100*(\beta_1 + 2\beta_2 BAL)$
5% percentiles	RMB 570.29	RMB 0.57029	0.062	Increase 6.2%
25% percentiles	RMB 2,007.06	RMB 2.00706	-0.026	Decrease 2.6%
50% percentiles	RMB 3,487.595	RMB 3.487595	-0.116	Decrease 11.6%
75% percentiles	RMB 5,053.34	RMB 5.05334	-0.212	Decrease 21.2%
95% percentiles	RMB 6,787.05	RMB 6.78705	-0.318	Decrease 31.8%

Figure 5.4: Effect of Balance on Outpatient Expenditure Graph: Employed Enrollees and Retired Enrollees

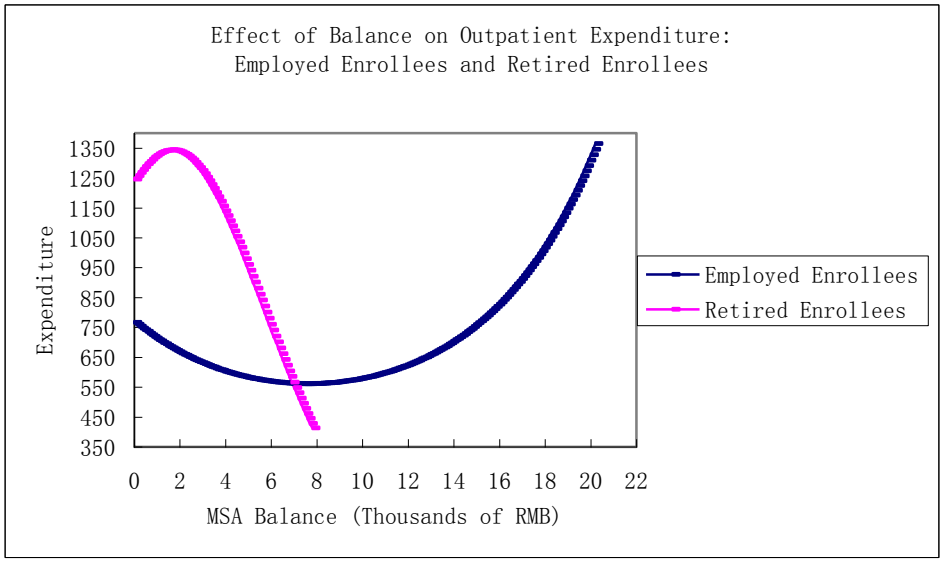


Table 5.6: Effect of Balance on Outpatient Expenditure Result: Employed Enrollees and Retired Enrollees

Employed and Retired Sample Part Two: Expenditure (OLS Model)				
	Employed Sample		Retired Sample	
	Coefficient	Percentage Change	Coefficient	Percentage Change
BAL	-0.0828 (0.0045)***		0.0964 (0.0088)***	
BAL^2	0.0055 (0.0003)***		-0.0305 (0.0011)***	
CHRONIC	0.7228 (0.0246)***	106.02%	0.3660 (0.0118)***	44.20%
AGE (real age)			0.0037 (0.0007)***	0.37%
AGE1 (<=35)	-0.0546 (0.0176)**	-5.31%		
AGE3 (45-55/60)	0.2608 (0.0119)***	29.80%		
FEMALE	0.1041 (0.0099)***	10.97%	-0.0288 (0.0090)**	-2.84%
_cons	6.3946 (0.0165)***		6.8146 (0.0543)***	
R^2	0.0398		0.1144	
N	56,084		43,402	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Employed and Retired Part Two Results:

Control variables:

As well as the effect of the MSA balance, other factors also affect the level of outpatient expenditure for users in the employed and retired sub-samples. The

presence of chronic conditions in both sub-groups is positively and significantly related to incurred expenditure, but the effect of chronic disease on employed MSA enrollees is much larger than on retired enrollees. Employed MSA enrollees having at least one of seven chronic diseases (Employed CHRONIC: β_3=0.7228, p=0.000) are estimated to incur 106.02% (the exact percentage change is 100*[exp (0.7228)-1] =106.02%) higher outpatient expenditure than those employed enrollees without a chronic condition, while retired enrollees having a chronic condition (Retired CHRONIC: β_3 =0.3660, p=0.000) instead incur 44.20% (100*[exp (0.3660)-1] =44.20%) more outpatient expenditure. This suggests that a chronic condition has a greater effect on employed account holders in the second part compared with retired account-holders. Regarding the age effect, the employed sub-group is divided into three age categories using three age dummy variables AGE1 (age<=35) AGE2 (35<age<=45) AGE3 (45<age<=Retirement age), while the retired sub-group uses a continuous variable AGE (retirees' real age) in the model. For retired MSA enrollees, continuous variable AGE (Retired AGE: β =0.0037, p=0.000) is significant, suggesting that a retirees' real age has a positive effect on the level of their outpatient expenditure. Increasing one year of retirees' real age leads to about 0.37% higher expenditure. Among employed samples, AGE2 (35<age<=45) is omitted as the reference group in the analysis. The dummy variable AGE1 (age<=35) is negative (Employed AGE1: β = -0.0546, p=0.002) at 1% significant level, and AGE3 (45<age<=Retirement age) is positive (Employed AGE3: β = 0.2608, p=0.000) at 0.1% significant level. This implies that the incurred expenditure for

(AGE1) employed account-holders aged below 35 is 5.31% (exact percentage change for AGE1:100*[exp (-0.0546)-1] = -5.31%) lower than (AGE2), those aged between 35 and 45. However, MSA enrollees (AGE3), aged above 45 but below retirement age (Female 55; Male 60), spend 29.80% (exact percentage change for AGE3:100*[exp (0.2608)-1] =29.80%) more on outpatient services than (AGE2), those aged between 35 and 45. The gender variable FEMALE is significant in both employed samples and retired samples, but the sign is opposite for them. For the employed sub-group, female MSA enrollees have a 10.97% (Employed FEMALE: β_5 = 0.1041, p=0.000; 100*[exp (0.1041)-1] = 10.97%) higher outpatient expenditure than male employed enrollees. But female retired MSA account holders incur 2.84% (Retired FEMALE: β_5 = -0.0288, p=0.001; 100*[exp (-0.0288)-1] = 2.84%) lower expenditure than male account holders in the retired sub-group.

The effect of gender on the level of expenditure is inconsistent and interesting for the employed group and the retired group. Among the employed group, female employed enrollees spend more than male employees, which is similar to previous studies (Broyles et al., 2000; Elhai et al., 2007; Maurer, 2008; Wong et al., 2006). But female retired enrollees have 2.84% lower expenses than male retirees, which is the opposite of employed enrollees in this study. This interesting result can be illustrated by the explanation that the actual relationship of cost to age and gender is not simple, and that the curves are nonlinear and differ by gender (Diehr et al., 1999). The findings of average outpatient costs by age and sex indicated by Diehr et al. (1999) (p.134) reveal that when individuals are aged above

58, males incur remarkably higher average outpatient costs than females; but when individuals are aged between 16 and 58, females have higher outpatient costs instead. In China, the retirement age for women is 55, while the retirement age for men is 60. Hence, male retired MSA account-holders will spend more in the outpatient sector, but female employed account-holders will have a higher level of outpatient expenditure. Another explanation for male enrollees incurring a higher level of spending after retirement age may be because of delayed treatment during younger ages. Since males belonging to the younger age categories have a lower propensity to visit doctors, and also spend less when having milder or nonfatal disorders, there is a greater chance of them having severe health conditions that lead to higher expenses later in life after retirement.

5.3 Regression Results for Four Different Income Groups

In order to determine whether income affects the relationship between MSA balance and outpatient utilization, employed enrollees are divided into four income groups, based on the value of their annual contribution: the lowest income group (Income1); the medium low income group (Income2); the medium high income group (Income3); and the highest income group (Income4). The same two-part model is conducted on each income group. Comparing the coefficients of BAL and BAL^2 in each group, we can see how the effect of the MSA balance on outpatient expenditure is different for each of the four income groups.

Four Income Groups Part One Results:

MSA Balance:

Among the four income groups, the same logit model is employed in the first part of the two-part model to estimate the probability of using any outpatient service respectively. Using the same method as before, we can plot a graph showing how the predicted probability is related to the MSA balance in each income group. As shown in Figure 5.5 below, the curves of predicted probability for the four income groups are obviously different. Regarding the lowest income group (Income1) and the highest income group (Income4), the overall trend for the probability of using any service decreases as MSA balance increases. For the two medium income groups, the 95% percentile of balance value for the medium low income group (Income2) is 6.07311, while the 95% percentile value for the medium high income group (Income3) is 11.03865. They are all smaller than the lowest point on their curves (Income2 is 6.4 and Income3 is 13.1). Therefore, the majority of those two medium income groups have a lower probability of using services as the MSA balance increases.

Figure 5.5: Effect of Balance on Probability of Usage Graph: Four Income Groups

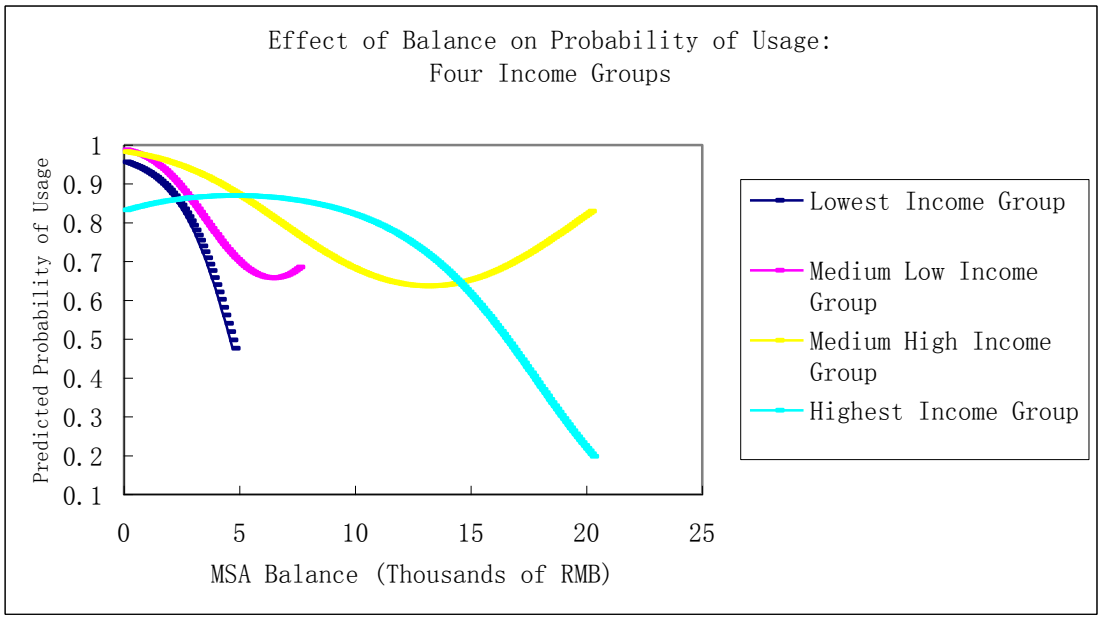


Table 5.7: Effect of Balance on Probability of Usage Result: Four Income Groups

Four Income Groups Part One: Probability of Use (Logit Model)								
	Income1 (Lowest)		Income2 (Medium Low)		Income3 (Medium High)		Income4 (Highest)	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
BAL	-0.4853		-1.1752		-0.5320		0.1271	
	(0.1488)**		(0.0516)***		(0.0180)***		(0.0388)**	
BAL^2	-0.0413		0.0928		0.0204		-0.0136	
	(0.0274)		(0.0063)***		(0.0011)***		(0.0018)***	
CHRONIC	2.2815	9.7914	1.9224	6.8371	1.8735	6.5111	3.1924	24.3462
	(1.0241)*		(0.2480)***		(0.1971)***		(1.0192)**	
AGE1	-0.6841	0.5046	-0.5754	0.5625	-0.4902	0.6125	-0.4603	0.6311
	(0.1110)***		(0.0532)***		(0.0491)***		(0.1055)***	
AGE3	0.8248	2.2814	0.8157	2.2608	0.5738	1.7749	1.2557	3.5102
	(0.0872)***		(0.0386)***		(0.0380)***		(0.1241)***	
FEMALE	0.3716	1.4500	0.4486	1.5662	0.2281	1.2562	0.2788	1.3215
	(0.0799)***		(0.0346)***		(0.0341)***		(0.0937)**	
_cons	2.5508		3.6885		3.5060		1.1432	
	(0.2056)***		(0.1048)***		(0.0791)***		(0.2099)***	
Pseudo R^2	0.1177		0.1083		0.1176		0.1014	
N	5,002		26,876		33,077		3,296	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Four Income Groups Part One Results:

Control variables:

To facilitate interpretation, coefficient estimates of all other control variables are translated into an odds ratio in each income group. With respect to chronic conditions, all income groups' odds ratios are significant and greater than one, suggesting that using outpatient services is more likely to occur in those MSA enrollees having one of seven chronic diseases, for all income groups. The odds ratio of CHRONIC for Income4 (Income4 CHRONIC: OR=24.3462, p=0.002) is the largest among the four income groups. This indicates that having chronic diseases plays a greater role in the decision to use outpatient services among the highest income group (Income4) than among the other three income groups. Similar to previously analyzing the employed samples, three age dummy variables AGE1 (age<=35) AGE2 (35<age<=45) and AGE3 (45<age<=Retirement age) are used to control the age effect in each income group. The reference group is again AGE2. Four income groups' odds ratios of AGE1 are all less than one, and all income groups' odds ratios of AGE3 are greater than one. So for all income groups, (AGE1) MSA enrollees, those aged below 35, are less likely to use any service, but (AGE3) enrollees, aged between 45 and retirement age, are more likely to use services when compared to (AGE2), those aged between 35 and 45. With respect to the gender variable FEMALE, the odds ratios are all significant and larger than one, showing that using any outpatient service is more likely to happen in female MSA enrollees, for all income groups.

The effect of age on the propensity to use any service is similar in all four income groups. MSA enrollees belonging to the older age categories are more likely to use health services in the outpatient sector for all four income groups. In addition, gender also has a similar effect on the likelihood of any use for all four income groups. Using any outpatient service is more likely to happen with female employed enrollees.

Four Income Groups Part Two Results:

MSA Balance:

The curvilinear relationship between MSA balance and outpatient expenditure is detected in Income1, Income2, Income3 and Income4, but the effect of the MSA balance is obviously different in these four income groups.

Both Income2 (Medium Low Income Group) and Income3 (Medium High Income Group) have significantly negative coefficients of first order term *BAL* and significantly positive coefficients of the quadratic term BAL^2, suggesting that they have a similar direction of curvature. However, the effect of the MSA balance for Income2 is different from Income3, because Income3's curve has a minimum point while Income2's does not have. Among Income2 sub-group, the maximum balance value only attains RMB 7,472.15, but the calculated minimum point of Income2's curve is a balance value equal to RMB 9,778 (Income2 $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.1760}{2*(0.0090)} = 9.778$; 9.778*1000=9,778). So the expected turning

point of the curve is beyond the actual range of Income2's balance value. In Income2 sub-group, the MSA balance has a negative effect on outpatient expenditure, with the magnitude of the effect decreasing as the balance gets larger. But for Income3 sub-group the MSA balance has a U-shaped curvilinear relationship with outpatient expenditure for users, due to its turning point falling within Income3's balance range. The relationship for Income3 is concave upward, and the curve has a minimum point. Regarding those Income3 sub-samples, *BAL* is negatively related to the natural log of outpatient expenditure (Income3 $\beta_1 = -0.1444$, p=0.000), while the quadratic term BAL^2 is positively correlated (Income3 $\beta_2 = 0.0073$, p=0.000). The minimum point of Income3's curve is an MSA balance value equal to RMB 9,890 (Income3 $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.1444}{2*(0.0073)} = 9.890$; 9.890*1000=9,890), at which predicted expenditure on the log scale takes on its lowest value. The value of Income3's MSA balance ranges from RMB 2.07 to RMB 20,043.74. When the balance value is less than this minimum point, MSA balance is negatively related to outpatient expenditure, suggesting that those MSA enrollees belonging to Income3 group spend less on outpatient services as their MSA balance increases. However, the relationship between balance and expenditure becomes positive after the MSA balance accumulates past the turning point of RMB 9,890. The marginal effect of MSA balance at five different points for Income2 and Income3 is illustrated in Table 5.21 and Table 5.22 respectively. For Income3 sub-group, when *BAL* is equal to

RMB 10,328.3 (95% percentiles), increasing the MSA balance by RMB 1,000 results in increasing outpatient expenditure by about 0.6%.

The effect of the MSA balance for Income1 (Lowest Income Group) and Income 4 (Highest Income Group) is opposite to Income2 and Income3, because the sign of first order term *BAL* is positive, while the sign of quadratic term BAL^2 is negative. So both Income1 and Income4 have a maximum point of the curve. They have a similar direction of curvature, with a concave downward relationship, but they have an obviously different turning point of the curve. Regarding Income1, *BAL* (Income1 $\beta_1 = 0.0486$, p=0.411) is positively related, but it is not significant. The quadratic term BAL^2 for Income1 (Income1 $\beta_2 = -0.0436$, p=0.000) is significant, and it is negatively correlated to outpatient expenditure on the log scale at 0.1% significant level. The turning point (Maximum point) for the Income1 curve is a balance value equal to RMB 557 (Income1 $Max = -\frac{\beta_1}{2\beta_2} = -\frac{0.0486}{2*(-0.0436)} = 0.557$; 0.557*1000=557), at which predicted expenditure on the log scale attains its highest value. With respect to the highest income group, Income4, *BAL* (Income4 $\beta_1 = 0.2799$, p=0.000) is positively related and BAL^2 (Income4 $\beta_2 = -0.0132$, p=0.000) is negatively related to the natural log of expenditure. The first order term and quadratic term are both significant at 0.1% significant level. However, the turning point of the curve for the highest income group, Income4, is much larger than for the lowest income group, Income1. The value of Income4's MSA balance at the turning point (Maximum

point) can reach RMB 10,602 (Income4 $Max = -\frac{\beta_1}{2\beta_2} = -\frac{0.2799}{2*(-0.0132)} = 10.602$; 10.602*1000=10,602). It suggests that when the value of the MSA balance is equal to RMB 10,602, the predicted outpatient expenditure attains the highest value in Income4 enrollees. Therefore, both Income1 group and Income4 group have an inverted U-shaped relation between MSA balance and outpatient expenditure. Before the balance value attains RMB 557 for Income1 and RMB 10,602 for Income4, the MSA balance has a positive effect on outpatient expenditure. The more balance that is accumulated, the higher the outpatient expenditure they incur. But after these two turning points, the relationship becomes negative for Income1 and Income4, indicating that people having a higher balance would have lower expenditure in the outpatient sector. Table 5.20 and Table 5.23 present the marginal effect of MSA balance at five different points for Income1 and Income4.

