

Are Assets in Medical Savings Accounts Discounted?

----- Evidence from a Natural Experiment in China

Maoyong Fan, Zhen Lei and Guoen Liu *

November 23rd, 2010

Abstract:

In China, Medical Savings Accounts (MSAs) are a major tool financing health care consumption in urban areas. Whether MSAs control medical expenditures and encourage saving is based on an assumption that enrollees treat the MSA money the same as their pocket money. This assumption has never been tested. Given the mandatory and restrictive nature of MSAs in China, we hypothesize that enrollees may discount their MSAs and spend them prematurely. To test whether assets in MSAs are discounted, we take advantage of a policy change as a natural experiment in city of Zhenjiang. The policy change affected different age cohorts differently in terms of financial contributions to MSAs. Empirical results show that a reduction in MSAs caused enrollees to reduce their annual medical expenditures by more than the amount of the MSA reduction. The effect was largest for those with intermediate medical expenditures, who were more likely to exhaust their MSAs and pay out-of-pocket expenses. The results are consistent with the hypothesis that enrollees discount their MSAs. The smaller their MSAs are, the higher the chance of paying medical expenditures out-of-pocket (the "true" price): when forced to pay the "true" price of medical services, they consume less.

Keywords: Medical Savings Account, Natural Experiment, Medical Expenditures, Health

JEL classifications: I11; I18; O12

* Maoyong Fan is an assistant professor in Economics Department at Ball State University. Zhen Lei is an assistant professor in Department of Energy and Mineral Engineering at Penn State University. Guoen Liu is a professor in Guanghua School of Management at Peking University.

1. Introduction

The reform in urban health care system is among the most significant policy reforms in China since the 1990s. The traditional health care system, established in the 1950s and pillared by the government insurance system (GIS) and the labor insurance system (LIS), had ran into financial difficulties since the late 1980s, due to escalating healthcare cost and minimal consumer cost-sharing (Winnie C. Yip and William C. Hsiao, 1997). The reform was initiated in 1994 in two pilot cities, Zhenjiang and Jiujiang, was extended to 57 other cities in 1996, and by the end of 1998, a nationwide reform campaign was carried out. While there were certain variations in policy design across cities the reform in all regions followed the government guidelines and share common key features: ensuring access to basic care; wide coverage; and an insurance policy featured with individual medical savings accounts (MSAs) and a social pooling account (SPA) financed by joint contributions from employers and employees (Gordon G. Liu et al., 2002). The reform marked China as the second nation, after Singapore, adopting MSA as a major tool of financing individual's health care.

The urban health insurance system in China is in essence a MSA combined with high deductible insurance plan. MSAs are personally owned accounts, funded by contributions from both employees and employers. These accounts are used to pay for certain medical expenses specified by insurance policies. SPA kicks in after a certain high deductible is met and covers a large share of health care costs. Consistent with arguments by MSA advocates in other countries,¹ the purpose of MSAs, according to Chinese central and local governments, is three-fold: (1) to contain health expenditures by addressing enrollees' moral hazard and controlling their demand for medical services; (2) to achieve equity by ensuring a certain level of health service consumption in

¹ Advocates of MSA have suggested that MSAs will reduce moral hazard, increase choice, improve the efficiency of insurance, and result in lower costs and expenditures on health care.(Anna Dixon, 2002).

medical services for everyone;² and (3) to serve as a mandatory saving tool, particularly for those young and healthy.

Whether or not MSAs can help achieve these goals depends on how enrollees view money in their MSAs. Deber et al. (2004) suggested that "different rules [of MSA] will clearly lead to different incentives for various players." Empirical studies on MSAs coupled with a high deductible plan in the USA showed that people treat payments with MSAs as less costly compared to payments with out-of-pocket money, due to the fact that contributions to MSAs are tax deductible. Consequently, MSAs mitigate the effects of a high-deductible plan, as the reduction in medical spending by a person with a MSA would be less than the reduction with a high deductible plan alone.

With regards to MSAs in China, there are several interesting features that are noteworthy. Contributions to a MSA by an employee are mandatory and directly withheld from her payroll. The money in her MSA earns little interest, is restricted to pay for her medical expenditures only, not for medical expenditures by her household members or for her other consumption expenditures. In principle, the MSA money cannot be cashed out during the enrollee's lifetime. When the enrollee dies, money in her MSA will be transferred to her heir's MSA account.

With such mandatory and restrictive nature of MSA,³ a natural question is raised: Do enrollees discount the MSA money and have incentives to use it up prematurely, just as people significantly discount gift cards and in-kind public assistance such as food stamps?⁴ If enrollees

² Contribution to an enrollee's SPA is in general based on her last year annual salary, with certain minimal level. In Zhenjiang, for instance, 60% of the city average worker salary is the minimal contribution base. For an enrollee whose last year annual salary was below, her contribution base was adjusted to that minimal base,

³ Employee contribution to MSA is tax deductible as is MSA contribution in U.S. But since historically Chinese pay little attention to income tax in general, we expect the tax deductibility alone does not render enrollees in China to discount MSAs as much as in the U.S.

⁴ See Robert A. Moffit (1989) and Diane Whitmore (2002).

think MSA money has less value than money in the pocket, the purported function of MSAs as instruments of controlling medical demand and of saving would be questionable.⁵

This paper studies whether money in MSAs is significantly discounted by enrollees in Zhenjiang, one of the first two cities in China that piloted urban health insurance reform. Under the MSA-Deductible-SPA system in Zhenjiang, an enrollee pays her medical expenditures, both for outpatient services and for inpatient services, using her MSA first. After exhausting her MSA, she is responsible for a deductible equal to 10% of her salary from the previous year with her out-of-pocket money. The SPA kicks in after the deductible is paid. At first thought, it seems that money in a MSA will be treated no differently than out-of-pocket money under a three-tier (MSA-deductible-SPA) pay scheme.

Yet, this is not the case. We explore a natural experiment caused by a policy change on MSA contribution rates in Zhenjiang. Before 2002, the contribution rate to MSA for an enrollee who was 44 years old or younger was 4% of her last year annual salary or 60% of the average city worker salary, whichever higher. In late 2001 the city government decided to reduce MSA contribution rate from 4% to 3% for enrollees younger than 35 years old, but kept the 4% contribution rate for those between 35 and 44. The policy change, promulgated in December 27, 2001 and in effect in 2002, caused an exogenous shock in amount contributed to MSAs and thus the initial amount in MSAs at the beginning of 2002 for enrollees younger than 35 years old, but not for those of 35 years or older.