Finally, the effects of MSA balance on expenditure for Income1, Income2, Income3 and Income4 are plotted in Figure 5.6, indicating that the curvilinear relationship between balance and expenditure is different for these four income groups.

Table 5.20: Marginal Effect of MSA Balance on Outpatient Expenditure: Lowest Income Group

Marginal Effect of MSA Balance on Outpatient Expenditure: Lowest Income Group				
Income1 Sample	*BAL* Value (The units: RMB 1)	*BAL* Value (The units: RMB 1,000)	Marginal Effect: $\beta_1 + 2\beta_2 BAL$	Percentage Change in Expenditure about $100*(\beta_1 + 2\beta_2 BAL)$
5% percentiles	RMB 357.32	RMB 0.35732	0.017	Increase 1.7%
25% percentiles	RMB 1,354.06	RMB 1.35406	-0.069	Decrease 6.9%
50% percentiles	RMB 2,428.05	RMB 2.42805	-0.163	Decrease 16.3%
75% percentiles	RMB 3,380.35	RMB 3.38035	-0.246	Decrease 24.6%
95% percentiles	RMB 4,282.48	RMB 4.28248	-0.325	Decrease 32.5%

Table 5.21: Marginal Effect of MSA Balance on Outpatient Expenditure: Medium Low Income Group

Marginal Effect of MSA Balance on Outpatient Expenditure: Medium Low Income Group				
Income2 Sample	*BAL* Value (The units: RMB 1)	*BAL* Value (The units: RMB 1,000)	Marginal Effect: $\beta_1 + 2\beta_2 BAL$	Percentage Change in Expenditure about $100*(\beta_1 + 2\beta_2 BAL)$
5% percentiles	RMB 595.66	RMB 0.59566	-0.165	Decrease 16.5%
25% percentiles	RMB 1,858.65	RMB 1.85865	-0.143	Decrease 14.3%
50% percentiles	RMB 3,011.49	RMB 3.01149	-0.122	Decrease 12.2%
75% percentiles	RMB 4,149.06	RMB 4.14906	-0.101	Decrease 10.1%
95% percentiles	RMB 5,953.64	RMB 5.95364	0.069	Decrease 6.9%

Table 5.22: Marginal Effect of MSA Balance on Outpatient Expenditure: Medium High Income Group

Marginal Effect of MSA Balance on Outpatient Expenditure: Medium High Income Group				
Income3 Sample	*BAL* Value (The units: RMB 1)	*BAL* Value (The units: RMB 1,000)	Marginal Effect: $\beta_1 + 2\beta_2 BAL$	Percentage Change in Expenditure about $100*(\beta_1 + 2\beta_2 BAL)$
5% percentiles	RMB 997.07	RMB 0.99707	-0.130	Decrease 13.0%
25% percentiles	RMB 2,778.78	RMB 2.77878	-0.104	Decrease 10.4%
50% percentiles	RMB 4,347.22	RMB 4.34722	-0.081	Decrease 8.1%
75% percentiles	RMB 6,145.7	RMB 6.1457	-0.055	Decrease 5.5%
95% percentiles	RMB 10,328.3	RMB 10.3283	0.006	Increase 0.6%

Table 5.23: Marginal Effect of MSA Balance on Outpatient Expenditure: Highest Income Group

Marginal Effect of MSA Balance on Outpatient Expenditure: Highest Income Group				
Income4 Sample	*BAL* Value (The units: RMB 1)	*BAL* Value (The units: RMB 1,000)	Marginal Effect: $\beta_1 + 2\beta_2 BAL$	Percentage Change in Expenditure about $100*(\beta_1 + 2\beta_2 BAL)$
5% percentiles	RMB 2,935.01	RMB 2.93501	0.202	Increase 20.2%
25% percentiles	RMB 4,698.21	RMB 4.69821	0.156	Increase 15.6%
50% percentiles	RMB 9,511.32	RMB 9.51132	0.029	Increase 2.9%
75% percentiles	RMB 13,679.58	RMB 13.67958	-0.081	Decrease 8.1%
95% percentiles	RMB 18,235.25	RMB 18.23525	-0.202	Decrease 20.2%

Figure 5.6: Effect of Balance on Outpatient Expenditure Graph: Four Income Groups

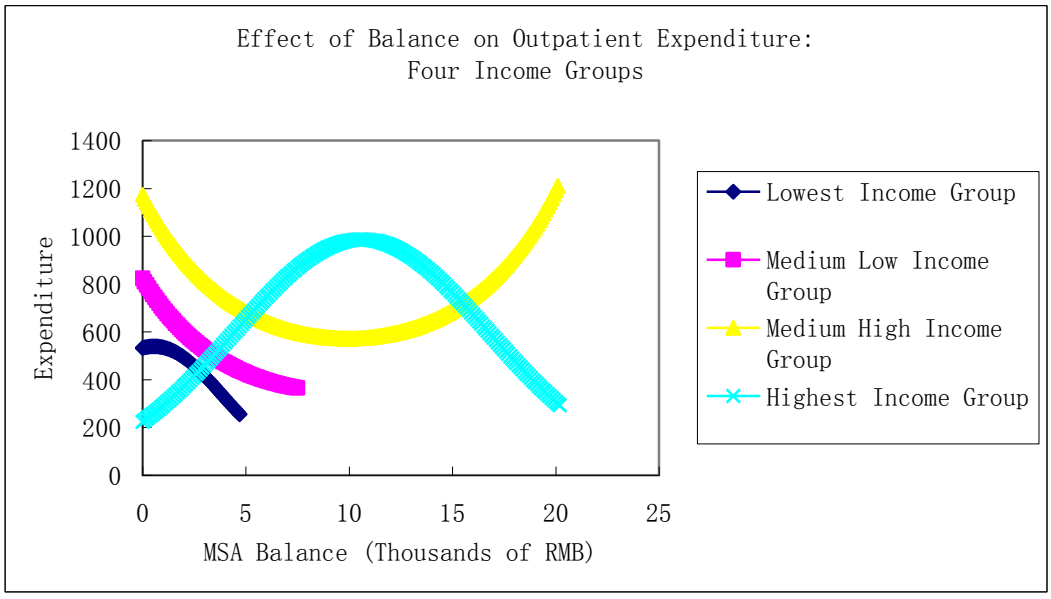


Table 5.8: Effect of Balance on Outpatient Expenditure Result: Four Income Groups

Four Income Groups Part Two: Expenditure (OLS Model)								
	Income1 (Lowest)		Income2 (Medium Low)		Income3 (Medium High)		Income4 (Highest)	
	Coefficient	Percentage Change	Coefficient	Percentage Change	Coefficient	Percentage Change	Coefficient	Percentage Change
BAL	0.0486		-0.1760		-0.1444		0.2799	
	(0.0591)		(0.0171)***		(0.0066)***		(0.0248)***	
BAL^2	-0.0436		0.009		0.0073		-0.0132	
	(0.0123)***		(0.0025)***		(0.0005)***		(0.0012)***	
CHRONIC	0.5180	67.87%	0.6634	94.14%	0.6119	84.39%	0.8918	143.95%
	(0.1577)**		(0.0427)***		(0.0303)***		(0.1713)***	
AGE1	-0.3098	-26.64%	-0.1426	-13.29%	-0.1725	-15.84%	0.0769	7.99%
	(0.0630)***		(0.0286)***		(0.0250)***		(0.0706)	
AGE3	0.2420	27.38%	0.3209	37.84%	0.2053	22.79%	0.6418	89.99%
	(0.0425)***		(0.0182)***		(0.0177)***		(0.0670)***	
FEMALE	-0.0465	-4.54%	0.1636	17.77%	-0.0536	-5.22%	-0.1148	-10.85%
	(0.0379)		(0.0154)***		(0.0145)***		(0.0583)*	
_cons	6.1842		6.4241		6.9458		5.1715	
	(0.0734)***		(0.0311)***		(0.0270)***		(0.1261)***	
R^2	0.0476		0.0577		0.054		0.0991	
N	3919		21866		27955		2344	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Four Income Groups Part Two Results:

Control variables:

Among the four income sub-groups, the need factor measured by chronic conditions is still the most important predictor of outpatient expenditure for users. The effect of chronic diseases on the level of expenditure is the largest for Income4 (highest income group), which has the largest percentage change in the four groups. For those MSA enrollees in the highest income group, people having any chronic disease (Income4 CHRONIC: β_3 = 0.8918, p=0.000) are estimated to have 143.95% (100*[exp (0.8918)-1] = 143.95%) higher expenditure than those without any chronic condition. This is followed by the medium low income group (Income2 CHRONIC: β_3 = 0.6634, p=0.000) individuals with chronic diseases, who can spend 94.14% (100*[exp (0.6634)-1] = 94.14%) more on outpatient services. Regarding Income1 and Income3 sub-groups, the incurred expenditure is 67.87% higher (Income1 CHRONIC: β_3 = 0.5180, p=0.001; 100*[exp (0.5180)-1] = 67.87%) and 84.39% higher (Income3 CHRONIC: β_3 = 0.6119, p=0.000; 100*[exp (0.6119)-1] = 84.39%) respectively for MSA enrollees who have one of the seven regulated chronic diseases than those without any in these two income groups. When examining the age effect in each income group, three age dummy variables AGE1 (age<=35), AGE2 (35<age<=45) and AGE3 (45<age<=Retirement age) are used, similar to when previously studying employed samples. The retirement age for female enrollees is 55, and for males is 60. The reference group is also the second age dummy variable AGE2 (35<age<=45), representing those MSA enrollees aged

between 35 and 45. Among the four income groups, only AGE1 in Income4 is not significant, suggesting that the incurred expenditures for those aged below 35 do not differ from those aged between 35 and 45 in the highest income group. Apart from this, all other age dummy variables in the four income groups are statistically significant. The results indicate that MSA account holders belonging to an older age category are predicted to have higher outpatient expenditure. In addition, the estimation result for the gender variable is different for the four income groups. Regarding the lowest income group, FEMALE is not significant, indicating that gender does not significantly affect the level of expenditure in Income1. Within the highest income group, FEMALE (Income4 FEMALE: β_5 = -0.1148, p=0.049) is negatively related to outpatient expenditure, at 5% significant level. Then, female enrollees have exactly 10.85% lower (100*[exp (-0.1148)-1] = -10.85%) outpatient expenditure than males in the highest income group. The medium high income group (Income3) has a similar gender effect to the highest income group (Income4), but with a smaller percentage change. With respect to Income3, FEMALE (Income3 FEMALE: β_5 = -0.0536, p=0.000) is also negatively correlated to the level of expenditure, and the incurred expenditure is 5.22% lower (100*[exp (-0.0536)-1] = -5.22%) for female account holders in the medium high income group. However, the gender effect in the medium low income group (Income2) is opposite to that in the medium high and highest income groups. Gender variable FEMALE (Income2 FEMALE: β_5 = 0.1636, p=0.000) is positively related to outpatient expenditure in this sub-group. As a result, female MSA enrollees spend 17.77% more (100*[exp

(0.1636)-1] = 17.77%) on outpatient services than do male enrollees in this medium low income group.

When examining the effect of age on outpatient expenditure for users only, the incurred expenditure of enrollees belonging to older age categories is remarkably higher among the three lower income groups, that is, not including the highest income group. Within the highest income group, the incurred expenditure for enrollees aged below 35 does not differ from those aged between 35 and 45, but employees aged above 45 will spend more than those aged between 35 and 45. The possible reason is that the highest income group includes more samples in the age category of below 35, compared with the other three income groups. The percentage of employed samples in the age category below 35 for the highest income group is double the percentage for the other three income groups. So the larger percentage of samples in this age category below 35 may narrow the spending difference between enrollees aged below 35 and enrollees aged between 35 and 45 in this highest income group.

However, the effect of gender on the level of spending is obviously different among the four income groups. For the lowest income group, gender does not significantly affect the level of expenditure. With respect to the medium low income group, female MSA enrollees spend 17.77% more on outpatient services than do male employees in this sub-group. However, the gender effect in the two higher income groups is opposite to that in the medium low income group discussed above. In the medium high income group, female enrollees have exactly 5.22% lower

outpatient expenditure than male enrollees. In addition, the highest income group has a similar gender effect as the medium high income group, but with an even larger percentage change. The incurred expenditure is 10.85% lower for female account holders in the highest income group.

5.4 Regression Results for Moderating Effect of Chronic Conditions

In order to see whether the needs of MSA enrollees are adequately met, the balance-expenditure relationship is examined with the need factor, measured by the presence of chronic conditions, as the moderator. Consequently, two interaction terms $BAL*CHRONIC$ and $BAL^2*CHRONIC$ are added into the two-part model.

5.4.1 Moderating Effect in All MSA Enrollees

All Samples Part One Results:

Moderating Effect of Chronic Conditions:

In the first part of the two-part model, the interaction terms $BAL*CHRONIC$ and $BAL^2*CHRONIC$ are included in the logit model for all samples. The coefficient of first order term interaction $BAL*CHRONIC$ (γ_4 = -0.2984, p=0.003) is significant at 1% significant level, and the coefficient of quadratic term interaction $BAL^2*CHRONIC$ (γ_5 = 0.0144, p=0.026) is significant at 5% significant level. As a result, the effects of the MSA balance on outpatient utilization differ between the chronic MSA enrollees group and the non-chronic MSA enrollees group. In order to see this different effect clearly, two separate

curves of predicted probability are plotted for those having any chronic disease and those without a chronic condition. Based on the estimated coefficients BAL (γ_1=-0.4469) BAL^2 (γ_2 =0.0174) $BAL*CHRONIC$ (γ_4 =-0.2984) $BAL^2*CHRONIC$ (γ_5 =0.0144) in the logit model presented in Table 5.9 below, two different coefficient sets of BAL and BAL^2 for these two groups within all enrollees can be obtained.

(1) Logit Model: Within all samples for those MSA enrollees having a chronic condition CHRONIC=1

- The coefficient of BAL is equal to: $\gamma_1 + \gamma_4$ = (-0.4469) + (-0.2984) = -0.7453
- The coefficient of BAL^2 is equal to: $\gamma_2 + \gamma_5$ = 0.0174 + 0.0144 = 0.0318

Using these two new coefficients, the predicted probability for the chronic MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve of predicted probability for this group is shown in the blue line in Figure 5.7.

(2) Logit Model: Within all samples for those MSA enrollees without a chronic condition CHRONIC=0

- The coefficient of first order term BAL is equal to: γ_1 = -0.4469
- The coefficient of quadratic term BAL^2 is equal to: γ_2 =0.0174

Using these two original coefficients, the predicted probability for the non-chronic MSA enrollees group can be obtained as the MSA balance changes, when holding

all other variables at their mean. The curve of predicted probability for this group is shown in the red line in Figure 5.7.

As can be seen, the overall probability of using any service for MSA enrollees having a chronic condition is higher than the probability for those without a chronic condition. These two curves have an obviously different shape.

Table 5.9: Moderating Effect of Chronic Conditions on Probability of Usage Result: All Enrollees

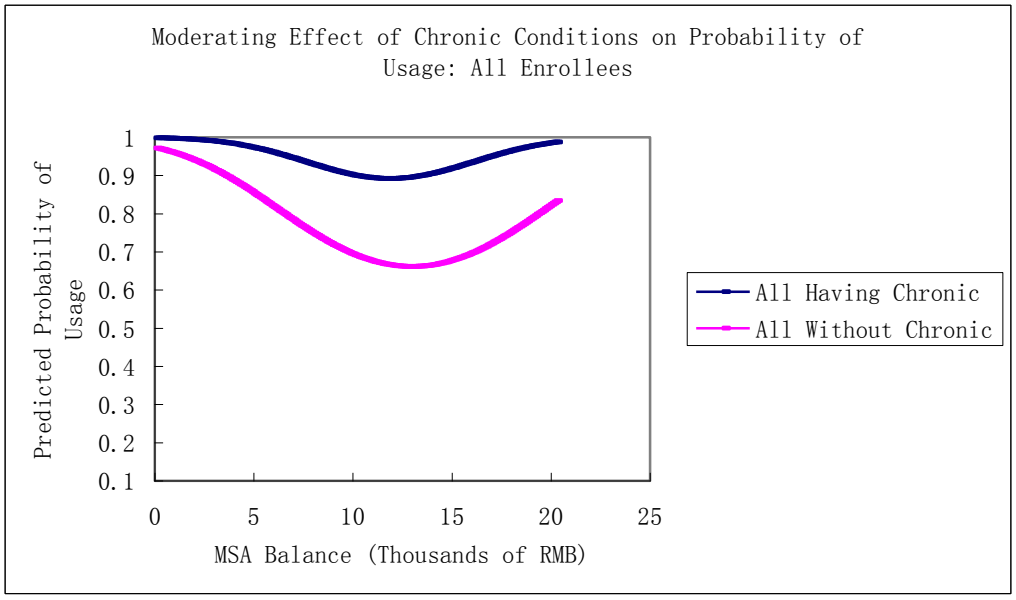
All Samples Part One: Probability of Use (Logit Model) Chronic is a Moderator		
	Coefficient	Odds Ratio
BAL	-0.4469	
	(0.0090)***	
BAL^2	0.0174	
	(0.0005)***	
*BAL*CHRONIC*	-0.2984	
	(0.1007)**	
BAL^2 **CHRONIC*	0.0144	
	(0.0065)*	
CHRONIC	2.9397	18.9108
	(0.3407)***	
AGE1 (<=35)	-0.3376	0.7135
	(0.0317)***	
AGE3 (45-55/60)	0.6265	1.8711
	(0.0241)***	
AGE4 (>55/60)	1.2144	3.3682
	(0.0275)***	
FEMALE	0.3509	1.4203
	(0.0190)***	
_cons	2.6545	
	(0.0362)***	

Pseudo R^2	0.1281
N	114,657

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Figure 5.7: Moderating Effect of Chronic Conditions on Probability of Usage Graph: All Enrollees



All Samples Part Two Results:

Moderating Effect of Chronic Conditions:

In order to examine whether chronic conditions can moderate the curvilinear relationship between MSA balance and outpatient expenditure, two interaction terms $BAL*CHRONIC$ and $BAL^2*CHRONIC$ are also added into the OLS model for users in the second part of the two-part model. Both the coefficient of first order

term interaction $BAL*CHRONIC$ (β_4 = 0.0964, p=0.000) and the coefficient of quadratic term interaction $BAL^2*CHRONIC$ (β_5 = -0.0045, p=0.000) are statistically significant at 0.1% significant level. As a result, the curvilinear relationship between MSA balance and outpatient expenditure differs between these two groups, the chronic MSA enrollees group and the non-chronic MSA enrollees group. In order to see this different effect clearly, two separate curves of predicted outpatient expenditure are plotted for those having any chronic disease and for those without a chronic condition. Based on the estimated coefficients BAL (β_1 =-0.1408) BAL^2 (β_2 =0.0081) $BAL*CHRONIC$ (β_4 =0.0964) $BAL^2*CHRONIC$ (β_5 =-0.0045) in the OLS model shown in Table 5.10 below, we can get two different coefficient sets of BAL and BAL^2 for these two groups within all samples.

(1) OLS Model: Within all samples for those MSA enrollees having a chronic condition CHRONIC=1

- The coefficient of BAL is equal to: $\beta_1 + \beta_4$ = (-0.1408) + (0.0964) = -0.0444
- The coefficient of BAL^2 is equal to: $\beta_2 + \beta_5$ = 0.0081 + (-0.0045) = 0.0036

Using these two new coefficients, the predicted expenditure for the chronic MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve of predicted expenditure for this group is shown in the blue line in Figure 5.8.

(2) OLS Model: Within all samples for those MSA enrollees without a chronic condition CHRONIC=0

- The coefficient of first order term BAL is equal to: β_1 = -0.1408
- The coefficient of quadratic term BAL^2 is equal to: β_2 = 0.0081

Using these two original coefficients, the predicted expenditure for the non-chronic MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curvilinear relationship for this group is shown in the red line in Figure 5.8.

As can be seen, the predicted outpatient expenditure for the chronic MSA enrollees group is significantly higher than the expenditure for the non-chronic MSA enrollees group. The U-shaped curvilinear relationship between MSA balance and outpatient expenditure is found in these two groups, but their U-shaped curves have an obviously different shape. The curvilinear relationship is not identical among these two groups. The turning point of the curve for these two groups is different. For the chronic MSA enrollees group, the lowest point on the curve is a balance value equal to 6.167 (All chronic group: $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.0444}{2*0.0036} = 6.167$). After changing the unit of MSA balance back to RMB 1, the turning point of this curve is a balance value equal to RMB 6,167. This is the value of the MSA balance for the chronic group at which predicted outpatient expenditure takes on its lowest value. However, the lowest point for the non-chronic MSA enrollees group is much higher than for the chronic group, being a point at which the balance value is equal to 8.691 (All non-chronic group: $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.1408}{2*0.0081} = 8.691$). After changing the

unit of MSA balance back to RMB 1, the turning point for the non-chronic group is instead RMB 8,691. Therefore, the linear and quadratic effects of the MSA balance are detected to differ between the chronic and non-chronic enrollees groups. The curvilinear relationship between MSA balance and outpatient expenditure is moderated by the presence of chronic conditions.

Table 5.10: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Result: All Enrollees

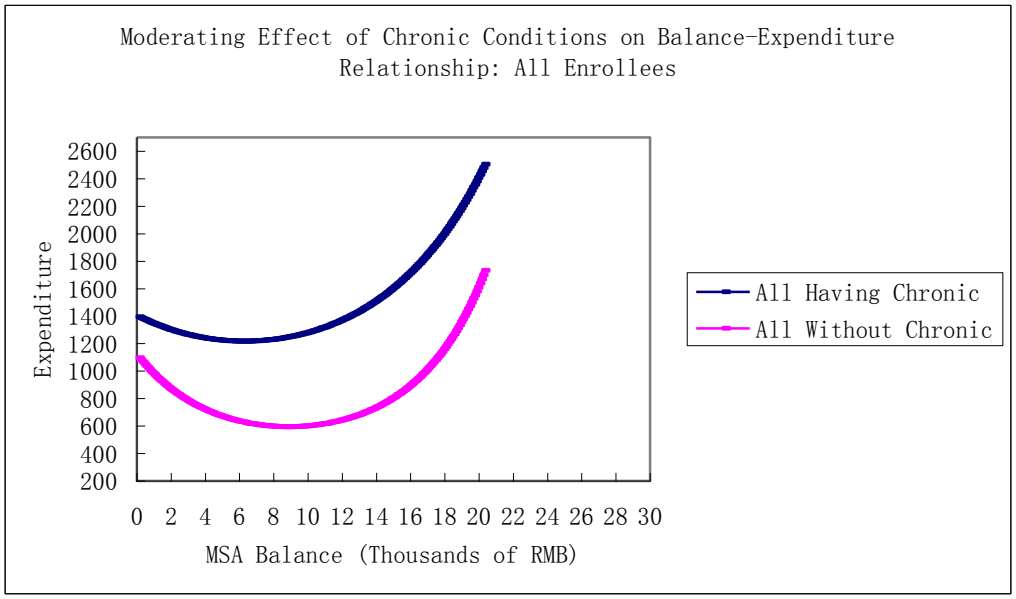
All Samples Part Two: Expenditure (OLS Model) Chronic is a Moderator		
	Coefficient	Percentage Change
BAL	-0.1408	
	(0.0034)***	
BAL^2	0.0081	
	(0.0002)***	
*BAL*CHRONIC*	0.0964	
	(0.0111)***	
BAL^2 **CHRONIC*	-0.0045	
	(0.0010)***	
CHRONIC	0.2402	27.15%
	(0.0257)***	
AGE1 (<=35)	-0.0814	-7.82%
	(0.0161)***	
AGE3 (45-55/60)	0.2791	32.19%
	(0.0108)***	
AGE4 (>55/60)	0.6378	89.23%
	(0.0108)***	
FEMALE	0.0332	3.38%
	(0.0068)***	
_cons	6.6062	
	(0.0131)***	

R^2	0.1029
N	99,486

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Figure 5.8: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Graph: All Enrollees



5.4.2 Moderating Effect in Employed and Retired MSA Enrollees

Similar to the previous analysis, all samples are categorized into two sub-samples: employed MSA enrollees and retired MSA enrollees. Within each sub-sample, two interaction terms $BAL*CHRONIC$ and $BAL^2*CHRONIC$ are included in the first part logit model and the second part OLS model, in order to examine

whether the linear and quadratic effects of the MSA balance are both permitted to differ among different health status groups.

Employed and Retired Part One Results:

Moderating Effect of Chronic Conditions:

Within the employed sub-sample and retired sub-sample, two interaction terms $BAL*CHRONIC$ and $BAL^2*CHRONIC$ are both included in the logit model respectively. Regarding the employed MSA enrollees, the coefficients of first order term interaction $BAL*CHRONIC$ (Employed: γ_4 = -0.0431, p=0.729) and quadratic term interaction $BAL^2*CHRONIC$ (Employed: γ_5 = -0.0002, p=0.977) are not statistically significant. This indicates that the effect of the MSA balance on the decision to use outpatient services does not differ between the chronic employed enrollees group and the non-chronic employed enrollees group.

However, the result for the retired MSA enrollees is the opposite. The coefficient of first order term interaction $BAL*CHRONIC$ (Retired: γ_4 = -0.8095, p=0.004) is significant at 1% significant level, and the coefficient of quadratic term interaction $BAL^2*CHRONIC$ (γ_5 = 0.0768, p=0.014) is significant at 5% significant level. Therefore, the effects of the MSA balance on outpatient utilization differ between the chronic retired enrollees group and the non-chronic retired enrollees group. Using the same method for analyzing all samples as before, two separate curves of predicted probability for retired MSA enrollees having any chronic disease

and for those without a chronic condition can be plotted to examine this different effect. Using the estimated coefficients BAL (Retired: γ_1 = 0.7372) BAL^2 (Retired: γ_2 =-0.1483) $BAL*CHRONIC$ (Retired: γ_4 =-0.8095) $BAL^2*CHRONIC$ (Retired: γ_5 =0.0768) in the retired sub-sample column presented in Table 5.11 below, two different coefficient sets of BAL and BAL^2 for these two groups within the retired MSA enrollees sub-sample can be obtained.

(1) Logit Model: Within the retired sub-sample for those MSA enrollees having a chronic condition CHRONIC=1

- The coefficient of BAL is equal to: $\gamma_1 + \gamma_4$ = 0.7372 + (-0.8095) = -0.0723
- The coefficient of BAL^2 is equal to: $\gamma_2 + \gamma_5$ = -0.1483 + 0.0768 = -0.0715

Using these two new coefficients, the predicted probability for the chronic retired enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve of predicted probability for this group is shown in the blue line in Figure 5.9.

(2) Logit Model: Within the retired sub-sample for those MSA enrollees without a chronic condition CHRONIC=0

- The coefficient of first order term BAL is equal to: γ_1 = 0.7372
- The coefficient of quadratic term BAL^2 is equal to: γ_2 = -0.1483

Using these two original coefficients, the predicted probability for the non-chronic retired enrollees group can be obtained as the MSA balance changes, when holding

all other variables at their mean. The curve of predicted probability for this group is shown in the red line in Figure 5.9.

Based on the two different coefficient sets of BAL and BAL^2 for the chronic retired group and the non-chronic retired group discussed above, we can see that the effect of the MSA balance on outpatient utilization differs among these two groups within retired MSA enrollees. For those in the chronic retired enrollees group, the coefficients of first order term BAL and quadratic term BAL^2 are both negative. As shown in Figure 5.9, the predicted probability of usage for this chronic group is decreasing from the beginning, although the magnitude is small and the overall probability is extremely high (close to one). But for those in the non-chronic retired enrollees group, the coefficient sign of BAL and BAL^2 is the opposite: positive for BAL and negative for BAL^2. The curve for this group suggests that the predicted probability is slightly increasing as the MSA balance accumulates. But when the balance value attains 2.6 (thousands of RMB), the probability starts to decrease instead. Furthermore, at a large amount of MSA balance (more than 6 thousand), the predicted probability falls dramatically.

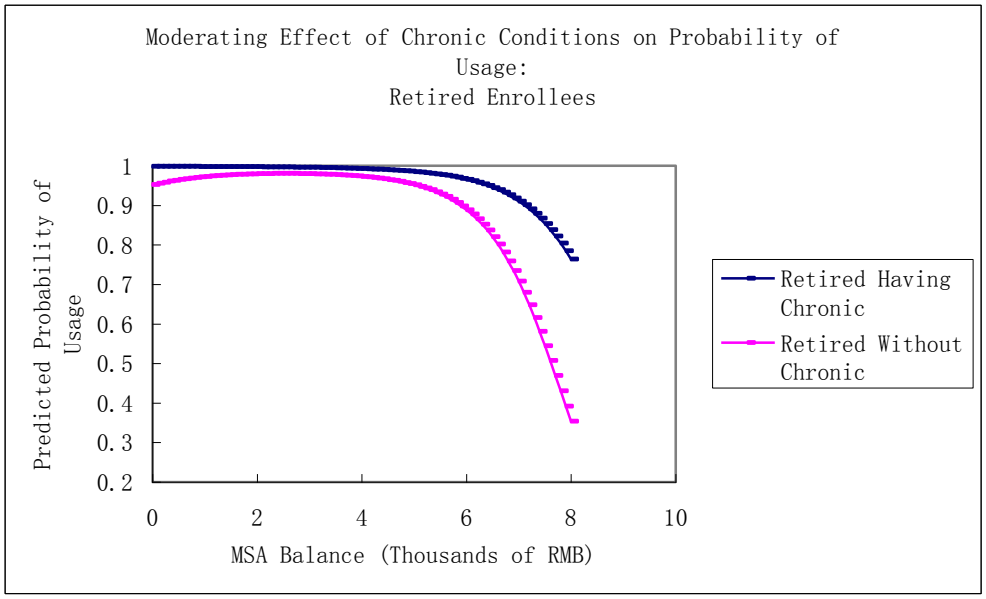
Table 5.11: Moderating Effect of Chronic Conditions on Probability of Usage Result: Employed Enrollees and Retired Enrollees

Employed and Retired Sample Part One: Probability of Use (Logit Model) Chronic is a moderator				
	Employed Sample		Retired Sample	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio
BAL	-0.3485		0.7372	
	(0.0097)***		(0.0475)***	
BAL^2	0.013		-0.1483	
	(0.0006)***		(0.0053)***	
*BAL*CHRONIC*	-0.0431		-0.8095	
	(0.1244)		(0.2839)**	
BAL^2 **CHRONIC*	-0.0002		0.0768	
	(0.0070)		(0.0312)*	
CHRONIC	2.378	10.7837	3.3334	28.0334
	(0.4452)***		(0.5953)***	
AGE (real age)			-0.0117	0.9884
			(0.0032)***	
AGE1 (<=35)	-0.2893	0.7488		
	(0.0314)***			
AGE3 (45-55/60)	0.6145	1.8487		
	(0.0239)***			
FEMALE	0.4503	1.5688	0.0534	1.0549
	(0.0217)***		(0.0422)	
_cons	2.2576		3.8038	
	(0.0378)***		(0.2633)***	
Pseudo R^2	0.0838		0.2137	
N	68,251		46,406	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Figure 5.9: Moderating Effect of Chronic Conditions on Probability of Usage Graph: Retired Enrollees



Employed and Retired Part Two Results:

Moderating Effect of Chronic Conditions:

In the second part of the OLS model for the employed MSA enrollees sub-sample and retired enrollees sub-sample, two interaction terms $BAL*CHRONIC$ and $BAL^2*CHRONIC$ are added into the regression model respectively. The results of the OLS model for these two sub-samples are different from the results of the logit model. In the first part of the logit model to study the decision to use any service, two interaction terms are only significant within the retired sub-sample. But with respect to the OLS model to examine the incurred level of outpatient

expenditure in the second part, the quadratic term interaction is significant in both the employed sub-sample and retired sub-sample.

Regarding the employed MSA enrollees, both the coefficient of first order term interaction $BAL*CHRONIC$ (Employed: β_4 = 0.0824, p=0.000) and the coefficient of quadratic term interaction $BAL^2*CHRONIC$ (Employed: β_5 = -0.0041, p=0.006) are statistically significant in the OLS model in this part. Therefore, the curvilinear relationship between MSA balance and outpatient expenditure differs among these two groups, the chronic employed enrollees group and non-chronic employed enrollees group. In order to see this different effect clearly, two separate curves of predicted outpatient expenditure are plotted for employed enrollees having any chronic disease and for those without a chronic condition. According to the estimated coefficients of BAL (β_1 =-0.0868) BAL^2 (β_2 =0.0057) $BAL*CHRONIC$ (β_4 =0.0824) $BAL^2*CHRONIC$ (β_5 = -0.0041) in the OLS model shown in Table 5.12 below, two different coefficient sets of BAL and BAL^2 for these two groups within the employed sub-sample can be obtained.

(1) OLS Model: Within the employed sub-sample for those MSA enrollees having a chronic condition CHRONIC=1

- The coefficient of BAL is equal to: $\beta_1 + \beta_4$ = (-0.0868) + (0.0824) = -0.0044
- The coefficient of BAL^2 is equal to: $\beta_2 + \beta_5$ = 0.0057 + (-0.0041) = 0.0016

Using these two new coefficients, the predicted expenditure for the chronic employed MSA enrollees group can be obtained as the MSA balance changes, when

holding all other variables at their mean. The curve of predicted expenditure for this group is shown in the blue line in Figure 5.10.

(2) OLS Model: Within the employed sub-sample for those MSA enrollees without a chronic condition CHRONIC=0

- The coefficient of first order term BAL is equal to: β_1 = -0.0868
- The coefficient of quadratic term BAL^2 is equal to: β_2 = 0.0057

Using these two original coefficients, the predicted expenditure for the non-chronic employed MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve for this group is shown in the red line in Figure 5.10.

As can be seen, the overall predicted outpatient expenditure for the chronic employed enrollees group is significantly higher than expenditure for the non-chronic employed enrollees group. The U-shaped curvilinear relationship between MSA balance and outpatient expenditure is found in these two groups, but their U-shaped curves have an obviously different shape. Within those employed MSA enrollees, the turning point of the curve for these two groups is different. For the chronic employed enrollees group, the lowest point on the curve is a balance value equal to 1.375 (Employed chronic group: $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.0044}{2*0.0016} = 1.375$). After changing the unit of MSA balance back to RMB 1, the turning point of the balance value is RMB 1,375. This is the value of the MSA balance for the chronic employed enrollees group at which predicted outpatient expenditure takes on its lowest value.