We take advantage of this discontinuity and compare medical expenditures between two consecutive birth cohorts: the cohort 1969 vs. the cohort 1968, who were 33 and 34 years old, respectively, in 2002. These two cohorts are very similar and thus, concerns about heterogeneous shocks in health situation can be assumed to be minimal. The cohort 1969 (treatment cohort)

⁵ One anecdotal story is that people sometimes buy over-priced toilet paper in drug store in Zhenjiang.

experienced an exogenous reduction in their MSA contribution in 2002, whereas the cohort 1968 (comparison cohort) did not. We employ the Difference-in-Difference method to estimate the impact of the exogenous shock in MSA contribution on medical expenditures.

Our results show that a reduction in MSAs caused the cohort 1969 to reduce their medical expenditures in 2002, relative to the comparison cohort 1968. The drop in medical expenditures by the cohort 1969 was bigger in magnitude than the amount of reduction in MSA contribution, and thus was unlikely caused by a mere income effect.⁶ Moreover, we find that the reduction in medical expenditures in 2002 by the treatment cohort was particularly significant for those likely to enter the deductible stage and pay medical services with their out-of-pocket money.

Our results suggest that enrollees in Zhenjiang, at least for cohorts around 35, studied in the paper, discounted money in their MSAs significantly. When their MSA accounts were reduced, enrollees, *Ceteris Paribus*, were more likely to pay their medical services out-of-pocket. Therefore, when the initial amount in MSAs was reduced, the "true" cost of their medical services, the cost they really cared about, was likely to be higher. As a result, they tended to cut their medical service consumption in response to a reduction in their MSAs.

The finding that enrollees in Zhenjiang significantly discounted money in their MSAs and did not view them as their own money, suggests that we need to be cautious about using MSAs as an instrument to address enrollees' moral hazard and contain medical expenditures and to encourage enrollees to save. Interestingly enough, despite significant differences in the MSA rules between Singapore, the first nation that adopted MSAs, and China, some studies on the

⁶ The income effect here refers to the possibility that the cohort 1969's total disposable income was reduced, relative to the cohort 1968, if the total income included money in the MSA accounts. But an income effect is unlikely to cause a reduction in medical expenditure that is even bigger than the reduction in the income.

Singapore experience concluded that "there is no evidence that they [MSAs] have been effective in restraining health costs" (Michael D. Barr, 2001).

The insights which our study provides on how enrollees in Zhenjiang viewed and treated money in their MSAs suggest an interesting perspective on the role of MSAs in health insurance. The study also highlights the importance of details and rules of MSA design if a country is to incorporate MSAs in the health insurance policy.

The rest of the paper is arranged as follows. Section 2 discusses wide-spread use of MSAs in urban health insurance reform in China and MSAs in Zhenjiang city in particular. Section 3 presents our hypothesis that MSAs are discounted significantly by enrollees in Zhenjiang, and a theory underlying our hypothesis testing that shows how a reduction in a MSA would have a different impact on an enrollee's medical expenditures if she views or does not view money in her MSA as her own money. Section 4 discusses data, followed by the empirical strategies in section 5. Section 6 presents estimation results. Section 7 concludes.

1. Chinese Urban Health Care Reform and MSA

2.1. MSA-Deductible-SPA System in China

Prior to reform, the urban health care system in China had been financed primarily through two major public programs: the Government Insurance Program (GIP) and the Labor Insurance Program (LIP). The GIP was primarily for government employees, veterans, educators, and college students; whereas the LIP was for workers of all state-owned and some non-state-owned enterprises. There were two major problems with the old system. First, both consumers and providers of health care had incentive to abuse the systems.⁷ Second, there was no risk pooling

⁷ On one hand, enrollees received outpatient and inpatient medical services with minimal cost sharing so that they had no incentive to seek the most cost-effective health care. On the other hand, hospitals were usually reimbursed on

across working units (enterprises or government agencies) because each working unit was self-insured.⁸ Consequently, the urban health care system reached a major health crisis due to rapid cost escalation and increasing inequality in health care financing, leading to the urban health insurance reform that started with pilot experiments in Zhenjiang and Jiujiang in 1994 and culminated with a nationwide implementation in 1998.

The reform has brought about three important changes. First, it mandates all enterprises and government agencies in the community (usually a city) to participate in a single-payer and city-run health insurance plan. This serves three primary functions: minimizing the risk of selection bias (both adverse selection by patients and favorable selection by providers); maximizing the pooling of health risks; and enabling equitable health care access. Second, the reform implements a combination of MSAs and SPA to finance medical expenditures. MSAs are owned by individual enrollees and the SPA is shared by all. MSAs and SPA are financed through joint contributions of employers, employees and local government subsidies. Third, the insurance benefits are comprehensive, covering major services including inpatient care, outpatient care, emergency room (ER), and medications, coupled with various demand and supply side cost sharing mechanisms in an attempt to control costs. All participating providers obtain reimbursement for services directly from the City Social Security Bureau. The reimbursement rates are determined according to fee schedules varying with the level and type of provider.

a fee-for-service basis according to a government-set fee schedule, which gave providers incentive to over-provide services.

⁸ No risk pooling under the old system was no problem prior to China's economic reform, as all state-owned enterprises were guaranteed the basic health care benefits through government subsidies. The economic reform detached most of the enterprises from the central government financially. As a result, those non-profitable state-owned enterprises had little capacity to reimburse large medical bills for their employees and retirees, who thus were effectively uninsured and had to pay out-of-pocket for their health care costs. This causes financial hardships for the elderly and those with chronic diseases. On the other hand, those profitable enterprises could continue to provide generous health care benefits, which often contained little patient cost-sharing responsibilities.

Across cities and regions in China, the MSA-Deductible-SPA system has taken two major forms, which are distinguished by rules on which services are paid by which accounts. One form is often referred to as the Pipeline Model, or the Zhenjiang Model, as it was first implemented in Zhenjiang and Jiujiang, the two pilot cities in the reform. In the Pipeline Model, no differentiation between outpatient services and inpatient services is made. An enrollee uses her MSA to pay her medical expenditures first, either outpatient or inpatient, until all MSA money is spent. Then, a deductible has to be paid out-of-pocket before the SPA kicks in. The SPA pays a majority of her medical expenditures beyond the deductible, with a certain percentage of copayments paid by the enrollee. The other form is called the Mixed Model, or the Nanjing Model.⁹ In the Mixed Model, the SPA covers an enrollee's outpatient expenditures for chronic diseases and the non-copayment portion of inpatient services beyond a certain high deductible. The enrollee can use her MSA money to pay for outpatient services, the deductible and the copayment portion of inpatient services she receives.

The combined system of MSA and SPA in China, in either model, in essence consists of a MSA plus a high deductible insurance plan. MSAs are used to contain medical expenditures through demand control, ensure a certain level of equity in terms of access to basic medical services, and serve as mandatory savings, primarily for those young and healthy.

2.2. MSAs in Zhenjiang

Zhenjiang adopted the Pipeline Model in 1994, which consists of a three tier pay scheme: MSAs, deductibles and the SPA. It is mandatory for employed people to participate in the city insurance program and the city authority creates a personal MSA for each enrollee. MSAs are funded

⁹ The Mixed model has evolved from an initial model for which outpatient services are paid first by MSAs and then by out-of-pocket money, whereas inpatient expenditures beyond a high deductible are paid by SPA with copayments.

jointly by employers and employees. The contribution rate varies for individuals with different ages and different working statuses. Figure 1 illustrates contribution rates by employees and employers for those younger than 44 years old in 2001 in Zhenjiang. Both the enrollee and her employer make contributions to the enrollee's MSA account, with the employee contributing 2 percent of her last year annual salary (a.k.a. contribution base) and the employer contributing 2 percent of the contribution base. The contribution by the enrollee is directly withheld from her payroll on a monthly basis. The employer, in addition, contributes 6% of the employee's base to the SPA on her behalf. A self-employed individual can participate in the program by contributing 4% of the city's last-year average annual salary to her MSA account and the SPA, respectively.

When medical expenditures are incurred, whether for outpatient or inpatient services, the MSA is used first to cover these expenses. After the enrollee exhausts her MSA, she then must pay out of pocket until her deductible is reached. The deductible is a certain percentage of her contribution base. After the deductible is met, the SPA kicks in to cover the remainder of the cost. Even with the SPA, the enrollee is still responsible for a copayment for each medical service beyond the deductible. The copayment percentage varies according to whether it is an inpatient or outpatient service, who provides the service, and how much the expenditure is.¹⁰ There is also an upper limit of 3,500 RMB on the total annual amount of copayments that an enrollee pays, beyond which the SPA will cover any remaining cost. Moreover, an upper limit of 30,000 RMB is set for the total annual amount of SPA and copayments. Beyond this limit, another insurance plan will kick in.¹¹

¹⁰ For a working enrollee, the copayment rates for an inpatient service are progressively reduced: 20% for the bracket of RMB 1-5000, 10% for the bracket of RMB 5001-10000, and 5% for RMB 10001-30000. A retired enrollee's copayment rates are half of those for a working enrollee. The contribution rates for an outpatient service are 35% if the service is provided by a Level 3 hospital (city owned hospitals, etc), 30% if a Level 2 hospital, and 25% if a Level 1 hospital (community clinics, etc).

¹¹ This insurance plan is also mandatory and aims to cover inpatient services that are very costly. The annual premium is RMB 60 for workers and RMB 48 for retirees.

Not only are MSAs in Zhenjiang mandatory, but their use is restrictive. An enrollee's MSA can be used to pay for her medical expenditures only; she cannot use her MSA to pay for health care costs of her family members or for other consumption. If her MSA account is not exhausted at the end of a year, the surplus will be retained in her MSA for next year and cannot be taken out. Interest is paid on the balance of her MSA at the end of the year at the current annual interest rate of a bank checking account. The interest is also kept in the MSA account. During the enrollee's lifetime, money in MSA can not be cashed out. When the enrollee dies, her MSA will be transferred to her heir's MSA account if the heir has one. If the heir does not participate in the plan, her MSA can be used to pay for the heir's medical expenditures until exhaustion. If the enrollee has no heir, when she dies, what is left in her MSA will be transferred to SPA.

2. Hypothesis and A Simple Theory

3.1. Hypothesis

Official documents from Bureau of Health Insurance in Zhenjiang have repeatedly stated two main purposes of MSAs: to contain fast growing medical expenditures and to encourage young and healthy people to accumulate funds for future use. Both purposes are hinged on a crucial assumption that enrollees treat money in MSA the same as out-of-pocket money. If this assumption holds, MSAs can function as an additional layer of deductible to reduce enrollees' moral hazard.

However, this paper hypothesizes that enrollees in Zhenjiang significantly discount money in MSAs and do not treat them as valuable as out-of-pocket money as MSAs are compulsory and restrictive. Even though contributions to MSAs are shared by employers and

employees, employees have no direct control over their contributions; the mandatory MSA contributions function like a payroll tax. Money in their MSAs is restricted to pay for their own medical expenditures and cannot be cashed out. As a consequence, money in MSA could seem less valuable for enrollees than cash-on-hand. Therefore, enrollees might feel that it is not necessary to constrain medial expenditures until they exhaust their MSAs. If this is the case, the MSA will not function as the policy designers in Zhenjiang had thought and hoped.

How do we empirically test our hypothesis that enrollees in Zhenjiang discount money in their MSAs significantly? We need an exogenous shock in individual MSAs in order to examine how enrollees responded to the shock. If the MSA money is as valuable as out-of-pocket money, we should not expect any change in behavior. However, if the MSA money is discounted, a reduction in individual MSAs will raise the "true" price of medical services and cause individuals to reduce their demand.

The following paragraph presents the intuition underlying our hypothesis. Consider an enrollee for whom there exists some probability that she will exhaust her MSA account and enter the deductible stage during the coming year. When she experiences a reduction in her MSA at the beginning of the year, *Ceteris Paribus*, the chance of her to entering the deductible stage where she pays her medical expenditures with her out-of-pocket money increases. If she discounts money in her MSA significantly, not viewing it as being as valuable as out-of-pocket money, then what she really cares about is the out-of-pocket payment during the deductible stage, which is the "true" cost to her. Therefore, with a reduction in the initial money in her MSA, the "true" cost of her medical services, other things being equal, is expected to become higher. Given that medical services are normal goods, we would expect her to reduce her consumption.

Consequently, her medical expenditures during that year will drop in response to a reduction in the initial amount of her MSA.

However, if the enrollee views money in her MSA the same as out-of-pocket money, a reduction in her MSA at the beginning of the year will not change the "true" cost of her consumption of medical services, unless she enters the third stage where SPA kicks in.. In this case, a reduction in her initial MSA amount would have little impact on her medical expenditures. Furthermore, if it is likely for the enrollee to enter the SPA stage, then a reduction in her MSA account could render the probability of entering the SPA stage even higher and the expected "true" cost of her medical consumption lower, as the "true" cost of her medical services is small when SPA covers most of the expenditures. As a result, the enrollee's demand for medical services could increase in response to a reduction in the initial MSA amount.

Therefore, how an enrollee's medical expenditure responds to the change in the amount of her MSA could reflect how she views money in her MSA. This is the idea underlying our empirical test of whether an enrollee considers her MSA money the same as cash-on-hand or if she discounts it significantly.

3.2. Graphical illustration

Figure 1 shows, with a numeric example, the relationship between "true" cost and nominal medical expenditure for an enrollee who does not value money in her MSA at all, an extreme example of discounting. Suppose that the enrollee has a contribution base (her last year annual salary) of 10000 RMB, the initial amount of money in her MSA is 400 RMB, and a deductible of 1000 RMB. The relationship between the enrollee's "true" cost vs. her nominal medical expenditure is shown as line OABC. For the first 400 RMB of her medical expenditure, the

"true" cost is zero. When MSA is exhausted, the enrollee enters the deductible stage and has to pay out-of-pocket up to the 1000 RMB deductible limit. The slope of AB is 45 degrees. When the deductible limit is reached, the SPA kicks in and pays a majority percentage of her further medical expenditures. The slope of BC depends on the copayment rate for the enrollee during the SPA stage.