However, the lowest point for the non-chronic employed enrollees group is much higher than for the chronic group, being a point at which the balance value is equal to 7.614 (Employed non-chronic group: $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.0868}{2*0.0057} = 7.614$). After changing the balance unit back to the original unit of RMB 1, the turning point for the non-chronic group is instead RMB 7,614.

As a result, for those employed MSA enrollees, the presence of chronic conditions can moderate the curvilinear relationship between balance and outpatient expenditure.

Table 5.12: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Result: Employed Enrollees and Retired Enrollees

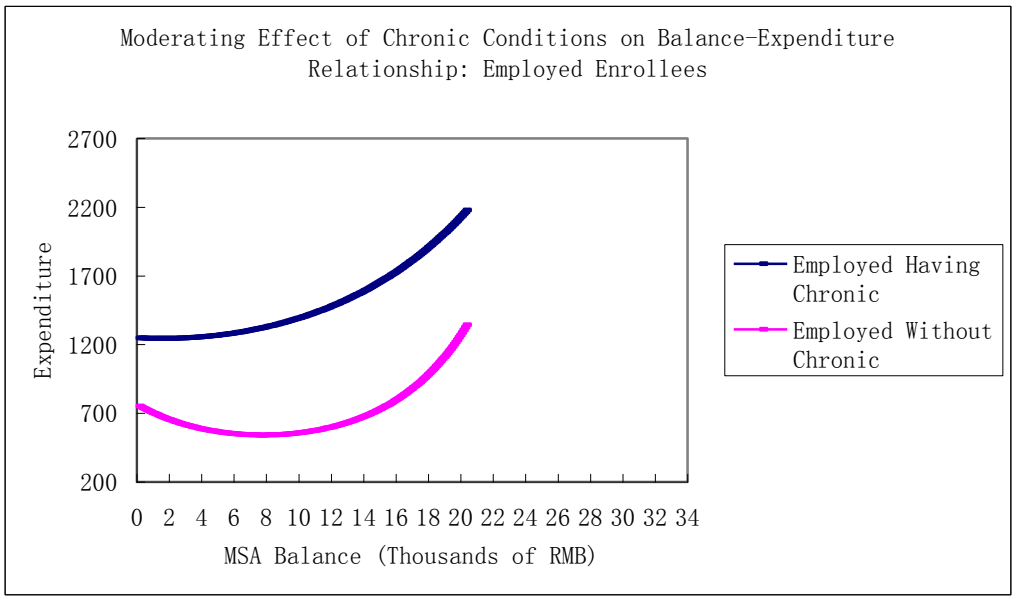
Employed and Retired Sample Part Two: Expenditure (OLS Model) Chronic is a moderator				
	Employed Sample		Retired Sample	
	Coefficient	Percentage Change	Coefficient	Percentage Change
BAL	-0.0868		0.0776	
	(0.0046)***		(0.0099)***	
BAL^2	0.0057		-0.0294	
	(0.0003)***		(0.0013)***	
*BAL*CHRONIC*	0.0824		0.0156	
	(0.0213)***		(0.0226)	
BAL^2**CHRONIC*	-0.0041		0.0080	
	(0.0015)**		(0.0033)*	
CHRONIC	0.5071	66.05%	0.2228	24.96%
	(0.0564)***		(0.0334)***	
AGE (real age)			0.0037	0.37%
			(0.0007)***	

AGE1 (<=35)	-0.0553 (0.0176)**	-5.38%		
AGE3 (45-55/60)	0.2613 (0.0119)***	29.86%		
FEMALE	0.1043 (0.0099)***	10.99%	-0.0284 (0.0090)**	-2.80%
_cons	6.4055 (0.0167)***		6.8673 (0.0548)***	
R^2	0.0401		0.1169	
N	56,084		43,402	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Figure 5.10: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Graph: Employed Enrollees



Considering retired MSA enrollees, the coefficient of first order term interaction *BAL*CHRONIC* (Retired: β_4 = 0.0156, p=0.491) is not significant, and

quadratic term interaction $BAL^2 * CHRONIC$ (Retired: β_5 = 0.0080, p=0.014) is significant at 5% significant level. Therefore, the curvilinear relationship between MSA balance and outpatient expenditure differs among these two groups, the chronic retired enrollees group and non-chronic retired enrollees group. In order to see this different effect clearly, two separate curves of predicted outpatient expenditure are plotted for retired enrollees having any chronic disease and for those without a chronic condition. According to the estimated coefficients of BAL (β_1 =0.0776) BAL^2 (β_2 =-0.0294) $BAL * CHRONIC$ (β_4 =0.0156) $BAL^2 * CHRONIC$ (β_5 = 0.0080) in the OLS model shown in Table 5.12 above, two different coefficient sets of BAL and BAL^2 for these two groups within the retired sub-sample can be obtained.

(3) OLS Model: Within the retired sub-sample for those MSA enrollees having a chronic condition CHRONIC=1

- The coefficient of BAL is equal to: $\beta_1 + \beta_4$ = 0.0776 + 0.0156 = 0.0932
- The coefficient of BAL^2 is equal to: $\beta_2 + \beta_5$ = (-0.0294) + 0.0080 = -0.0214

Using these two new coefficients, the predicted expenditure for the chronic employed MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve of predicted expenditure for this group is shown in the blue line in Figure 5.10.

(4) OLS Model: Within the retired sub-sample for those MSA enrollees without a chronic condition CHRONIC=0

- The coefficient of first order term BAL is equal to: $\beta_1 = 0.0776$
- The coefficient of quadratic term BAL^2 is equal to: $\beta_2 = -0.0294$

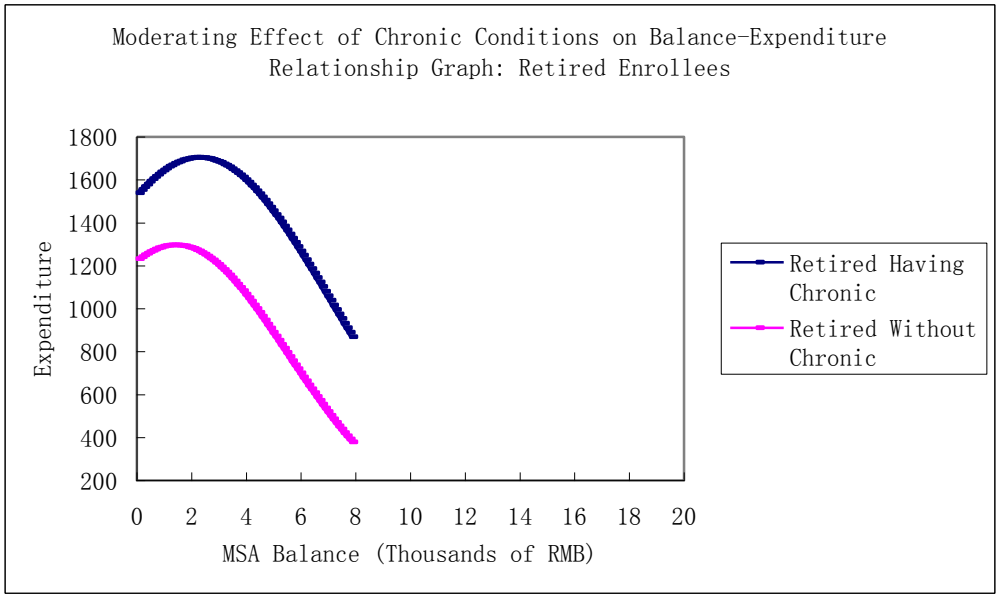
Using these two original coefficients, the predicted expenditure for the non-chronic retired MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve for this group is shown in the red line in Figure 5.11.

As can be seen, the overall predicted outpatient expenditure for the chronic retired enrollees group is significantly higher than expenditure for the non-chronic retired enrollees group. The inverted U-shaped curvilinear relationship between MSA balance and outpatient expenditure is found in these two groups, but their inverted U-shaped curves have an obviously different shape. Within the retired MSA enrollees, the turning point of curve for these two groups is different. For those in the chronic retired enrollees group, the highest point on the curve is a balance value equal to 2.182 (Retired chronic group: $Max = -\frac{\beta_1}{2\beta_2} = -\frac{0.0932}{2*(-0.0214)} = 2.178$). After changing the unit of MSA balance back to RMB 1, the turning point of the balance value is RMB 2,178. This is the value of the MSA balance for the chronic retired enrollees group at which predicted outpatient expenditure takes on its highest value. However, the highest point for the non-chronic retired enrollees group is much lower than for the chronic group, being a point at which the balance value is equal to 1.321 (Retired non-chronic group: $Max = -\frac{\beta_1}{2\beta_2} = -\frac{0.0776}{2*(-0.0294)} = 1.320$).

After changing the balance unit back to the original unit RMB 1, the turning point for the non-chronic group is instead RMB 1,320.

As a result, for the retired MSA enrollees the presence of chronic conditions moderates the inverted U-shaped relationship between balance and outpatient expenditure.

Figure 5.11: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Graph: Retired Enrollees



5.4.3 Moderating Effect in Two Medium Income Groups

As suggested by the results in the previous part, the effect of the MSA balance is different between Income2 (Medium Low Income Group) and Income3 (Medium High Income Group). In this part, the interaction terms

of $BAL*CHRONIC$ and $BAL^2*CHRONIC$ are all included in a two-part model for those Income2 and Income3 sub-samples.

Medium Low and Medium High Income Groups Part One Results:

Moderating Effect of Chronic Conditions:

Similar to the result for employed MSA enrollees, the first order term interaction $BAL*CHRONIC$ (Income2: γ_4 = -0.3679, p=0.651; Income3: γ_4 = -0.0474, p=0.821) and quadratic term interaction $BAL^2*CHRONIC$ (Income2: γ_5 = 0.0628, p=0.549; Income3: γ_5 = -0.0028, p=0.815) are not statistically significant in both Income2 sub-sample and Income3 sub-sample. This shows that the effect of the MSA balance on the decision to use any outpatient service does not differ among different health status groups for these two different income sub-samples.

Table 5.13: Moderating Effect of Chronic Conditions on Probability of Usage Result: Medium Low Income Group and Medium High Income Group

Income2 and Income3 Part One: Probability of Use (Logit Model) Chronic is a moderator				
	Income2 (Medium Low)		Income3 (Medium High)	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio
BAL	-1.1739		-0.5313	
	(0.0517)***		(0.0181)***	
BAL^2	0.0925		0.0204	
	(0.0063)***		(0.0011)***	
*BAL*CHRONIC*	-0.3679		-0.0474	
	(0.8130)		(0.2094)	

$BAL^2 * CHRONIC$	0.0628		-0.0028	
	(0.1048)		(0.0121)	
CHRONIC	2.2812	9.7884	2.3815	10.8213
	(1.5127)		(0.8067)**	
AGE1 (<=35)	-0.5758	0.5623	-0.4888	0.6134
	(0.0532)***		(0.0491)***	
AGE3 (45-55/60)	0.8159	2.2611	0.5739	1.7752
	(0.0386)***		(0.0380)***	
FEMALE	0.4483	1.5657	0.2277	1.2557
	(0.0346)***		(0.0341)***	
_cons	3.6876		3.5010	
	(0.1050)***		(0.0793)***	
Pseudo R^2	0.1083		0.1177	
N	26876		33077	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Medium Low and Medium High Income Groups Part Two Results:

Moderating Effect of Chronic Conditions:

In the second part of the OLS model, the curvilinear relationship between MSA balance and outpatient expenditure is moderated by chronic conditions for both the medium low income sub-sample and medium high income sub-sample, but the moderating effect is different for these two medium income sub-samples.

For the Income2 (Medium Low Income Group) sub-sample, the coefficient of first order term interaction $BAL * CHRONIC$ (Income2: β_4 = 0.1939, p=0.027) is significant at 5% significant level, but the coefficient of quadratic term interaction $BAL^2 * CHRONIC$ (Income2: β_5 = -0.0123, p=0.357) is not significant. Hence, the effects of the MSA balance on expenditure differ between the chronic Income2

enrollees group and the non-chronic Income2 group. Using the same method as before, two separate curves of predicted outpatient expenditure are plotted for Income2 enrollees having any chronic disease and Income2 enrollees without a chronic condition. According to the estimated coefficients of BAL (β_1 =-0.1859) BAL^2 (β_2 =0.0098) $BAL*CHRONIC$ (β_4 =0.1939) $BAL^2*CHRONIC$ (β_5 = -0.0123) in the OLS model shown in Table 5.14 below, two different coefficient sets of BAL and BAL^2 for these two groups within the Income2 sub-sample can be obtained.

(1) OLS Model: Within the Income2 sub-sample for those MSA enrollees having a chronic condition CHRONIC=1

- The coefficient of BAL is equal to: $\beta_1 + \beta_4$ = (-0.1859) + (0.1939) = 0.0080
- The coefficient of BAL^2 is equal to: $\beta_2 + \beta_5$ = 0.0098 + (-0.0123) = -0.0025

Using these two new coefficients, the predicted expenditure for the chronic Income2 MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve of predicted expenditure for this group is shown in the blue line in Figure 5.12.

(2) OLS Model: Within the Income2 sub-sample for those MSA enrollees without a chronic condition CHRONIC=0

- The coefficient of first order term BAL is equal to: β_1 = -0.1859
- The coefficient of quadratic term BAL^2 is equal to: β_2 = 0.0098

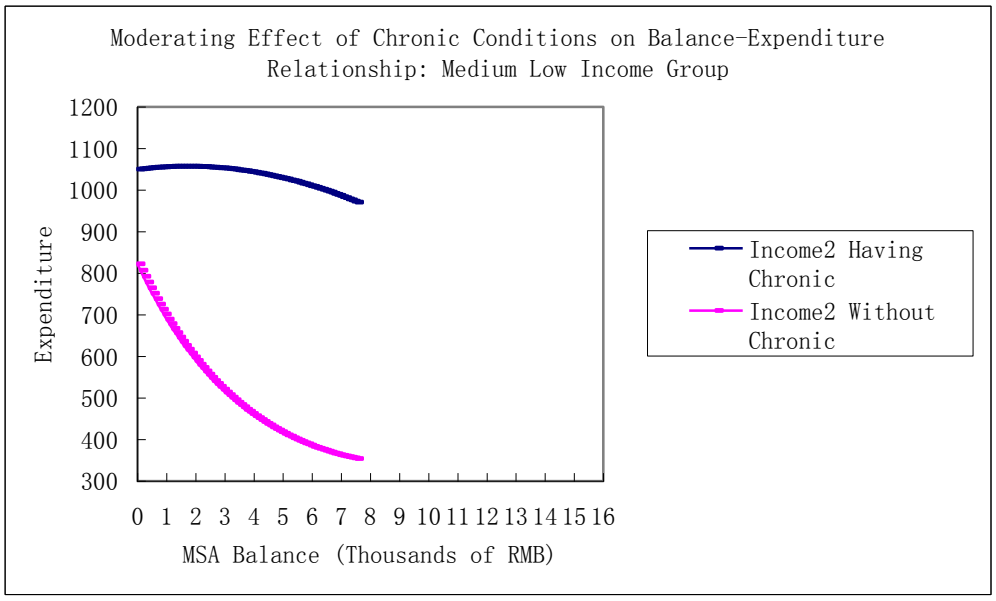
Using these two original coefficients, the predicted expenditure for the non-chronic Income2 enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve for this group is shown in the red line in Figure 5.12.

As suggested by the opposing signs of BAL and BAL^2 for these two groups that have a different health status, it is found that the presence of chronic conditions can moderate the curvilinear relationship between MSA balance and expenditure by changing the curve's direction of curvature. Regarding Income2 enrollees who have one of the seven chronic diseases, there is an inverted U-shaped relation between MSA balance and expenditure, the maximum value of which is found at the highest point on the curve. Due to a positive BAL and negative BAL^2, the linear trend for the chronic Income2 group is predominantly positive, and the direction of curvature is concave downward. The highest point on the curve is a balance value equal to 1.600 (Income2 chronic group: $Max = -\frac{\beta_1}{2\beta_2} = -\frac{0.0080}{2*(-0.0025)} = 1.600$). After changing the unit of MSA balance back to RMB 1, the turning point of the balance value is RMB 1,600. When the balance value is less than RMB 1,600, enrollees having more balance in their MSA would have higher outpatient expenditure. If the balance value is greater than RMB 1,600, then the balance has a negative effect instead on expenditure.

But the direction of curvature is opposite for those Income2 enrollees without a chronic condition. Among the Income2 sub-samples, the observed

maximum balance value is 7.47215 (thousands of RMB), but the calculated minimum point of the curve for that non-chronic Income2 group is a balance value equal to 9.485 (Income2 non-chronic group: $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.1859}{2*0.0098} = 9.485$). The expected turning point of the curve falls outside the meaningful range of Income2's balance. Therefore, the relationship is monotonic. For non-chronic Income2 enrollees, the MSA balance has a negative effect on outpatient expenditure.

Figure 5.12: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Graph: Medium Low Income Group



Regarding the Income3 (Medium High Income Group) sub-sample, the coefficient of first order term interaction $BAL*CHRONIC$ (Income3: β_4 = 0.0763, p=0.011) is significant at 5% significant level, but the coefficient of quadratic term

interaction $BAL^2 * CHRONIC$ (Income3: β_5 = -0.0021, p=0.389) is not significant. Hence, the effects of MSA balance on expenditure differ among the chronic Income3 enrollees group and the non-chronic Income3 group. In order to see this different effect clearly, two separate curves of predicted outpatient expenditure are plotted for Income3 enrollees having any chronic disease and Income3 enrollees without a chronic condition. According to the estimated coefficients of BAL (Income3: β_1 = -0.1504) BAL^2 (Income3: β_2 =0.0075) $BAL * CHRONIC$ (Income3: β_4 =0.0763) $BAL^2 * CHRONIC$ (Income3: β_5 = -0.0021) in the OLS model shown in Table 5.14 below, two different coefficient sets of BAL and BAL^2 for these two groups within the Income3 sub-sample can be obtained.

(3) OLS Model: Within the Income3 sub-sample for those MSA enrollees having a chronic condition CHRONIC=1

- The coefficient of BAL is equal to: $\beta_1 + \beta_4$ = (-0.1504) + (0.0763) = -0.0741
- The coefficient of BAL^2 is equal to: $\beta_2 + \beta_5$ = 0.0075 + (-0.0021) = 0.0054

Using these two new coefficients, the predicted expenditure for the chronic Income3 MSA enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve of predicted expenditure for this group is shown in the blue line in Figure 5.13.

(4) OLS Model: Within the Income3 sub-sample for those MSA enrollees without a chronic condition CHRONIC=0

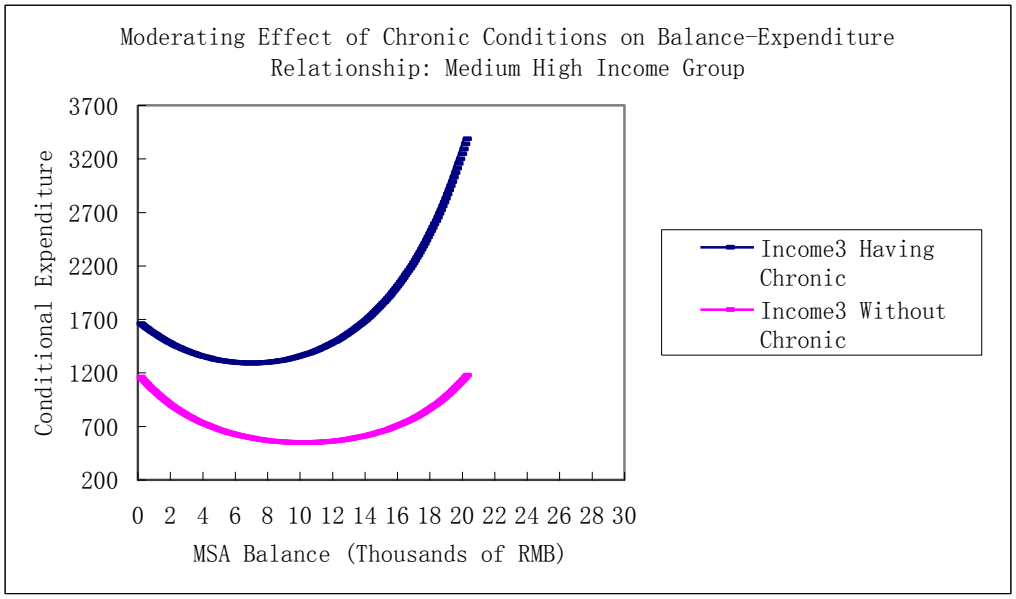
- The coefficient of first order term BAL is equal to: β_1 = -0.1504

- The coefficient of quadratic term BAL^2 is equal to: $\beta_2 = 0.0075$

Using these two original coefficients, the predicted expenditure for the non-chronic Income3 enrollees group can be obtained as the MSA balance changes, when holding all other variables at their mean. The curve for this group is shown in the red line in Figure 6.13.

As can be seen, the U-shaped curvilinear relationship between MSA balance and outpatient expenditure is found in both two groups, but the turning point of the curve for each is obviously different. For the chronic Income3 enrollees group, the lowest point on the curve is a balance value equal to 6.861 (Income3 chronic group: $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.0741}{2*0.0054} = 6.861$). After changing the unit of MSA balance back to RMB 1, the turning point of the balance value is RMB 6,861. But the lowest point for the non-chronic Income3 group is much higher than for the chronic group, being a point at which the balance value is equal to 10.027 (thousands of RMB) (Income3 non-chronic group: $Min = -\frac{\beta_1}{2\beta_2} = -\frac{-0.1504}{2*0.0075} = 10.027$). After changing the balance unit back to the original unit RMB 1, the turning point for the non-chronic group is instead RMB 10,027.

Figure 5.13: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Graph: Medium High Income Group



In summary, the moderating effect of chronic conditions is significantly different for the medium low income group (Income2) to the medium high income group (Income3). For the medium low income group (Income2), the presence of chronic conditions changes the shape of the curve from a predominantly negative concave upward to that of an inverted U-shaped curve. However, for those medium high income enrollees (Income3), the presence of chronic conditions moderates the U-shaped balance-expenditure relationship by changing the balance value at its lowest point.

Table 5.14: Moderating Effect of Chronic Conditions on Balance-Expenditure Relationship Result: Medium Low Income Group and Medium High Income Group

Income2 and Income3 Part Two: Expenditure (OLS Model) Chronic is a moderator				
	Income2 (Medium Low)		Income3 (Medium High)	
	Coefficient	Percentage Change	Coefficient	Percentage Change
BAL	-0.1859		-0.1504	
	(0.0175)***		(0.0068)***	
BAL^2	0.0098		0.0075	
	(0.0025)***		(0.0005)***	
*BAL*CHRONIC*	0.1939		0.0763	
	(0.0879)*		(0.0299)*	
BAL^2 **CHRONIC*	-0.0123		-0.0021	
	(0.0133)		(0.0024)	
CHRONIC	0.2446	27.71%	0.3592	43.22%
	(0.1261)		(0.0754)***	
AGE1 (<=35)	-0.1456	-13.55%	-0.1756	-16.10%
	(0.0286)***		(0.0250)***	
AGE3(45-55/60)	0.3222	38.02%	0.2044	22.68%
	(0.0182)***		(0.0177)***	
FEMALE	0.1623	17.62%	-0.0529	-5.15%
	(0.0154)***		(0.0145)***	
_cons	6.445		6.9672	
	(0.0316)***		(0.0275)***	
R^2	0.0586		0.0548	
N	21866		27955	

Note: 1. * $p<0.05$; ** $p<0.01$; *** $p<0.001$

2. Standard Errors in parentheses.

Table 5.15: Summary Results for the Impact of MSA Balance and Effect of Income Levels

	MSA Enrollees	**Support/Reject Part 1 Hypothesis**	**Support/Reject Part 2 Hypothesis**	**Balance Value At The Turning Point**
RQ1: Impact of MSA Balance	All MSA Enrollees	Support H1-1a: Balance affects the probability of usage for all enrollees	Support H1-1b: The balance-expenditure relationship is nonlinear for all enrollees. (**U-shaped**)	RMB 8,653
	Employed MSA Enrollees	Support H1-2a: Balance affects the probability of usage for the employed group..	Support H1-2b: The balance-expenditure relationship is nonlinear for the employed group. (**U-shaped**)	RMB 7,527
	Retired MSA Enrollees	Support H1-3a: Balance affects the probability of usage for the retired group.	Support H1-3b: The balance-expenditure relationship is nonlinear for the retired group. (**Inverted U-shaped**)	RMB 1,580
RQ2: Effect of Income Levels	Lowest Income MSA Enrollees	Support H2-1a: Balance affects the probability of usage for the lowest income group.	Support H2-1b: The balance-expenditure relationship is nonlinear for the lowest income group. (**Inverted U-shaped**)	RMB 557
	Medium Low Income MSA Enrollees	Support H2-2a: Balance affects the probability of usage for the medium low income group.	Support H2-2b: The balance-expenditure relationship is nonlinear for the medium low income group. (**Part of U-shaped: Predominantly Negative**)	None
	Medium High Income MSA Enrollees	Support H2-3a: Balance affects the probability of usage for the medium high income group.	Support H2-3b: The balance-expenditure relationship is nonlinear for the medium high income group. (**U-shaped**)	RMB 9,890
	Highest Income MSA Enrollees	Support H2-4a: Balance affects the probability of usage for the highest income group.	Support H2-4b: The balance-expenditure relationship is nonlinear for the highest income group. (**Inverted U-shaped**)	RMB 10,602

Table 5.16: Summary Results for the Moderating Effect of Chronic Conditions

	MSA Enrollees	**Support/Reject Part 1 Hypothesis**	**Support/Reject Part 2 Hypothesis**			**Balance Value At The Turning Point**
RQ3: Moderating Effect of Chronic Conditions	All MSA Enrollees	Support H3-1a: Chronic conditions moderate the effect of balance on the probability of usage for all enrollees.	Support H3-1b: Chronic conditions moderate the balance-expenditure relationship for all enrollees.	Chronic	U-shaped	RMB 6,167
				Non-Chronic	U-shaped	RMB 8,691
	Employed MSA Enrollees	Reject H3-2a: Chronic conditions moderate the effect of balance on the probability of usage for the employed group.	Support H3-2b: Chronic conditions moderate the balance-expenditure relationship for the employed group.	Chronic	U-shaped	RMB 1,375
				Non-Chronic	U-shaped	RMB 7,614
	Retired MSA Enrollees	Support H3-3a: Chronic conditions moderate the effect of balance on the probability of usage for the retired group.	Support H3-3b: Chronic conditions moderate the balance-expenditure relationship for the retired group.	Chronic	Inverted U-shaped	RMB 2,178
				Non-Chronic	Inverted U-shaped	RMB 1,320
	Medium Low Income MSA Enrollees	Reject H3-4a: Chronic conditions moderate the effect of balance on the probability of usage for the medium low income group.	Support H3-4b: Chronic conditions moderate the balance-expenditure relationship for the medium low income group.	Chronic	Inverted U-shaped	RMB 1,600
				Non-Chronic	Part of U-shaped: Predominantly Negative	None
	Medium High Income MSA Enrollees	Reject H3-5a: Chronic conditions moderate the effect of balance on the probability of usage for the medium high income group	Support H3-5b: Chronic conditions moderate the balance-expenditure relationship for the medium high income group.	Chronic	U-shaped	RMB 6,861
				Non-Chronic	U-shaped	RMB 10,027

CHAPTER6 DISCUSSION

The objectives behind reforming the urban health financing system for China's urban population are to contain healthcare costs and to improve individuals' access to basic healthcare. The Medical Savings Account (MSA), under the urban healthcare system in China, has three functions: (1) "Cost-containment": Contain costs by restricting an individual's health behavior and by controlling medical expenditure due to a sense of self-responsibility; (2) "Savings for the future": Save unused funds in a person's account for future medical needs; and (3) "Enabling for utilization": Paying for personal qualified health expenditure (G. G. Liu, Y. Tang et al., 2009). As a result, the impact of the MSA balance on outpatient utilization is examined, to evaluate whether the MSA in China can achieve its three intended functions. As discussed in the literature review section, there are two types of MSA models existing in urban China: the "Tongdao" model and the "Bankuai" model. This study focuses on the MSA program in the city of Guangzhou (and the majority of cities in China) which adopts the "Bankuai" model. As a result, the findings about the MSA balance in this research can only be applied to cities using the "Bankuai" MSA model.

In the following part, this section first discusses and explains the findings on the impact of the MSA balance on the probability of usage, the impact of the balance on outpatient expenditure for general cases, the impact of the balance on outpatient expenditure for special cases, and the effect of income levels and chronic conditions

on the balance-expenditure relationship. Then, in the last part, the limitations of this research and suggestions for future studies are mentioned.

6.1 Impact of MSA Balance on Probability of Usage

This study analyzes the impact of the MSA balance on outpatient utilization in two aspects: The probability of using any outpatient service, and the level of utilization as measured by outpatient expenditure among users. We assume that outpatient service users and non-users will each have different health behaviors. In the section that now follows, the main findings on the probability of usage are discussed.

6.1.1 All MSA Enrollees and Sub-Groups

This study indicates that the MSA balance has an impact on the probability of using any outpatient service for all MSA enrollees and all income and chronic condition sub-groups. Among the 114,657 MSA enrollees in this study, there are 86.77% account holders who have some positive expenditure in the year 2007. The probability of using their MSA to pay for any expense in the outpatient sector is quite high. The reasons are as follows: (1) Samples used in the analysis are the first group of enrollees since the MSA program was initiated in the city of Guangzhou in December 2001. By the year 2007, these participants are familiar with the MSA policy and, after six years, know how to use their accounts efficiently and effectively. (2) In this study, the MSA can only be used to pay for outpatient expenditure. When

compared with inpatient services, outpatient services are generally considered discretionary and related to less serious health problems. As a result, the frequency of visiting an outpatient department is much higher. (3) In this study, the average age of included MSA enrollees is relatively high, the average age being around 57 years. It is reasonable to believe that older people tend to be less healthy and are more likely to use the health service. (4) In addition, positive outpatient expenditure in this study not only includes spending in hospital outpatient departments, but also includes expenses incurred in qualified drug retailers outside hospitals in Guangzhou. This can also increase the likelihood of incurring positive expenditure during the year. Therefore, the high probability of outpatient service usage implies that the MSA is widely used among the first group of enrollees in the Urban Employee Basic Medical Insurance in Guangzhou. The widespread use of the MSA suggests that this policy can, to some extent, improve enrollees' access to outpatient care.

6.1.2 Difference between Chronic and Non-Chronic Group: All Enrollees

The effects of the MSA balance on the probability of using outpatient services can differ between the chronic group and non-chronic group for all MSA enrollees in this study. For the same MSA balance, the predicted probability of outpatient usage for MSA enrollees having chronic diseases is obviously higher than the probability for those without chronic conditions. This result confirms that the need factor remains the most important predictor of health service utilization, which is in line with previous studies (Andersen & Newman, 1973; Kaplan et al., 1996; G.

G. Liu et al., 2002). As pointed out by Wong et al. (2006), individuals suffering from chronic conditions are more likely to consult a western medical practitioner, which is similar to this study. According to Remington et al. (2010) (p.4), they define a chronic disease as "a disease that has a prolonged temporal course, that does not resolve spontaneously, and for which a complete cure is rarely achieved". Chronic diseases can be controlled but not cured, and normally require ongoing or daily treatment to control the underlying effects of the diseases. As a result, MSA enrollees with chronic conditions need to visit physicians regularly, and obtain certain necessary medicines, in order to control their diseases over time. In Guangzhou, physicians usually only prescribe sufficient medicines to last one month for chronically ill patients in the outpatient sector. That is why chronic MSA enrollees have to visit outpatient departments frequently, and have a remarkably higher probability of usage than those without chronic conditions.

6.1.3 Difference between Chronic and Non-Chronic Group: Employed and Retired Group

The presence of chronic conditions cannot moderate the effect of the MSA balance on the probability of usage for the employed group, but it can moderate the effect for the retired group. The reason for this is thought to be that, among the employed MSA enrollees, there are only 3.5% in this study having chronic diseases. What's more, the number of chronic employed samples who did not use any outpatient service in the year is even smaller. Therefore, regarding this employed

group, the moderating effect of their chronic status on the probability of usage cannot be found, based on such a small number of chronic employees. In addition, since MSA enrollees in the two medium income sub-groups account for 87.8% of the total employed samples in this study, the result of the two medium income groups is similar to the whole employed group, indicating that the effect of balance on the probability of usage does not differ between chronic medium income groups and non-chronic medium income groups. However, the result for those retired MSA enrollees is just the opposite. It is found that the effect of the MSA balance on the probability of using any outpatient service is different between chronic retired enrollees and non-chronic retired enrollees. Comparing the different health status groups together, it can be seen that at the same value of MSA balance, the predicted probability of outpatient usage for the chronic retired group is higher than the probability for that of the non-chronic retired group, but this probability difference is much smaller than the one for all enrollees (employed enrollees and retired enrollees together). This is because retired enrollees without chronic conditions usually have a worse health status than other enrollees without chronic conditions. According to Andersen's behavioral model of health services use, individual need characteristics include both "perceived" need and "evaluated" need. "Perceived" need represents "how people view their own general health and functional state, and how they experience and emotionally respond to symptoms of illness, pain, and worry about their health condition" (Andersen & Davidson, 2007) (p.7). "Evaluated" need is defined as "professional judgment and objective measurement about a patient's

physical status and need for medical care", and the indicators of it include blood pressure readings, temperature and blood cell count, as well as diagnoses and prognoses for particular conditions the patient experiences and so on (Andersen & Davidson, 2007) (p.8). In this study, the presence of doctor-diagnosed chronic conditions is employed to measure the individual need characteristics, but this is only one indicator of individual need factors. In addition to chronic conditions, many other indicators can also reflect the health status of MSA enrollees. Regarding these retirees, even though they do not have any one of the seven chronic diseases in this study, they can also have other diseases or even worse indicators of other need factors which can also lead to a high probability of outpatient usage. So this can narrow the probability difference between the chronic retired group and the non-chronic retired group.

6.2 Impact of MSA Balance on Outpatient Expenditure: General Cases

Examining the effect of the MSA balance on the level of expenditure, given that one is using outpatient services, is the main focus in this research. For the majority of MSA enrollees, this study suggests that the level of MSA balance significantly affects outpatient expenditure, and that the relationship is U-shaped. Before the lowest point on the curve, the MSA balance is negatively associated with outpatient expenditure; but after this lowest point the balance is instead positively related to expenditure. This U-shaped balance-expenditure relationship can be found for all non-chronic MSA enrollees, all chronic MSA enrollees, the non-chronic

employed sub-group, the chronic employed sub-group, the non-chronic medium high income sub-group, the chronic medium high income sub-group, and the non-chronic medium low income sub-group. Initially, MSA enrollees with certain balances in their accounts tend not to spend as much, up to a certain point. Beyond that point outpatient expenditure will go up. This U-shaped balance-expenditure relationship for general cases will be discussed in the following part.

6.2.1 Before the Turning Point

The negative relationship between the MSA balance and outpatient expenditure prior to the lowest point on the curve can be due to the MSA's three intended functions of "Cost-containment", "Savings for the future", and "Enabling for utilization". The majority of MSA enrollees fall within this range prior to the turning point.

First, *"Cost-containment"*: This negative balance-expenditure relationship before the turning point demonstrates that the MSA program can achieve medical cost-containment to some extent. After creating a personal MSA, account holders become more cost-conscious, and make healthcare spending decisions more judiciously, because they are using their own money in the account to pay for outpatient expenditure, and the funds remaining in the MSA belong to them. Enrollees themselves, not third-party payers, have control over how available balances in the MSA are used for health services. So the MSA program provides

incentives to restrain the growth rate of enrollees' health expenditure, and thus contains healthcare costs effectively.