When the initial MSA amount is reduced from 400 RMB to 300 RMB, the line of "true" cost to the enrollee vs. nominal medical expenditure shifts from OABC to OA'B'C'. It is clear to see that a reduction in MSAs has different impacts on different types of enrollees. For an enrollee who is unlikely to enter the deductible stage, mostly due to a good health status and thus a low medical expenditure (left part), a reduction in the MSA amount at the beginning of a year is unlikely to change the "true" cost of her medical services and thus to change her level of medical service consumption. For those who are likely to enter the deductible stage, because of their intermediate or high medical expenditures, a reduction in the initial MSA amount causes them to face a higher average price for medical services. If health care services are normal goods, the demand for medical services will decrease and their medical expenditures during that year will drop. Moreover, it is shown in the figure that a reduction in a MSA has much bigger impact on enrollees who have intermediate medical expenditure and are likely to enter the deductible stage but unlikely to enter the SPA stage (middle part) than enrollees with high medical expenditure (far right part). For enrollees with high medical expenditures (who use the SPA), health care services only become slightly more costly and we do not expect their medical expenditures to respond to a reduction in MSAs as much as those of enrollees with intermediate level of medical expenditures. Therefore, if enrollees discount their MSA money significantly, a reduction in the initial MSA amount would have the following effects: (1) people with low

medical expenditures who are unlikely to enter the deductible stage are less likely be affected; (2) people with intermediate medical expenditure who are likely to enter the deductible stage but not the SPA stage will be affected most and will decrease their medical expenditures; (3) people with high medical expenditures who are likely to enter the SPA stage will also decrease their medical expenditures, but the drop is likely to be small.

Figure 2, by contrast, shows the other extreme case where an enrollee considers money in a MSA to have the same value as cash-on-hand. Spending with MSA is thus no different from spending using cash. Line OAB overlaps the 45 degree line, and there is no kink at point A of entering the deductible stage. One RMB medical expenditure amounts to one RMB "true" cost to the enrollee. The SPA kicks in when the deductible limit of 1,000 RMB is reached. When the initial MSA amount is reduced from 400 RMB to 300 RMB, the line OBC shifts to OB'C'. From the figure, the "true" price of health services does not change for enrollees with low or intermediate medical expenses who are unlikely to enter the SPA stage, but enrollees with high medical expenditure now faces an average lower "true" prices. Therefore, if enrollees do not discount money in their MSAs, their medical expenditures, in response to a reduction in MSAs, is likely to remain unchanged for those with low or intermediate medical expenditures, but to increase for those with high medical expenditures.

3.3. A Simple Model

We use a simple model to illustrate that if an enrollee does not value the money in her MSA at all, her decision on how much medical services to consume will be positively dependent on the initial MSA amount. The enrollee cannot predict accurately her medical expenditures during a

year, which is stochastic and depends on her health status and the nature.¹² But she has knowledge about the distribution of her medical expenditures, X , which is the total annual expenditures if all her medical needs are satisfied. Let the distribution of X follow an exponential distribution:

$$(1) \quad f(x; \lambda) = \begin{cases} \lambda e^{-\lambda x}, & x \geq 0 \\ 0, & x < 0 \end{cases}$$

The parameter λ represents the health status of the enrollee. A larger λ indicates better health.

Let α be the probability of seeing a doctor when a enrollee is sick, and the range of α is $[0,1]$.¹³ Given α , the enrollee's total medical expenditures would be $X\alpha$. For simplicity, let us assume that the SPA stage does not exist and the enrollee pays her medical expenditures first with her MSA and then out-of-pocket. Let M represent the initial amount in her MSA in the beginning of a year. Given that the enrollee does not value her MSA at all and that the probability of her seeking medical services is α , the expected "true cost" of her medical consumption during the year is:

$$(2) \quad \int_{\frac{M_i}{\alpha_i}}^{\infty} (x_i \alpha_i - M_i) \lambda_i e^{-\lambda_i x_i} dx_i = \frac{\alpha_i}{\lambda_i} e^{-\lambda_i \frac{M_i}{\alpha_i}}$$

However, there is a disutility associated with not seeing a doctor when sick. Let the total disutility of not seeking for medical services when needed during the year is:

$$(3) \quad Disutility = C \left(\frac{1}{\alpha} - 1 \right) X$$

¹² For example, the outburst of flu or a car accident.

¹³ For instance, if the number of times the enrollee being sick is N_1 in a year and the number of times that the enrollee goes to see a doctor is N_2 , then α can be considered to be N_2/N_1 .

where C is a positive and individual specific coefficient. The cost is higher when the total medical expenditure X is higher or the probability of going to see a doctor when needed, α , is lower. Expected disutility for the enrollee is:

$$(4) \quad \int_0^{\infty} C_i \left(\frac{1}{\alpha_i} - 1 \right) x_i \lambda_i e^{-\lambda_i x_i} dx_i = \frac{C_i}{\lambda_i} \left(\frac{1}{\alpha_i} - 1 \right)$$

At the beginning of the year, the enrollee i decides α_i to minimize the sum of her expected "true" medical cost and the expected disutility:

$$(5) \quad \underset{\alpha_i}{\text{Min}} \frac{\alpha_i}{\lambda_i} e^{-\lambda_i \frac{M_i}{\alpha_i}} + \frac{C_i}{\lambda_i} \left(\frac{1}{\alpha_i} - 1 \right)$$

Take first order condition w.r.t. α_i , we get:

$$(6) \quad e^{-\lambda_i \frac{M_i}{\alpha_i}} \left(1 + \lambda_i \frac{M_i}{\alpha_i} \right) - \frac{2C_i}{\lambda_i \alpha_i} = 0$$

The relationship between α_i , the probability of going to see a doctor when sick and the initial MSA balance M is:

$$(7) \quad \frac{\partial \alpha_i}{\partial M_i} = \frac{\lambda^2 \alpha_i M_i e^{-\lambda_i \frac{M_i}{\alpha_i}}}{\lambda_i^2 M_i^2 e^{-\lambda_i \frac{M_i}{\alpha_i}} + 2C_i} > 0$$

It says that when the initial MSA balance is reduced, the probability of seeing a doctor becomes lower for the enrollee. Since total medical expenditure equals $X\alpha$, the total medical expenditures

will also be lower. Moreover, when $\lambda_i \rightarrow \infty$, $\frac{\partial \alpha_i}{\partial M_i} \rightarrow \frac{\alpha_i}{M_i} \approx 0$. This indicates that very healthy

people do not respond to the initial MSA amount.

We do a simple comparative static analysis to show which enrollees respond most to a shock in their MSA in terms of their decisions to see a doctor when sick, and as a consequence, their medical expenditures change. We take first order derivative of equation (7) w.r.t. λ_i :

$$(8) \quad \frac{\partial(\partial\alpha_i/\partial M_i)}{\partial\lambda_i} = \frac{2C_i(2\lambda_i\alpha_iM_i - \lambda_i^2M_i^2)e^{-\lambda_i\frac{M_i}{\alpha_i}}}{\left(\lambda_i^2M_i^2e^{-\lambda_i\frac{M_i}{\alpha_i}} + 2C_i\right)^2}$$

Solve for $\frac{\partial(\partial\alpha_i/\partial M_i)}{\partial\lambda} = 0$, we get $\lambda_i^* = \frac{2\alpha_i}{M_i}$. And we plug λ_i^* back in equation (7), we get:

$$\frac{\partial\alpha_i}{\partial M_i} \Big|_{\lambda_i^* = \frac{2\alpha_i}{M_i}} > 0. \text{ Thus, enrollees with } \lambda_i^* = \frac{2\alpha_i}{M_i} \text{ respond most to a change in the initial MSA}$$

balance, M . When M is reduced, their α_i and annual medical expenditures are reduced most

dramatically. When $\lambda_i > \lambda_i^*$, $\frac{\partial(\partial\alpha_i/\partial M_i)}{\partial\lambda} < 0$. It says that enrollee is less responsive to change

in MSA when he becomes healthier than λ_i^* . When $\lambda_i < \lambda_i^*$, $\frac{\partial(\partial\alpha_i/\partial M_i)}{\partial\lambda} > 0$. It says that

enrollee is less responsive to change in MSA when he becomes less healthy than λ_i^* .

Therefore, this simple model illustrates that if enrollees discount their MSA money significantly, a reduction in the initial MSA balance will reduce their medical expenditures. Such effects are the biggest for enrollees with an intermediate health status.

3. Data and Empirical Strategy

To empirically test how enrollees' medical expenditures respond to a reduction in MSAs, we explore a natural experiment that caused an exogenous shock to MSAs for certain birth cohorts but not others in Zhenjiang.

The city authority adjusted the MSA contribution rates for different age cohorts in December 2001. The new policies took effect on January 1, 2002. Before the policy change, the required contribution to MSAs is 4% of individual annual salary for all enrollees younger than 45 years old. The new policy cut the contribution for enrollees younger than 35 years old from 4% to 3% while maintaining the rates at 4% for people who were between 35 and 45 years old. The policy change creates an exogenous shock in MSA contributions for those born in 1969 or later. Their MSA contributions suffer from a sudden loss of 1% of their annual salary. For those born in 1968 and before, their MSA contributions do not change. Since birth cohorts 1968 and 1969 should be very similar in terms of health and health care demand, we can compare changes in their medical expenditures before and after the policy change and attribute the differences to MSA levels.

We summarize the policy change in Table 1. There are four birth cohorts in the table: 1968, 1969, 1970 and 1971. The contribution rate for all cohorts was the same, 4%, in 2000 and 2001. But in 2002, due to the policy change, the MSA contribution rate dropped to 3% for two younger cohorts, 1970 and 1971, but remained at 4% for two older cohorts, 1968 and 1969.

4.1. Data

Data for this study is from Zhenjiang's social health insurance database managed by the city government. The database was established to monitor medical expenditures of enrollees covered by Urban Employee Health Insurance Program (UEHIP). The data set covers every employed or

retired person in the city. We focus on a panel of four cohorts, 1968, 1969, 1970 and 1971, which were continuously enrolled in the UEHIP from 2000 to 2003. We exclude employees working for government agencies because they were subsidized by other sources of health care funds for which we have no information. Since the UEHIP covers all enterprises (both state-owned and private) in Zhenjiang and each worker has to participate, we do not worry about the entry-exit type of attrition problem which is common in most health insurance datasets.¹⁴ The data set records every enrollee's annual salary which is used to determine the amount of individual MSA contributions each year. Individuals' total annual medical expenditures are also recorded. We also know the balance of MSAs at the beginning of each year. With this information, we can easily tell whether or not enrollees' medical expenditures reach the deductible or SPA levels. Other demographic information is limited except age, gender, occupation, and retirement status.

4.2. Difference-in-Difference (DID) Model

Since we have panel data, we employ the panel Difference-in-Difference (DID) method to estimate the average effects of a reduction in MSA on medical expenditures. We compare the change in medical expenditures from 2001 to 2002 for cohorts that experienced a cut in their MSAs and cohorts that did not. Specifically, we run the following model:

$$(9) \quad Y_{it} = \alpha + \gamma TG_i \times TY_t + \lambda TY_t + X_{it}\beta + \phi_i + \varphi_t + \varepsilon_{it}$$

Where Y_{it} is enrollee i 's total medical expenditures in year t . TG_i is a dummy variable with 1 indicating the treatment group. TY_t is a dummy variable with 1 indicating the year of 2002. Since

¹⁴ Based on official documents, more than 90% of all employed people were enrolled in UEHIP in Zhenjiang from 2000 to 2002.

we estimate equation (9) using the fixed effect model, TG_i dummy drops out. X_{it} is a vector including enrollee i 's annual salary and left-over money in her MSA from last year in year t , both of which are time-varying control variables. ϕ_i is the individual fixed effects which captures the differences of demand for medical care due to individual specific time-invariant factors like genetics. φ_t is the year fixed effects which captures . ε_{it} is the error term.

Moreover, our theory predicts that enrollees with intermediate health status who are likely to enter the deductible stage are most likely to be affected by a reduction in MSAs. Therefore, we divide the cohorts into three subgroups according to their level of medical expenditures before the treatment. Then we run the following equation to allow the treatment effects to vary across the three subgroups:

$$(10) \quad Y_{it} = \alpha + \gamma_1 TG_i \times TY_t \times SG_i^1 + \gamma_2 TG_i \times TY_t \times SG_i^2 + \gamma_3 TG_i \times TY_t \times SG_i^3 \\ + \lambda_1 TY_t \times SG_i^1 + \lambda_2 TY_t \times SG_i^2 + \lambda_3 TY_t \times SG_i^3 + X_{it}\beta + \phi_i + \varphi_t + \varepsilon_{it}$$

where SG_i^j indicates that enrollee i belongs to a certain subgroup j . SG_i^1 refers to the subgroup of enrollees who were relatively healthy and unlikely to enter the deductible stage SG_i^2 refers to the subgroup with intermediate health status who are likely to enter the deductible stage but not the SPA stage. SG_i^3 indicates the subgroup whose total medical expenditures before the treatment year were above the SPA payment line. The key coefficients are parameters to three third-order interactions in equation (10). They indicate how enrollees in each of the three subgroups react to a shock in MSA contribution.