Second, *"Savings for the future"*: MSA enrollees having a greater balance in their accounts and incurring lower outpatient expenditures also supports the argument that the MSA can be an effective means of saving for future medical needs. This is because the MSA system enables enrollees to accumulate a healthcare reserve fund of their own over time for meeting expected future higher healthcare costs, which can address the problem of the ageing population and the intergenerational equity problem. Funds accumulated in the MSA provide resources for personal healthcare expenditure in later years of life. As pointed out by Hanvoravongchai (2002), average income and capability to save for an MSA account holder are usually high throughout the working years compared to retirement, but the average level of medical expenditure is often low at younger ages and becomes higher in later years of life. As a result, MSA enrollees can save in advance during their working life so as to ensure having sufficient funds in the accounts for future healthcare needs. In addition, those having large balances in their accounts may be in better health status and less likely to incur a large amount of expenditure in the outpatient sector. Then, more and more unspent funds can be accumulated in the MSA, resulting in lower spending. Consequently, MSA enrollees save unspent funds in their accounts for their future medical needs.

Third, *"Enabling for continuous utilization"*: The negative balance-expenditure relationship suggests that available balances in the MSA are used to pay

for outpatient expenditure for those enrollees in need, implying that the MSA can play its enabling role. The MSA program in Guangzhou has already been implemented for six years, since December 2001. Enrollees who have smaller balances in their accounts in December 2006 will have higher outpatient spending in the year 2007. This is because these enrollees are frequent users of health services and often in a poorer state of health. During the previous five years from 2002 to 2006, they continuously incurred high medical expenses, so then they have a lower level of available funds in their MSA at the end of December 2006. It is reasonable to believe that these less healthy enrollees will also have higher expenditure in the following year 2007, because of their continuous health conditions and greater medical needs. As a result, the MSA balance enables these less well-off individuals to pay for their needed health expenditures in the outpatient sector.

6.2.2 After the Turning Point

The positive relationship between the MSA balance and outpatient expenditure after the turning point can be attributed to "Enabling for occasional utilization", "Some unnecessary utilization", and even "Some improper utilization" in the outpatient sector. Only a small number of MSA enrollees have this positive relationship, and are able to retain such large amounts of balance in their personal accounts.

First, *"Enabling for occasional utilization"*: The positive balance-expenditure relationship after the turning point shows that available balances

accumulated in the MSA are also used to pay for certain occasional health spending. Some individuals will have higher outpatient expenses as their balances in the account are rising. MSA enrollees in this case are those more healthy account holders who have much less spending in the years from 2002 to 2006, or have even never used outpatient services during the previous five years, so they are able to keep a large amount of unspent funds in their accounts. However, these healthy enrollees may become sick occasionally in the examined year 2007 for unexpected reasons, such as catching cold carelessly, or eating the wrong foods. Therefore, they can use unspent funds accumulated beforehand in their MSA to pay for any chance health service needs.

Second, "Some unnecessary utilization": This increased usage after the turning point also suggests that some unnecessary utilization may occur after the MSA balance attains a certain high level. When MSA balances are quite high, it may create incentives for MSA account holders to spend more than they would usually be able to afford at the expense of conserving their MSA for future medical needs. It is possible that high levels of MSA balances might give account holders a false sense of security, and encourage them to spend more than they are usually able to afford out of current money (Hanvoravongchai, 2002). This is in line with some studies in Singapore, which imply that the MSA may induce an increased demand for unnecessary health services. For example, a study in Singapore reveals a dramatic shift in demand from government hospitals to the restructured and private hospitals, and a discernible upgrading from lower to higher priced beds (Phua, 1997).

Furthermore, Lim (1997) also alleged that in a number of cases the MSA encouraged enrollees to spend beyond their means by choosing higher class wards than they could reasonably afford. In view of the fact that Singapore requires individuals to contribute a very high percentage of income to their MSA, it has been proposed that the high balance in their MSA would induce unnecessary utilization. Thus, some account holders in this study are likely to abuse their higher available MSA balance in order to obtain certain unnecessary outpatient services. For example, they may visit physicians for only minor conditions, such as the common cold, or may have more expensive interventions in the outpatient sector.

Third, "Some improper utilization": Another possible explanation for this increased usage is that there are a few improper health behaviors involving a small number of MSA enrollees. According to existing MSA policy in Guangzhou, each enrollee's account is only available for his/her own health spending in the outpatient sector. But as far as is known, some enrollees give their personal MSA to their family members to pay for outpatient expenditure that they are not entitled to. In this study, the MSA is not only used to pay for medical spending in hospital outpatient departments, but also to purchase medicines in qualified drug retailers outside hospitals. Specifically, most improper health behaviors probably happen in these drug stores. For example, a government report shows that several enrollees use their MSA to purchase cosmetic products and nutrition in retail drug stores, items which are not qualified health services according to existing MSA regulations (GuangzhouGovernment, 2007b). Furthermore, a newspaper article published in

Guangzhou "Yang Cheng Wan Bao" on 28 April 2007 reveals that an inappropriate method of withdrawing cash from an MSA exists in the market. Therefore, having large amounts of money in the MSA can give rise to improper health spending behavior.

6.2.3 Possible Explanations

This study shows that the MSA balance significantly affects outpatient expenditure, and that the relationship is U-shaped for the majority of MSA enrollees. The finding of this nonlinear balance-expenditure relationship is inconsistent with two previous studies of the MSA balance in China. The possible reasons are discussed as follows.

First, one study examining the effect of the balance on health expenditure under the "Tongdao" MSA model in Zhenjiang city indicates that the MSA balance is positively associated with payments from the MSA and the overall annual health expenditure, which is inconsistent with the current study's findings (G. G. Liu, T. T. Tang et al., 2009). The positive relationship between the MSA balance and payments from the MSA in Zhenjiang city could be due to the design of the "Tongdao" model, which finances healthcare through three tiers: The MSA, out-of-pocket spending in the form of deductibles, and the Social Risk-pooling Fund. Only when the funds in a personal MSA are exhausted can enrollees' health expenditure be paid out of the Social Risk-pooling Fund, albeit with some deductibles and coinsurance. Accordingly, those MSA enrollees under the "Tongdao" model who

have a significantly greater balance in their personal account tend to make much higher payments from their MSA, in order that subsequently their health spending can be reimbursed by the whole city's Social Risk-pooling Fund. However, the current research analyzes the effect of the MSA balance under the "Bankuai" MSA model, which states that funds in the MSA can only be used to pay for outpatient expenditure. When funds in the MSA are exhausted, account holders must pay any excess expenditure out of their own pockets. As a result, in the current study, those MSA enrollees who have a greater balance in their personal account tend not to spend as much prior to the turning point, so as to retain a higher available balance in their MSA. In addition, previous literatures suggest that the "Tongdao" MSA model may actually induce overuse and even moral hazard in the transfer of outpatient services to inpatient services, in comparison with the "Bankuai" MSA model (Huang, 2007; Yip & Hsiao, 1997). Therefore, the MSA under this "Tongdao" model may not actually restrain the growth rate of overall health expenditure, which leads to this positive balance-expenditure relationship.

Second, the finding of another study conducted by Liu et al. (2009), which examines how the MSA balance affects health expenditure under the "Bankuai" MSA model in Nanjing city, is also different from this study. On the one hand, this previous Nanjing study shows that those MSA enrollees who have a higher balance in their personal account incur higher payments from the MSA in the outpatient sector, which is inconsistent with the current research. This is because samples used in the Nanjing study are chronic disease patients who have previously used health

services in the outpatient sector. They use available balances in the MSA to pay for their necessary chronic disease medicines, which leads to this positive relationship between balance and payment from the MSA. However, samples in the current study are the first group of MSA enrollees in the city of Guangzhou, which includes both health service users and non-users, and enrollees both with and without chronic conditions. Many samples in the current research have better health status and thus incur lower health spending. So the negative relationship between MSA balance and payments from the MSA prior to the turning point is reasonable in the current study. On the other hand, the previous Nanjing study also suggests that those MSA enrollees who have a greater balance in their personal account will incur lower overall outpatient expenditure, which is similar to this study's negative balance-expenditure relationship prior to the turning point. This is because outpatient expenditure as used in the current research is considered as being the overall outpatient expenditure in the Nanjing study, and the balance value of the samples in the Nanjing study is much less than of those in this research. The mean and maximum values of the MSA balances used in the Nanjing study are only RMB 1,023 and RMB 1,981 respectively, whereas the current study's mean and maximum balance values reach as high as RMB 4,145 and RMB 20,143 respectively. Therefore, the balance accumulated in each MSA used in the Nanjing study may still not be sufficient to reach the turning point of this study's U-shaped curve. The result of this previous Nanjing study, which shows a negative relationship between MSA

balance and overall outpatient expenditure, may in fact be only the former decreasing part of the U-shaped relationship found in the current study.

In summary, the findings on the balance-expenditure relationship for general cases suggest that the MSA can achieve its three intended functions of "Cost-containment", "Savings for the future", and "Enabling for utilization" for the majority of its enrollees. But the analysis also implies that a high balance in the MSA may induce the increased usage of unnecessary outpatient services, and even certain improper utilization. So, setting lifetime limits on the balances retained in their medical savings accounts is an important issue regarding MSA usage. If the maximum balance limit is set too low, enrollees will have to pay a large portion of health spending out of their own pockets, and available funds in the MSA may not be enough to cover large medical expenditures during their later years of life. If the maximum balance limit is set too high, it may create incentives for MSA enrollees to abuse the accumulated high balance and use some unnecessary outpatient services at the expense of conserving the MSA for future medical needs, especially for during old age. At present, the MSA policy in China does not have any regulations concerning maximum balances permitted in personal accounts. Therefore, health policy makers can consider setting a ceiling on the MSA lifetime balance for outpatient services, but the specific amount of this ceiling should be calculated by further economic simulation studies.

6.3 Impact of MSA Balance on Outpatient Expenditure: Special Cases

This study also reveals that an inverted U-shaped relationship between MSA balance and outpatient expenditure is found for some special sub-groups: The non-chronic retired sub-group, the chronic retired sub-group, the lowest income sub-group, the highest income sub-group, and the chronic medium low income sub-group. Initially, MSA enrollees having higher balances tend to increase their expenditures up to a certain point. After that turning point the relationship becomes negative. This inverted U-shaped balance-expenditure relationship for special cases can be explained below.

6.3.1 Before the Turning Point

The positive relationship before the highest point on the curve can be derived from the "Enabling for needed utilization" function of the MSA. When some MSA enrollees have medical needs, available balances in the accounts are used to pay for health spending in the outpatient sector. According to the data provided by the Bureau of Health in Guangzhou, the total number of outpatient visits in all hospitals is 50,642,154 times in 2007 (Guangzhou, 2007b). Guangzhou's officially registered population in the same year is 7,701,900 (GuangzhouStatisticsBureau, 2008). So the average number of outpatient visits for the whole population of Guangzhou is 6.58 times (50,642,154/7,701,900=6.58) in the year 2007. In addition, the Bureau of Health also makes known that the average outpatient expenditure per visit in Guangzhou in 2007 is RMB 153 (Guangzhou, 2007a). As a result, each Guangzhou

citizen's actual average outpatient expenditure incurred during 2007 is equal to RMB 1,006.74 (6.58*153=1006.74). Comparing this figure of RMB 1,006.74 that a normal citizen needs to spend in the examined year with the predicted maximum outpatient expenditure at the highest point on the curve, it can be seen whether enrollees in special cases can have enough balance in their accounts to use the outpatient services they actually need and pay by their personal MSA. For example, with respect to the non-chronic retired group, the predicted maximum outpatient expenditure at the turning point is equal to RMB 1,296.93, which seems reasonable. Therefore, the MSA is being used to pay for needed outpatient care for retired enrollees without chronic conditions.

6.3.2 After the Turning Point

After the turning point, the negative relationship between balance and expenditure can be due to three reasons. First, the MSA "Cost-containment" function can exercise some effect on the non-chronic retired sub-group and the highest income sub-group. After paying for necessary outpatient services, enrollees in these sub-groups may like to maintain adequate balances in their accounts, and to make more prudent healthcare spending decisions, which can restrain the growth in medical expenditure. Second, for those chronic retired enrollees and the lowest income enrollees who have worse health conditions and will naturally incur rather high expenditure, the available balance in their MSA is not adequate for needed health spending. Third, this negative balance-expenditure relationship for both

chronic and non-chronic retired MSA enrollees in this study may also be due to a shift in care from outpatient care to hospitalization treatment.

6.3.3 Possible Explanations

The findings on the balance-expenditure relationship for special cases indicate that the MSA cannot achieve its three intended functions of "Cost-containment", "Savings for the future", and "Enabling for utilization". It seems that "Enabling for needed utilization" plays a major role among the three design functions for these special sub-groups.

Comparing together MSA retired enrollees and employed enrollees, we can see that the curvilinear relationship between MSA balance and outpatient expenditure is the opposite way round for these two sub-groups. The reasons are discussed as follows: (1) Most retired enrollees have poorer health status than employed enrollees, and will thus require more healthcare. So while the account balances are initially increasing, retirees will incur higher expenditures, but employees will instead have lower spending. As a result, the predicted expenditure of the retired group is significantly higher than that of the employed group for the majority of MSA enrollees. (2) In comparison with employed people, retired MSA enrollees do not have much incentive to save for future medical needs, because they do not know how long they will continue living. As a result, retirees with medical needs will use available funds in their MSA to pay for necessary health services, which indicates a positive relationship between balance and expenditure. However,

employed enrollees, who are younger than retirees, will have more incentive to save money in their accounts, because they still have a long way to go before reaching their later years of life. They know that they may require more care in the future and will thus incur much higher expenditure, especially after retirement. So employees are more willing to accumulate reserves, in order to assure sufficient funds in their MSA for future medical needs. (3) Available funds for retirees in their MSA accounts mean extra money that can be used to pay for their necessary health services. Regarding the employed group, contributions to the MSA are made by both employees themselves and their employers, based on a certain percentage of individuals' annual salary. According to the policy, all contributions from employees themselves, equaling 2 percentage of each individual's annual salary, will be put into their personal accounts. But contributions to retirees' MSA accounts (5.1 percentage of the average yearly salary of all employees in the city) are only made by their employers. Retirees themselves do not need to contribute any amount of funds to their accounts. Hence, when extra money is put into the accounts, retired enrollees in need will use available funds in their MSA to pay for health services, suggesting initially a positive relationship between balance and expenditure for the retired group.

6.4 Effect of Income Levels and Chronic Conditions on Balance-Expenditure Relationship

6.4.1 Effect of Income Levels

In order to control the income effect when examining the nonlinear relationship between MSA balance and outpatient expenditure, employed MSA enrollees are divided into four income sub-groups. This study suggests that the curvilinear balance-expenditure relationship is obviously different for these four income groups. Employed enrollees belonging to the lowest income group are individuals whose annual salary is equal to around 60% of society's average salary level. The medium low income enrollees are employees whose personal annual salary is higher than 60% of the social level, but lower than the whole city's average salary level. The medium high income group includes MSA enrollees having a salary that exceeds the average level of all employees in the city, but does not exceed three times that amount. In addition, employed enrollees whose salary is more than three times the average yearly salary of all employees in the city, or above, are in the highest income group. It is important to note that this study divides the four income groups based on the actual income levels of society in reality. So the number of employed samples in these four income groups is not the same. The majority of employees fall into the two medium income groups, that is, the medium low income group and the medium high income group. The different effects of the MSA balance in these four income groups can be explained as follows.

First, the three intended functions of the MSA, namely, “Cost-containment”, “Savings for the future” and “Enabling for utilization” under the urban healthcare system in China, can be achieved in the two medium income groups, the medium low income group and the medium high income group. However, the effect of the MSA balance for the medium low income group is significantly different from that of the medium high income group, since the latter group’s curve has a turning point, whereas the former group’s curve does not. The reasons are discussed as follows: (1) Among the medium low income enrollees, the balance has a predominantly negative curvilinear relationship to outpatient expenditure. In this study, the medium low income group’s balance value ranges from RMB 1.45 to RMB 7,477.17. According to the calculation, the lowest point on its curve is a balance value equal to RMB 9,778, which is beyond the actual range of its balance value. As a result, only the former decreasing part of the U-shaped relationship represents the curvilinear relationship between balance and expenditure for this medium low income group. (2) But with respect to the medium high income group, the MSA balance has a U-shaped relationship to health expenditure, with the curve’s turning point falling within this group’s balance range. The reason is that medium high income enrollees have larger contributions to their accounts than the medium low income enrollees. MSA contributions made by both employers and employees themselves are determined by a certain percentage of enrollees’ personal salary level. So medium low income employees with less contribution will have limited funds in their MSA,

and accumulated balances in the accounts cannot attain the calculated value of the turning point on the medium low income group's curve.

Second, the lowest income group and the highest income group have similar inverted U-shaped curvilinear relationships between MSA balance and outpatient expenditure, but they have a significantly different balance value at the highest point on the curves. The impact of balance for the lowest and highest income group is opposite to the two medium income groups. The turning point of the curve when the balance value is RMB 10,602 for the highest income group is much larger than the turning point of the lowest income group's curve, at which the balance value is only RMB 557. This is because contributions to the MSA are income-related, so the money accumulated in the lowest income group's account is much less than that retained in the highest income enrollees' accounts.