4.3. Matching

Given such a large number of enrollees in our data, we also employ covariate matching (CVM), a semi-parametric econometric method with the advantage that no specific parametric

relationship between the outcome and explanatory variables needs to be assumed. CVM compares an individual in the treatment group with individual(s) in the comparison group directly based on their individual characteristics. In CVM, every treated unit is matched to a number of units in the comparison group based on the distance measured by the vector norm $\|\cdot\|$.

Let $\|x\|_V = (x'Vx)^{1/2}$ be the vector norm with positive definite matrix V^{15} , the CVM defines $\|z-x\|_V$ as the distance between the vector x and z , where x and z represent the covariates for a treated unit and a potential match. Let $d_M(i)$ be the distance from unit i to the M^{th} nearest match with the opposite treatment. Consider the set of observed covariates for unit i to be X_i , the set unit i will match with is:

$$\Psi_M(i) = \{l = 1, \dots, N \mid T_l = 1 - T_i, \|X_l - X_i\|_V \leq d_M(i)\}$$

and $d_M(i)$ is defined as

$$\sum_{l: T_l = 1 - T_i} 1\{\|X_l - X_i\|_V \leq d_M(i)\} = M$$

where $1\{\cdot\}$ is the indicator function, which is equal to 1 when the value in brackets is true and zero otherwise.

The simple matching estimator will be biased in finite samples when the matching is not exact. Abadie and Imbens (2002) develop a bias-corrected matching estimator adjusting the difference within the matches for the differences in their covariate values. Although theoretically

¹⁵ We use the diagonal matrix, of which the diagonal elements are the inverses of the variances of X_i (the element of the set of covariates), as our weighting matrix V . The weighting matrix V accounts for the difference in the scale of the covariates.

matching on multidimensional covariates can lead to substantial bias, the matching approach combined with bias adjustment often leads to estimates with little remaining bias.

5. Results

5.1. Effects on Total Medical Expenditures

First, we want to show that the treatment cohort(s) and the comparison cohort(s) are comparable. Presumably, their medical expenditures would be similar in the absence of the treatment. Therefore, any differences between those two groups attribute to the treatment. Table 2 shows means and standard deviations of main characteristics of two groups, including their annual salary, MSA contributions and their various medical expenditures in 2000 and 2001. Simple t-tests show that those two cohorts are statistically indifferent.

The average contribution to MSA, the total medical expenditures, and the total amount of money in MSA over time are plotted in Figure 4. Solid (dashed) lines are for the cohort 1969 (1968). It can be seen clearly from the graph that cohorts 1969 and 1968 are very similar to each other in terms of contributions to MSAs, initial MSA balances, and medical expenditures in 2000 and 2001. However, all three measures diverged in 2002. For the cohort 1969, total medical expenditures in 2002 decreased while both MSA contributions and initial MSA amounts dropped due to the policy change.

Table 3 presents the estimated results of DID. Column 1 shows DID estimates for two birth cohorts 1969 and 1968. Panel A presents estimates of the average effect of the policy for the whole group, estimated from equation (9). The results show that a reduction in MSAs of the treatment group reduced their total medical expenditures significantly in 2002. With 1%

reduction in MSA contribution rate,¹⁶ amounting to an average reduction of 87 RMB in their initial MSA accounts at the beginning of 2002, the cohort 1969 reduced their annual medical expenditures by 106 RMB. Our theory predicts that enrollees with medical expenditures reaching the deductible level will react to a reduction in MSA most significantly. Based on our theory, we divide the full sample into three subgroups. The first group includes enrollees that never exhausted their MSA in both 2000 and 2001. The third group includes enrollees that entered SPA at least once in 2000 and 2001. The rest belongs to the second group which is mostly likely to be affected by the policy change. There are 5309, 2234, and 726 enrollees in the first, second, and third group. Panel B of Table 1 present the effects for these three subgroups, based on estimates of equation (10). We can see that the coefficient is significant and negative for the second group, but not for other two groups. Consistent with our theory, those enrollees whose medical expenditures are more likely to enter the deductible stage are most sensitive to the policy change.

In Panel C of Table 1, we divide the full sample into three subgroups according to their level of total medical expenditures before 2002, the treatment year. We use total medical expenditures as a noisy proxy for health status, and thus the estimates could provide us useful information concerning the effects of MSAs on enrollees with different health statuses. Lower Quintile indicates that enrollee's average annual medical expenditure in 2002 and 2001 falls into 0-33.3 percentiles, Middle Quintile 33.3-66.7 percentiles, and Upper Quintile indicates the rest of enrollees. Our results show that, for those with low medical expenditures, a 25% reduction in MSA contribution has no significant impact on total medical expenditures. For those with medical expenditures in the middle, a 25% reduction in MSA contribution led to statistically

¹⁶ Given that previous contribution rate is 4%, a change from 4% to 3% equals 25% reduction in the amount of contribution.

significant cut in total medical expenditure. Finally, for the group with high medical expenditures, the coefficient is negative and significant at the 5% level.

Column 2 shows DID estimates for a larger sample. The treatment includes cohorts 1969 and 1970 and the comparison includes cohorts 1967 and 1968. The conclusions by and large hold. Even though the estimates become smaller, the story still holds.

Results from CMV matching are shown in Table 4. Each entry represents an estimate of average treatment effects of a 25% reduction in MSA contributions on medical expenditures for the treated subsample. To minimize the impact of the size of MSA, we match the size of MSA exactly. Other matching variables include gender and annual salary of pre-treatment period. We also experiment with different number of matching neighbors to ensure the robustness of our matching results. We report matching results using 1, 5 and 10 neighbors.

Panel a of Table 4 presents the number of enrollees in the treatment/comparison group and matching results estimates for the cohort 1969 vs. the cohort 1968. Results using different number of matching neighbors are similar. Our results show that, for those whose medical expenditures did not reach the deductible stage in 2000 and 2001, a 25% reduction in MSA contribution has no significant impact on medical expenditures. For those whose medical expenditures reached the deductible stage in 2000 or 2001, a 25% reduction in MSA led to a statistically significant cut in total medical expenditures. Finally, for the group with high medical expenditures and whose medical expenditures reached SPA in 2000 or 2001, there were no significant effects even though the coefficient is negative. The conclusion reached with the matching method is consistent with that of the DID model.

Even though we have a relatively large sample size, we are still concerned about outliers which could drive the results in theory. Therefore, we dropped those enrollees who experienced

serious sickness and incurred a large amount of medical expenditures during our sample period. Our criterion is that anyone whose change in year-to-year medical expenditure is more than twice their average individual salary is dropped from the samples. We re-run our equations and matching after eliminating the outliers. The new results are very consistent with our main results.¹⁷

5.2. Comparing Cohorts Using Placebo Laws

We did two placebo law tests to ensure that the estimation on reduction in treatment cohorts' total medical expenditure was due to the exogenous shock in their MSA contribution, caused by the policy change in 2002. (Bertrand et al. 2004) First, we tested the difference between cohorts that are either both affected by the policy or both unaffected by the policy in 2002. Second, we use 2001 as a placebo treatment year. We then estimate equation (9) and (10) using the fixed effect model on these placebo laws. The estimate generates an estimate of the laws' "effect".

Table 5 presents the results of the first placebo law. We compare cohort 1969 with cohort 1970. Both cohorts experienced a 25% reduction in MSA contributions in 2002. We can see that there is no significant difference in the two cohorts' change in total medical expenditures from 2001 to 2002. We also compare cohort 1967 with cohort 1968, for both of which MSA contribution rates did not change in 2002. Again, there is no significant difference between these two cohorts in terms of total medical expenditure from 2001 to 2002.

Table 6 presents the results of the second placebo law, using 2001 as a placebo treatment year.¹⁸ Panel A shows estimates using cohorts 1968 and 1969. Panel B shows estimates using

¹⁷ Due to the length of the paper, those results are not presented. They are available upon request for interested readers.

¹⁸ Placebo law using 2003 as the treatment year generate similar results. They are available upon request.

cohorts 1967 and 1968. Panel C shows estimates using cohorts 1969 and 1970. None of these estimates are statistically significant.

5.3. Decomposing the Effects on Total Medical Expenditures Using Simulation

So far we have shown that with a 1% reduction in MSA contribution rate in 2002, amounting to an average reduction of 87 RMB in their initial MSA accounts at the beginning of 2002, the cohort 1969, on average, reduced their total annual medical expenditures by 105.8 RMB. In Zhenjiang, an enrollee's total annual medical expenditure is the sum of three components: MSA payment, deductible payment, and the SPA payment. How is a reduction in total annual medical expenditures distributed among the three components? Our theory predicts that with a reduction in a MSA amount, an enrollee has a tendency to cut her demand for health services; given the stochastic nature of her demand for medical services, each of the three component payments can be impacted. A further look into how a reduction in a treated enrollee's annual medical expenditures is decomposed provides not only a robust check but also further insights on her behavioral change in response to a MSA reduction. However, we cannot apply the DID model directly to the recorded MSA payments, deductible payments and SPA payments in the data, to see if there is a reduction in these three component payments that is caused by the behavioral change, in response to a reduction in MSA, by the treatment cohort. A reduction in the initial MSA amount for the treatment cohort would lead to a difference in the recorded component payments between the treatment and comparison cohorts, even if the treatment cohort had not cut back their medical consumption.

To illustrate, let us go back to the numerical example in Section 3. Suppose that enrollee A in the treatment cohort and enrollee B in the comparison cohort, who are similar to each other,

both had an initial balance in a MSA account of 400 RMB and total medical expenditures of 700 RMB in 2001. In 2002, enrollee B still has an initial MSA amount of 400 RMB and total medical expenditures of 700 RMB. The total expenditure was paid using 500 RMB from the MSA and a deductible payment of 300 RMB and recorded in the data. For enrollee A, her initial MSA account was reduced to 300 RMB in 2002. Now suppose this enrollee did not reduce her medical service consumption in response to the reduction in her MSA and still had a total medical expenditure of 700 RMB. She will pay 300 RMB using her MSA and 400 RMB deductible. If we directly compared the recorded MSA payments between the two enrollees, a reduction in the MSA payment for the treatment enrollee will be found, but this reduction is not due to a behavioral change by the treated enrollee but to an accounting matter. Therefore, to identify any change in the three component payments, which was caused by a *behavioral change* by the treatment cohort in response to a reduction in MSA, we need to control for an *accounting change*.

To control for such accounting differences, we pretend that the comparison group (the cohort 1968) also had a reduction in their MSA contribution rate in 2002, from 4% to 3%, and revise their MSA, deductible and SPA payments based on their pretended initial MSA amount, the deductible and their total annual medical expenditure in 2002 that were recorded. Doing so, we create an adjusted comparison group whose behavior can be considered unchanged but whose three component payments were adjusted for a reduction in MSAs. Therefore, any difference between the treatment cohort 1969 and the adjusted comparison group will pick up the behavioral change by the treatment cohort in response to the 1% reduction in MSA contribution rate. The results are presented in Table 7.

5.3.1. MSA Payment

Compared to cohort 1968, cohort 1969's MSA payments, overall, dropped by a significant 11.0 RMB in 2002, in response to a reduction in their MSA contribution. If we look at the three subgroups, MSA payments by enrollees in the MSA subgroup is reduced by 13.2 RMB, at 10% level, suggesting that some enrollees in the MSA subgroup might cut back their medical service consumption when experiencing a reduction in their MSAs, as there was some chance for them to enter the deductible stage. For the deductible subgroup and the SPA subgroup, there was no difference between the treatment and the comparison cohort in their MSA payments in 2002, as the chance was high that they would enter the deductible stage even though they reduced their medical service consumption. Also shown in the table are the results comparing consecutive cohorts 1969 vs. 1970, which both had a 1% reduction in MSA contribution rates in 2002, and comparing cohorts 1968 vs. 1967, whose contribution rates remained at 4% in 2002. There is no statistically significant difference for these comparisons.

5.3.2. Deductible Payment

The deductible payment of the treatment cohort 1969 dropped by a significant 19.4 RMB in 2002, compared to that of cohort 1968. If we look at the three subsamples, the deductible payment by the deductible subgroup in the treatment cohort was reduced significantly by 54.23 RMB, compared to their counterparts in comparison cohort 1968. There was a reduction of 8.4 RMB, significant at 10% level, for the MSA subgroup and no significant difference for the SPA subgroup between the treatment cohort and the control cohort. Again, results that compare consecutive cohorts 1969 vs. 1970 and cohorts 1968 vs. 1967 show clearly that there is no statistically significant difference in terms of deductible payments.

5.3.3. SPA Expenditure

For SPA payment, cohort 1969 had an overall drop of 76.8 RMB in 2002, significant at 10% level. SPA payment by the SPA subgroup in the treatment cohort was reduced significantly by 122.32 RMB, compared to their counterpart in the comparison cohort 1968. There were no significant difference in SPA payments for the MSA subgroup and the deductible subgroup. Again, no significant differences are observed, either overall or for each of the three subgroups, between consecutive cohorts 1969 vs. 1970 and between cohorts 1968 vs. 1967.

5.4. Substitution Effects

Our results have shown that an enrollee, when faced with an exogenous reduction in her MSA in 2002, cut back her medical service consumption and thus annual medical expenditures in that year. An interesting question naturally follows: did the treatment cohort 1969, anticipating that their MSA contribution rates will again rise to 4% in 2003, substitute future medical expenditures for current medical expenditures, in the sense that some of their medical needs in 2002 were postponed to the next year? If so, we will see an increase in their medical expenditures in 2003, relative to the comparison cohort. Another possible reason for an increase in the treatment cohort 1969's medical expenditures, compared to the comparison cohort, is that enrollees who cut medical expenditures may suffer more from the sickness in 2003 than 2002 and have to spend more on illness treatment.