Third, the empirical findings for the lowest income group reveal that the lowest income enrollees do not in reality have enough balance in their MSA to cover their total necessary outpatient expenditure. When they become sick in the examined year 2007, they will use available balances in the accounts to pay for their outpatient expenditures. At the highest point on the curve, when the balance value is equal to RMB 0.557 (thousands), the predicted maximum outpatient expenditure for this lowest income group is equal to RMB 539.42. It is felt that this RMB 539.42 does not actually represent the full amount of outpatient expense incurred. As discussed before, each Guangzhou citizen's actual outpatient expenditure incurred in 2007 is on average equal to RMB 1,006.74. But the lowest income enrollees in this study are

predicted to have only RMB 539.42 maximum outpatient expenditure in 2007, this being the full amount of expenses paid out of the MSA. It is therefore probable that they use these limited MSA balances to pay for only half of their actual outpatient spending. In support of this, one study conducted by Liu et al. (2009) demonstrates that enrollees are going to use money from their personal MSA first, not money from their own pockets, to pay for medical expenditure when the balances in their accounts are sufficient. As a result, the lowest income MSA enrollees may still need to pay an extra RMB 467.32 (RMB 1, 006.74 – RMB 539.42 = RMB 467.32) out of their own pockets in order to meet their actual medical needs in the examined year 2007. In actual fact, this finding is consistent with previous literature. As suggested by Scott (1996), the MSA can affect the lower income group adversely, due to the relative burden of medical costs on their available resources. Moreover, lower-income MSA enrollees can be excluded from receiving necessary health services due to lacking enough funds in the accounts to purchase health services (Saltman, 1998). For the lowest income group, this result is similar to Yi et al. (2005) who examine the impact of new urban health insurance reform on vertical equity in healthcare financing, using annual survey data in China's Zhenjiang city from 1993 to 1999. They find that, according to the Kakwani progressivity index, lower-income MSA enrollees would have a greater financial burden because they are in poorer health status and use more health services, but have smaller contributions to their personal accounts because these contributions are income related. Therefore, the available balances in the MSA for the lowest income group are not, in reality,

adequate to cover total necessary outpatient spending, and cannot therefore meet actual medical needs. In view of this, supplementary health financing mechanisms are necessary to assist the lowest income MSA enrollees. Health policy makers in China can consider using money from the Social Risk-pooling Fund to subsidize those MSA account holders in the lowest income group. Since a Guangzhou citizen's actual outpatient expenditure is an average equal to RMB 1,006.74, as calculated before, subsidies can be subject to an annual outpatient subsidy limit of RMB 1,000 per enrollee per account, with some co-payments.

Fourth, the highest income MSA enrollees are found to have much larger amounts of funds available in their accounts than the other three income groups, this to pay for relatively small outpatient expenditure in the examined year 2007, which leaves even more savings remaining for this highest income group. This empirical result is in line with the findings of Yi et al. (2005) suggesting that the introduction of the MSA results in more resources being available for high-income insured employees to use more healthcare, as demonstrated by the Kakwani progressivity index of the estimated MSA balance. It is also possible that some of the highest income enrollees may have certain non-qualified medical expenditures that cannot be paid by their MSA. They may use their own money to pay for certain preventive care and luxury services, such as sophisticated screening tests and new medicines, which are not allowed to be paid for by their accounts, according to the MSA policy in China. But these highest income enrollees having good financial status can afford these luxury health services out of their own pockets. So the MSA cannot take effect

according to its intended functions for this highest income group, especially since large amounts of available balances and savings are left in the accounts. As a result, health policy makers could consider extending the MSA coverage for these highest income employees. Additional health services that can also be paid by a personal MSA are recommended as follows: (1) The MSA is allowed to be used to pay for certain preventive procedures in the outpatient sector which are not qualified health services under the current MSA policy in China. For example, they can use an individual MSA to pay for vaccinations, outpatient MRI scans, CT scans and other diagnostics for early predictions. (2) Higher income enrollees are permitted to use their own MSA for certain cost-effective procedures. For example, employees aged 50 and above can use the accounts for screening colonoscopies at approved hospitals. Additionally, women aged 50 and above can use a personal MSA for mammogram screenings. (3) The highest income enrollees can use their individual MSA to pay for their immediate family members' qualified outpatient expenditure when needed. The immediate family member refers to a person's spouse, child or parent.

Fifth, "Unnecessary and improper utilization" can only occur within the two higher income groups, the medium high income enrollees and the highest income enrollees, whose annual salaries are higher than the average yearly salary of all employees in the city of Guangzhou. One possible reason is that, compared with the other two lower income groups, employees in these two higher income groups have a better financial status and so do not care about the money in their personal MSA. They are able to afford any incurred expenditure out of their own pockets. Another

possible reason is that these two higher income groups contribute more than the other two lower income groups, since MSA contributions are income-related, but also they use less health services due to having a better health status. Then, large amounts of balance can be kept in these two higher income groups' accounts. Until December 2006, the maximum balance value for the medium high income enrollees is equal to RMB 20,043.74, while the maximum balance value for the highest income enrollees can reach RMB 20,143.73. Therefore, a high balance in the MSA account of enrollees in these two higher income groups might induce an increased demand for unnecessary health services and even improper healthcare behaviors. Accordingly, policy makers can consider improving the implementation of the MSA, and setting additional regulations covering MSA usage. New regulations are suggested as follows: (1) Claim limits on the amounts which can be paid by the MSA should be set for various categories of health services incurred in hospital outpatient departments (OPD). For example, up to RMB 500 per year for ordinary cough treatment in outpatient departments can be set as MSA claim limits. The specific amounts of the various MSA claim limits for different types of health services in outpatient departments should be calculated by additional studies on cost-effectiveness. (2) With regard to spending on medication outside the hospital that can presently also be paid by an individual MSA, a daily payment ceiling should be set for payments from an MSA to qualified drug retailers. For example, MSA policy can limit the maximum medication payments in drug stores to RMB 300 per day. (3) The MSA administrative institution can randomly send out official letters to check

on enrollees' payment receipts for the previous three months. Account holders who have unreasonable MSA payments should then be punished.

6.4.2 Moderating Effect of Chronic Conditions

In order to control the need factor when examining the nonlinear relationship between MSA balance and outpatient expenditure, the moderating effect of chronic conditions on the balance-expenditure relationship is analyzed in all MSA enrollees, employed enrollees, retired enrollees, and two medium income sub-groups respectively. The findings in this research indicate that the presence of chronic conditions: (1) moderates the U-shaped balance-expenditure relationship by changing the balance value at the lowest point for all MSA enrollees, the employed group and the medium high income group; (2) moderates the inverted U-shaped balance-expenditure relationship by changing the balance value at the highest point for the retired group; and (3) changes the shape of the curve from a predominantly negative concave upward to that of an inverted U-shaped curve for the medium low income group.

As the criterion for determining whether the needs of enrollees with chronic conditions are adequately met under the MSA system, the largest outpatient expenditure for chronic disease medicines paid by an MSA in the examined year 2007 should first be estimated. According to the government document (GuangzhouGovernment, 2007d), a new Outpatient Chronic Disease Program is launched for all urban health system enrollees on 1 July 2007, and states that part of

the enrollees' expenditure for needed chronic disease medicines incurred in the outpatient sector can be subsidized by the Social Risk-pooling Fund (SRF); the SRF can pay for 80% of the total expenditure in community medical clinics and 60% of the total expenditure in other larger hospitals. The program lists seven common chronic diseases, including Hypertension, Coronary Heart Disease, Schizophrenia, Rheumatoid Arthritis (RA), Parkinson's Disease (PD), Diabetes, and Systemic Lupus Erythematosus (SLE) (GuangzhouGovernment, 2007c). The policy of this program regulates that when enrollees incur chronic disease spending, 80% of the total expenditure in community medical clinics and 60% of the total expenditure in other larger hospitals can be paid by the SRF, while the remaining part of the total expenditure is paid for by a personal MSA or out of the enrollee's own pocket (GuangzhouGovernment, 2007d). The policy also declares that for one regulated chronic disease, the maximum payment ceiling of chronic disease medicines from the SRF is RMB 100 each month per patient; if enrollees have more than one regulated chronic disease, they can only choose two out of the seven regulated chronic diseases that can then have an RMB 200 maximum payment ceiling from the SRF each month (GuangzhouGovernment, 2007d). In addition, the subsidy from the SRF cannot accumulate, cannot roll over each month, and is thus valid only in the current month.

The highest MSA payment for one enrollee who has regulated chronic diseases in the year 2007 can be calculated by the methods explained as follows. (1) If it is assumed that each enrollee has two of the seven chronic diseases, then the

maximum payment ceiling for chronic disease medicines paid by the SRF is RMB 200 per month. As stated before, this subsidy of RMB 200 per month from the SRF started on July1, 2007. So only during the latter six months (July-December) in the examined year 2007 have part of the total medicine expenditures been paid by the SRF, thus equaling RMB 1,200 (200*6=1200) during the latter half of the year. (2) In order to obtain the largest expenditure paid by the MSA, it is assumed that the SRF pays for the smaller percentage expense in the community medical clinic, which is 60% of total spending. Regarding the latter six months of 2007, the RMB 1,200 paid by the SRF accounts for 60% of the total expenditure in larger hospitals, so the total expenditure for chronic disease controlling medicines incurred in the outpatient sector is equal to RMB 2,000 (1200/60%=2000) for the latter half of the year. Also, the policy regulates that except for the chronic disease expenses subsidized by the SRF, the remaining part of the total expenditure incurred in the outpatient sector is paid either by a personal MSA or out of the enrollee's own pocket (GuangzhouGovernment, 2007d). In order to estimate the largest medicine spending paid out of an MSA in one year, it is assumed that only the MSA is responsible for the remaining part. Therefore, the chronic disease medicine expenditure paid by a personal MSA for one patient is equal to RMB 800 (2000-1200=800) in the latter six months of 2007. (3) For the previous six months (January-June) in the examined year 2007, prior to the new Outpatient Chronic Disease Program being initiated, no part of the total medicine expenditure can be subsidized by the SRF. All chronic disease medicine expenditure incurred in the

outpatient sector should be paid by an individual MSA or out of one's own pocket. As before, to estimate the largest MSA payment in one year, it is also assumed that the MSA is responsible for the total medicine spending in the former six months. Because the latter half of the year has a total of RMB 2,000 medicine expenditure, the earlier half of the year should also have the same total RMB 2,000 outpatient expenses that are all paid for by a personal MSA. (4) Adding together the calculated MSA payments for the latter half year and the former half year, the highest MSA payment for one enrollee with regulated chronic diseases in 2007 (RMB 800+RMB 2000=RMB 2800) can be obtained. Therefore, the estimated largest expenditure for chronic disease medicines paid by an MSA in the examined year 2007 is equal to RMB 2,800.

January 2007 - June 2007	July 2007 – December 2007
SRF: RMB 0 Total in Half Year: RMB 2,000 MSA: RMB 2,000	SRF: RMB 200*6=RMB 1,200 Total in Half Year: RMB 1,200/60%=RMB 2,000 MSA: RMB 2000-RMB 1,200=RMB 800
Estimated Largest Expenditure for Chronic Disease Medicines Paid by MSA in 2007 RMB 2,000+RMB 800=RMB 2,800	

The moderating effect of chronic conditions on the nonlinear relationship between MSA balance and outpatient expenditure can be explained as follows.

First, for general cases, balances in the MSA are adequate to pay for the needed healthcare of both minor ailments and chronic diseases in the outpatient sector, among all enrollees, the employed group and the medium high income group. (1) The U-shaped balance-expenditure relationship is different for the group with chronic conditions and the group without chronic conditions. Overall, for the same MSA balance, the incurred level of expenditure for the chronic group is significantly higher than the spending for the non-chronic group. (2) The MSA "Enabling for utilization" function for necessary chronic disease spending leads to the lowest point on the curve, shifting certain balance values in front of it: RMB 2,524 balance difference for all enrollees; RMB 6,239 balance difference for the employed group; and RMB 3,166 balance difference for the medium high income group. This is because those MSA enrollees having chronic conditions in the examined year will use available balances in the account to pay for certain necessary medicines that can control the effects of chronic diseases over time. (3) Compared with the RMB 2,800 that is the estimated largest expenditure for chronic disease medicines paid by an MSA, as calculated before, the amount of actual balance difference for these cases at the lowest point between the chronic group and non-chronic group is thought to be reasonable. Therefore, the needs of enrollees with chronic conditions are adequately met under the MSA program for the majority of its enrollees.

Second, for one special case, the MSA balance of the retired group without chronic conditions should be adequate to pay for spending on minor ailments normally incurred in the outpatient sector, but the balance of those retired enrollees

having chronic diseases may not be adequate to pay for needed healthcare. (1) The inverted U-shaped balance-expenditure relationship is different for those retired enrollees with and without chronic conditions. In general, for the same balance value, the predicted expenditure for the chronic retired group is obviously higher than the one for the non-chronic retired group. (2) The MSA intended function of "Enabling for utiliztaion" for the extra expenditure on necessary chronic disease medicines results in the highest point for the chronic retired group, shifting RMB 858 forward. (3) The MSA is being used to pay for needed outpatient care for retired enrollees without chronic conditions. For the non-chronic retired group, the predicted maximum expenditure at the highest point on the curve is equal to RMB 1,296.93. Compared with the RMB 1,006.74 that an average Guangzhou citizen normally spends on outpatient expenditure incurred in 2007, this RMB 1,296.93 seems reasonable. So, before the turning point, retirees without chronic diseases can use necessary outpatient services that they actually need, and pay by MSA as long as they have funds in their account. (4) Chronic retired MSA enrollees may not have adequate balances in their account to pay for all the spending on chronic disease treatment. Regarding the chronic retired group, the predicted maximum outpatient expenditure at the turning point is equal to RMB 1,704.33. But when compared with the RMB 2,800 of the estimated largest amount paid by an MSA for one chronic patient in the year, this RMB 1,704.33 for the chronic retired group seems not enough to cover their total chronic disease expenditure. Retired chronic patients may still need to pay an extra RMB 1,095.67 (RMB 2,800 – RMB 1704.33 = RMB

1,095.67) out of their own pockets in order to meet their actual medical needs. As a result, an accumulated balance in the MSA is not enough to pay for all necessary medicines that can control the effects of chronic disease over time, and thus it cannot meet the needs of retired MSA enrollees with chronic conditions. Therefore, consideration could be given to increasing the current subsidy of RMB 100 monthly from the Social Risk-pooling Fund for each chronic disease for chronic retired MSA enrollees, because the estimated largest outpatient expenditure on chronic disease medicines paid by the MSA for one chronic patient in a year, as calculated before, is equal to RMB 2,800, which is RMB 1,095.67 more than the predicted annual expenditure at the turning point for the chronic retired group in this study. Thus, for each retired MSA enrollee with a chronic condition, it is proposed that a new subsidy of RMB 200 monthly is needed from the Social Risk-pooling Fund for each chronic disease, which is RMB 100 more than under the current policy.

Third, for another special case, the MSA balance of the medium low income group without chronic conditions should be adequate to pay for spending on minor ailments normally incurred in the outpatient sector, but the balance of those medium low income enrollees having chronic diseases may not be adequate to pay for needed healthcare. (1) The presence of chronic conditions changes the shape of the curve from a predominantly negative concave upward to that of an inverted U-shaped curve for this medium low income group. Although having a totally different shape of the relationship, the incurred level of expenditure for the chronic group is significantly higher than the one for the non-chronic group, when having the same

MSA balance. (2) Regarding medium low income enrollees without chronic conditions, the negative relationship between balance and expenditure can be attributed to the MSA intended functions of "Cost-containment", "Savings for the future" and "Enabling for utilization". Among these three functions, "Savings for the future" plays the leading role for this non-chronic group. (3) For those enrollees having one or two of seven regulated chronic diseases in this group, an inverted U-shaped balance-expenditure relationship is found, which is opposite to the non-chronic group. This is because the MSA designed function of "Enabling" for necessary spending on chronic disease plays the leading role for this chronic medium low income group. In addition, at the highest point on the curve, the predicted maximum expenditure for this chronic group is equal to RMB 1,057, which is much smaller than the chronic patient criterion of RMB 2,800 estimated in this study. It is possible that chronic patients in this medium low income group still need to pay an extra RMB 1,743 (RMB 2,800 – RMB 1,057 = RMB 1,743) out of their own pockets for actual medical needs. As a result, increasing the current subsidy of RMB 100 monthly from the Social Risk-pooling Fund for each chronic disease could be considered for those medium low income enrollees with chronic conditions. The estimated largest outpatient expenditure on chronic disease medicines paid by the MSA for one chronic patient in a year, as calculated before, is equal to RMB 2,800, which is RMB 1,743 larger than the predicted maximum annual expenditure at the turning point in this study. Consequently, it is proposed that a new subsidy of RMB 200 monthly from the Social Risk-pooling Fund for each

chronic disease is needed for each medium low income MSA enrollee with chronic conditions.

6.5 Limitations of the Study

There are several limitations in this research.

First, the findings about the MSA balance in this study can not be generalized to other types of MSA models. Nowadays, "Tongdao" model and "Bankuai" model are two types of MSA models coexisting in urban China. This research only examines the MSA program in the city of Guangzhou, which adopts the "Bankuai" MSA model. As a result, this study should not be generalized to cities with other types of MSA models. The majority of cities in China have adopted the "Bankuai" MSA model as examined in this research. Therefore, the experiences gained from implementing the MSA program in the city of Guangzhou can offer some useful insights for other cities adopting the "Bankuai" model.

Second, this study does not consider other companion policy factors, such as co-payment and cap policies. While this research suggests that the MSA balance is an important factor in determining one's outpatient utilization, other companion policy factors are also important such as changes in co-payment and cap policies. However, available data only contains information on MSA balance and MSA payment. The impact of other policy factors is not considered in the current study.

Third, outpatient expenditure used in the analysis may not in reality be the total healthcare spending incurred by MSA enrollees. In this study, outpatient

expenditure in the examined year is approximated by using the MSA payments, because only the value of MSA payments for all samples is included in the available dataset. Only the amounts of expenses paid by the MSA are shown in the dataset, but it is not known whether the enrollees pay for additional expenditure out of their own pockets, or how much they pay, rather than using their MSA. We cannot exclude the possibility that some outpatient services are not purchased by an enrollee's MSA. If funds in the MSA are not enough to cover total health spending, then enrollees have to pay for part of the total expenditure out of their own pockets. It is also possible that some individuals choose to temporarily not use their personal MSA, in order to save the funds for future medical needs. Thus, the result may underestimate the impact of the MSA balance on total outpatient spending actually incurred. However, most of the samples' MSA balances in this study should be enough to cover actual outpatient spending in general. As calculated in the previous part, one Guangzhou citizen's actual normal outpatient spending in 2007 is equal to RMB 1,006.74. The average MSA balance of the total samples in this study reaches RMB 4,145.694, and the value of the balance in the 10% percentile is RMB 1181.99. As a result, more than 90% of the samples' balances are larger than the actual average outpatient spending of RMB 1,006.74 mentioned before. Therefore, it seems acceptable that outpatient expenditure refers only to MSA payments in this study.

Fourth, the number of MSA enrollees with chronic conditions used in the analysis may not in reality be the total number of chronic patients. In this study, only 3.5% of employed samples and 15.7% of retired samples are recorded as chronic

patients in the dataset used in the analysis. This is because the original MSA information dataset does not include the health status of each enrollee. This chronic disease information is identified by a separate chronic disease dataset from the Outpatient Chronic Disease Program initiated on 1 July 2007. Under this program, only MSA enrollees who have professional doctor's certificates demonstrating that they have one or two of the seven regulated chronic diseases can be registered in this chronic disease dataset and then receive additional subsidies each month. It is possible that some chronic patients do not join this program because they cannot get the doctor's certificate, or because they still do not know they are eligible for this subsidized program, due to its limited implementation period. In this case, these MSA enrollees with chronic conditions may be wrongly categorized into the non-chronic group, which can underestimate the actual number of chronic patients. In addition, only seven chronic diseases are included in this subsidized program. Maybe some enrollees having other types of chronic diseases are also categorized into the non-chronic group. Therefore, the number of samples in this study who have chronic conditions is relatively small, which may also weaken the moderating effect of chronic conditions on the balance-expenditure relationship in this study.

Fifth, limited factors that affect outpatient utilization are included in the analysis. When examining the impact of the MSA balance on outpatient utilization, this study only includes age, gender and chronic conditions as control variables. According to Andersen's behavioral model of health services, many different factors of individual characteristics can affect the use of personal health services. As well as

age and gender, other factors from the predisposing component, such as education and occupation, are not shown in the available dataset. In addition, the need component includes both "evaluated" need factors and "perceived" need factors. The presence of chronic conditions used in this study is only one factor among many "evaluated" need factors. Our dataset does not have records of many other "evaluated" need factors, such as blood pressure readings, temperature and blood cell count. With respect to "perceived" need factors, they are usually available in the primary survey data. The secondary dataset used in this study cannot include this kind of information. Consequently, this may be the reason for the relatively low Pseudo R-squared and R-squared values for all models in this study.

Sixth, the actual income information for each MSA enrollee is not available in this study. This study is designed to examine whether income level affects the relationship between MSA balance and outpatient utilization. Having the data concerning each sample's annual salary, how income level moderates the balance-utilization relationship can be analyzed using the interaction term "Balance*Income". However, the available dataset used in this study does not contain records of income information. It only has the records of each sample's annual contribution to the MSA, which is computed by using a certain percentage of their personal annual salary. As a result, this study uses the amount of their annual contribution to the MSA as a proxy for samples' income levels, and divides the employed samples into four different income sub-groups, based on the actual income levels of society in general. It is possible that several samples having abnormal contributions are categorized into

the wrong income group. In order to minimize this possibility, the study excludes certain outliers that have an extremely large or small value of annual contribution initially. Even if some problematic samples still exist, the impact could be minimal, due to the large sample size used in this study. Therefore, this research can control the income effect by analyzing the effect of the balance on outpatient utilization within each income sub-group respectively.

Seventh, the average age of all samples in this study is relatively high, it being 57 years old. This is because, in order to obtain the balance accumulating over the same period, the samples selected are confined to the first group of enrollees since the MSA program was initiated in the city of Guangzhou. In the beginning, the urban healthcare reform, including the MSA program, is more likely to cover employees and retirees in those firms with a worse financial performance. Individuals retained in these firms are usually older. In addition, compared with the general population, the results of older samples could have a higher probability of health service usage, given the same MSA balance. Therefore, the number of these samples who have a positive expenditure is much larger. In this study, there are only 13.23% of the samples that do not use any health services in the examined year. As a result, how the MSA balance affects the probability of using health services in this study cannot be detected clearly. As far as is known, previous studies on the MSA balance did not try to analyze the impact of balance on the probability of health service usage before examining the effect on health expenditure. Therefore, this

research can provide some preliminary findings on the impact of the MSA balance on the probability of health service usage.

6.6 Suggestions for Further Research

First, a panel data analysis on the dynamic effects of MSA balance on outpatient utilization can be conducted in the future. Future study can try to collect more recent MSA data from 2008 to 2011, and conduct a panel data analysis on the dynamic effects of MSA balance on outpatient expenditure.

Second, comparing the groups with MSA and those without MSA, or conducting a pre- and post-MSA policy modeling analysis can be considered in future studies. Besides the Urban Basic Medical Insurance (UBMI) with an MSA component for employees and retirees of enterprises and social organizations, Guangzhou also has another health care financing scheme "Government Insurance Scheme" (GIS) for government employees and retirees, which does not have an MSA. Future study can compare enrollees under the UBMI program and those under the GIS program, in order to see how one's behavior of seeking care would be altered in response to the MSA policy. In addition, Guangzhou government employees enrolled in the GIS without MSA now will be required to join the UBMI scheme with MSA in a few years time. Therefore, a pre- and post-MSA policy modeling analysis for those government employees can be conducted in the future to see how their outpatient utilization would be affected by the MSA policy.

Third, future research can conduct a study to examine how the MSA policy would impact the use of inpatient services.The subsitution effect between outpatient and inpatient care is the core issue of the current debate on the MSA policy in China and elsewhere.This subsitution effect is more obvious under the "Tongdao" MSA model. There is a tendency to shift from using inpatient care to outpatient care (Liu et al. 1999). Future study can include inpatient utilization for MSA enrollees, in order to see how they take advantages of the Social Risk-pooling Fund for inpatient care.

Fourth, qualitative studies on how MSA enrollees use their accounts can be conducted in future studies. This research mainly analyzes the impact of the MSA balance on outpatient expenditure, using quantitative methods. It suggests that the level of balance significantly affects health expenditure, and that the relationship is nonlinear. This study only shows that MSA enrollees have spending in the outpatient sector, but it cannot identify which type of outpatient service they have used or how they use it in reality. Therefore, some in-depth interviews of MSA account holders can be conducted to understand how they use their personal MSA and their changing behavior in response to different levels of balance in different situations.

Fifth, examining the impact of the MSA balance on health expenditure for chronic patients with one specific chronic disease, and comparing the effect between patients with different types of chronic disease, can be considered in future studies. In this study, the variable of chronic conditions takes on a value of one if the sample is recorded as having one or two of seven regulated chronic diseases, and is zero

otherwise. This study only includes information as to whether each enrollee has any doctor-diagnosed chronic condition, but does not clarify which specific type of chronic disease he/she is suffering from. As a result, future studies can try to analyze the effect of the MSA balance within each sub-group having one specific chronic disease, to see whether the impact is different among the various chronic sub-groups. In addition, these chronic patients registered under the Outpatient Chronic Disease Program should have records on the amount of outpatient spending paid by the MSA, the amount paid by the Social Risk-pooling Fund, and the portion paid out of their own pockets. Therefore, future studies can try to collect this data and examine the impact of the MSA balance on different types of medical expenditure.

Sixth, some stimulation studies could be conducted to estimate how much in the way of savings enrollees need to accumulate in their personal MSA so as to adequately finance their medical expenses over the entire post-retirement period. This study only suggests which enrollee sub-groups have an adequate balance in the MSA for needed healthcare, and which sub-groups do not have enough balance to cover necessary medical expenditure, but it is unable to identify the specific value of appropriate savings that should be retained in the MSA. Therefore, future studies can try to predict the appropriate value of MSA maximum and minimum balance limits, by estimating the present value of lifetime healthcare expenditure under various scenarios.

CHAPTER7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The objective of this study is to examine the impact of MSA balance on outpatient utilization, in order to evaluate whether the MSA can achieve its three intended functions of “Cost-containment”, “Savings for the future” and “Enabling for utilization” in China.

This research has three main theoretical contributions:

Firstly, few empirical studies focusing on the impact of balance in the MSA have been conducted before. The limited studies do not include MSA enrollees who are non-users of health services, and they only investigate the linear relationship between MSA balance and total healthcare expenditure in China. This research fills the gap by analyzing the effect of the MSA balance on the probability of outpatient usage for both users and non-users, and by examining for the first time the nonlinear relationship between balance and outpatient expenditure among users. The findings in this study conclude that the MSA balance significantly affects the probability of using an outpatient service, and that the balance-expenditure relationship for general cases is U-shaped.

Secondly, when examining how the MSA balance affects healthcare expenditure, existing studies seldom consider the health status of account-holders. This study fills the gap by examining the presence of chronic conditions in the analysis. The findings show that the presence of chronic conditions can moderate the

nonlinear relationship between MSA balance and outpatient expenditure in such a way that enrollees with chronic conditions incur higher spending.

Thirdly, some empirical studies in Singapore and China indicate that the MSA cannot constrain healthcare costs, and may actually induce increased healthcare utilization as well as costs, which is inconsistent with the cost-containment goal. However, this study shows that the MSA can achieve cost-containment for the majority of its enrollees, other than for certain special cases.

The main findings of this study are presented in the following part.

First, the MSA balance has an impact on the probability of using any outpatient service for all MSA enrollees, and all income and chronic condition sub-groups, and the probability of usage is quite high. For the same MSA balance, the predicted probability of outpatient usage for enrollees having chronic diseases is significantly higher than the probability for those without chronic conditions in general, which is consistent with previous studies showing that the need factor remains the most important predictor of health service utilization. But this probability difference is not significant for the employed group, due to the small number of employed samples with chronic conditions in this study.

Second, for general cases, the level of MSA balance significantly affects outpatient expenditure, and the relationship is U-shaped. Initially, MSA enrollees with certain balances in their accounts tend not to spend as much, up to a certain point. Passing that point, outpatient expenditure goes up. This U-shaped balance-expenditure relationship can be found for all non-chronic MSA enrollees, all chronic

MSA enrollees, the non-chronic employed sub-group, the chronic employed sub-group, the non-chronic medium high income sub-group, the chronic medium high income sub-group, and the non-chronic medium low income sub-group. This finding for general cases suggests that the MSA can achieve its three intended functions of "Cost-containment", "Savings for the future", and "Enabling for utilization" for the majority of its enrollees. But the analysis also implies that a high balance in the MSA may induce an increased demand for unnecessary healthcare services and even induce improper healthcare behaviors.

Third, an inverted U-shaped relationship between MSA balance and outpatient expenditure is also found for some special sub-groups: the non-chronic retired sub-group, the chronic retired sub-group, the lowest income sub-group, the highest income sub-group, and the chronic medium low income sub-group. Initially, MSA enrollees having higher balances tend to increase their expenditures up to a certain point. After that turning point the relationship becomes negative. This finding indicates that the MSA cannot achieve its three intended functions of "Cost-containment", "Savings for the future", and "Enabling for utilization" for these special cases. It suggests that only the MSA "Enabling" function can have a major effect.

Fourth, within the employed enrollees, the effect of MSA balance on outpatient expenditure is significantly different for the four income sub-groups, indicating that income levels actually affect the balance-expenditure relationship. The three intended functions of the MSA, including "Cost-containment", "Savings

for the future", and "Enabling for utilization", can only be achieved in the two medium income groups (the medium low income group and the medium high income group). Specifically, the findings suggest that the lowest income enrollees do not in reality have adequate balance in their MSA to cover their total necessary outpatient expenditure, but that large amounts of available balances and savings in the account are left over for the highest income group. In addition, unnecessary and improper utilization can only occur within the two higher income groups (the medium high income group and the highest income group).

Fifth, a moderating effect of chronic conditions on the balance-expenditure relationship can be found, implying that the need factor actually does affect the relationship between MSA balance and outpatient expenditure. For general cases, balances in the MSA are adequate to pay for the needed healthcare of both minor ailments and chronic diseases in the outpatient sector. As a result, the needs of enrollees with chronic conditions are adequately met under the MSA program for the majority of its enrollees. However, the findings also suggest two special cases. Specifically, the MSA balances of the retired group and the medium low income group without chronic conditions should be adequate to pay for spending on minor ailments normally incurred in the outpatient sector, but the balances of these two special groups that have chronic diseases may not be adequate to pay for needed healthcare.

In conclusion, the MSA balance significantly affects the probability of outpatient usage and the incurred level of expenditure. For general cases, the

relationship between the MSA balance and outpatient expenditure is U-shaped. Both income levels and the presence of chronic conditions can affect the nonlinear balance-expenditure relationship. In general, the MSA has achieved its three intended functions of "Cost-containment", "Savings for the future", and "Enabling for utilization" for the majority of its enrollees, with the exception of certain special cases.

7.2 Policy Implications

Nowadays, many scholars question the effectiveness of the MSA program in China. Some people even suggest that the MSA policy should be abolished and that the money currently held in the MSA should instead be integrated into the Social Risk-pooling Fund. The empirical findings from this study on the impact of MSA balance on outpatient utilization from this study concludes that the MSA can achieve its three intended functions of "Cost-containment", "Savings for the future" and "Enabling for utilization" for the majority of its enrollees in China. So there is a case for retaining the MSA under the existing urban healthcare system. This study also suggests that current balances in the MSA are adequate to pay for needed healthcare for almost all non-chronic enrollees, except for those in the lowest income group. But for those MSA enrollees with chronic conditions, only the employed and those with higher incomes can have adequate balance in their MSA. Retirees and those in the underprivileged groups who are patients with chronic conditions are unlikely to accumulate sufficient balance in their personal MSA for future expected healthcare

needs. Furthermore, the differing shapes of nonlinear balance-expenditure relationships, together with different balance values at the turning point, suggest that different MSA policies for different enrollee sub-groups are needed. Several policy implications are discussed in the following part.

First, setting lifetime limits on the balance retained in each enrollee's account is an important issue with regard to MSA usage, since the findings of this study suggest that a high balance in the MSA may induce the increased usage of unnecessary outpatient services and even certain improper utilization. If the maximum balance limit is set too low, enrollees will have to pay a large portion of health spending out of their own pockets, and available funds in the MSA may not be enough to cover large medical expenditures later in life. If the maximum balance limit is set too high, it may create incentives for MSA enrollees to abuse the accumulated high balance and use unnecessary outpatient services at the expense of conserving their MSA for future medical needs, especially for during old age. Nowadays, the MSA policy in China does not have any regulations on the maximum balance permitted in personal accounts. Therefore, health policy makers can consider setting a ceiling on the MSA lifetime balance for outpatient services, but the specific amount of this ceiling should be calculated by further economic simulation studies.

Second, in order to control unnecessary and improper health service utilization, policy makers can consider improving the implementation of the MSA and setting additional regulations on its usage. New regulations are suggested as

follows: (1) Claim limits on the amounts which can be paid by a personal MSA should be set for various categories of health services incurred in hospital outpatient departments (OPD). For example, up to RMB 500 per year for ordinary cough treatment in outpatient departments can be set as MSA claim limits. The specific amounts of the various MSA claim limits for different types of health services in outpatient departments should be calculated by additional studies on cost-effectiveness. (2) With regard to spending on medication that can also be paid by an individual MSA, a daily payment ceiling needs to be set on the maximum amount that can be paid to qualified drug retailers by the MSA. For example, MSA policy could limit the maximum medication payments in qualified drug stores to RMB 300 per day. (3) The MSA administrative institution could randomly send out official letters to check on enrollees' payment receipts for the previous three months. Account holders who have unreasonable MSA payments should then be punished.

Third, supplementary health financing mechanisms are necessary to assist the lowest income MSA enrollees, who do not have adequate balances in their accounts to realistically cover their total necessary outpatient expenditure. Health policy makers in China can consider using money from the Social Risk-pooling Fund to subsidize those MSA account holders in the lowest income group. Since a Guangzhou citizen's actual outpatient expenditure is on average equal to RMB 1,006.74, as calculated before, subsidies could be subject to an annual outpatient subsidy limit of RMB 1,000 per enrollee per account, with some co-payments.

Fourth, health policy makers could consider extending the coverage of the highest income employees' MSA, since large amounts of available balances and savings are left in their accounts. Additional health services that could also be paid by a personal MSA are recommended as follows: (1) The MSA could be allowed to be used to pay for certain preventive procedures in the outpatient sector which are not qualified health services under the current MSA policy in China. For example, they could use an individual MSA to pay for vaccinations, outpatient MRI scans, CT scans and other diagnostics for early predictions. (2) Higher income MSA enrollees could be permitted to use their own MSA for certain cost-effective procedures. For example, employees aged 50 and above could use their own MSA for screening colonoscopies at approved hospitals. Additionally, women aged 50 and above could use their personal MSA for mammogram screenings. (3) The highest income enrollees can use their individual MSA to pay for their immediate family members' qualified outpatient expenditure when needed. 'Immediate family member' refers to a person's spouse, child or parent.

Fifth, increasing the current subsidy of RMB 100 monthly from the Social Risk-pooling Fund for each chronic disease could be considered for chronic patients in the retired group and the medium low income group, because the balances of these two special groups having chronic diseases may not be adequate to pay for needed healthcare. This study estimates that they may still need to pay more than one thousand yuan out of their own pockets under the current Outpatient Chronic Disease Program in Guangzhou. Therefore, it is proposed that for those retirees and

medium low income enrollees with chronic conditions a new subsidy of RMB 200 monthly from the Social Risk-pooling Fund is needed for each chronic disease, which is RMB 100 more than under the current policy.

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