We test whether the cohort 1969's medical expenditure went up from their 2001 level, compared to the cohort 1968. Both cohorts had a 4% of MSA contribution rate in both 2001 and 2003. In equations (9) and (10), the amount of MSA surplus from last year is also controlled.

Thus, the results will pick up the effect of the only difference between the two cohorts, which is that the cohort 1969 experienced a MSA reduction and cut back their medical service consumption in 2002. Estimates are presented in Table 8. None of the coefficients are positive and significant. Therefore, there are no substitution effects.

6. Discussion

Medical savings accounts have become an important component of the urban health care financing system in China since the 1990s. The primary purpose of MSAs is to control cost by forcing patients to be responsible for their own medical expenditures. However, a crucial assumption for MSAs to be functional is that enrollees treat money in MSA the same as cash. We empirically test the assumption by taking advantage of a policy change in 2002 in Zhenjiang. We employ DID strategy to estimate the effects of MSA contribution on total medical expenditures. We find that MSA contributions do affect patients' total medical expenditures. However, enrollees with different levels of medical expenditures are affected differently. Consistent with our theoretical model, we find that enrollees with medical expenditures reaching the deductible stage are significantly affected, but those in MSA or SPA stages are not affected.

Our findings have important policy implications. First, MSAs are widely adopted in China's urban areas. Policy makers expect them to contain health care costs and serve as a savings tool. Those goals would be fruitless if enrollees do not value the money in MSAs. Second, we show that compulsory MSAs based on individual annual salary might adversely affect equity in health service usage. Since people feel the pinch only when they need to pay deductibles, those with small MSAs may restrict their use of health services even when they are necessary.

References:

- Abadie, Abadie and Imbens, Guido W.** "Simple and Bias-Corrected Matching Estimators for Average Treatment Effects." 2002, *NBER Working Paper No. 283*.
- Barr, Michael D.** "Medical Savings Accounts in Singapore: A Critical Inquiry." *Journal of Health Politics, Policy and Law*, 2001, 26(4), pp. 709.
- Bertrand, Marianne; Duflo, Esther and Mullainathan, Sendhil.** "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics*, 2004, 119(1), pp. 249-75.
- Deber, Raisa B.; Forget, Evelyn L. and Roos, Leslie L.** "Medical Savings Accounts in a Universal System: Wishful Thinking Meets Evidence." *Health Policy*, 2004, 70(1), pp. 49-66.
- Dixon, Anna.** "Are Medical Savings Accounts a Viable Option for Funding Health Care?" *PUBLIC HEALTH*, 2002, 43(4), pp. 408-16.
- Liu, Gordon G.; Zhao, Z; Cai, R and Yamada, T.** "Equity in Health Care Access To: Assessing the Urban Health Insurance Reform in China." *Social Science & Medicine*, 2002, 55(10), pp. 1779-94.
- Moffit, Robert. A.** "Estimating the Value of an in-Kind Transfer: The Case of Food Stamps." *Econometrica*, 1989, 57(2), pp. 385-409.
- Whitmore, Diane.** "What Are Food Stamps Worth?" 2002, *Industrial Relations Section, Princeton University*.
- Yip, Winnie C. and Hsiao, William C.** "Medical Savings Accounts: Lessons from China." *Health Affairs*, 1997, 16(6), pp. 244.

Table 1. Contribution Rates to MSAs for Different Cohorts From 2000 to 2003

		Year			
		2000	2001	2002	2003
Cohort 1970	Contribution Rate	4%	4%	3%	3%
	Age	30	31	32	33
Cohort 1969	Contribution Rate	4%	4%	3%	4%
	Age	31	32	33	34
Cohort 1968	Contribution Rate	4%	4%	4%	4%
	Age	32	33	34	35
Cohort 1967	Contribution Rate	4%	4%	4%	4%
	Age	33	34	35	36

Notes: For each cohort, the first row is the percentage of individual annual salary and the second row is age in each year.

Table 2. Comparison between Cohorts 1968 and 1969

	Cohort 1969	Cohort 1968	Significantly Different?	Cohorts 1969&1970	Cohorts 1967&1968	Significantly Different?
Contribution Base (Annual Salary)	8701.21 [3506.66]	8758.75 [3761.44]	N	8588.31 [3443.76]	8681.18 [3753.40]	N
MSA Balance at the Beginning of the Year	253.73 [376.77]	271.44 [399.87]	N	250.18 [375.99]	268.08 [397.67]	N
MSA Balance at the End of the Year	366.78 [156.05]	370.65 [167.36]	N	362.56 [153.22]	366.58 [167.05]	N
Medical Expenditures in MSA Part	334.18 [180.53]	336.73 [189.60]	N	328.84 [175.24]	334 [188.12]	N
Medical Expenditures in Deductible Part	51.56 [135.77]	55.06 [140.42]	N	53.02 [134.37]	54.88 [139.42]	N
Medical Expenditures in SPA Part	156.54 [994.86]	162.47 [934.60]	N	170.21 [1317.01]	165.88 [1236.47]	N
Total Medical Expenditures	542.29 [1100.83]	554.26 [1046.27]	N	552.06 [1394.44]	554.76 [1328.94]	N
# of Enrollees	3896	4373		7786	7773	

Notes: Standard deviations are in brackets. Test for mean differences are based on t-statistics:

$$t_{(\bar{X}_{Treated} - \bar{X}_{Control})} = \frac{\bar{X}_{Treated} - \bar{X}_{Comparison}}{\sqrt{\frac{\sigma_{Treated}^2}{n_1} + \frac{\sigma_{Comparison}^2}{n_2}}}, \text{ where } n_1 \text{ and } n_2 \text{ are the numbers of observations for the treatment and comparison groups.}$$

Table 3: The Effects of a Shock in MSA on Total Medical Expenditures (Difference-in-Difference)

	(1)	(2)
	Cohort 1969 vs. Cohort 1968	Cohorts 1969&1970 vs. Cohorts 1967&1968
	Panel A	
Treatment Group × Y2002	-105.87*	-55.74
	[41.09]	[30.92]
	Panel B	
MSA × Treatment Group × Y2002	-4.35	-15.79
	[21.97]	[17.81]
Deductible × Treatment Group × Y2002	-185.44**	-120.57**
	[63.95]	[45.38]
SPA × Treatment Group × Y2002	-662.48	-221.82
	[374.57]	[279.49]
	Panel C	
Lower Quintile × Treatment Group × Y2002	-2.3	-10.75
	[37.10]	[25.88]
Middle Quintile × Treatment Group × Y2002	-93.66**	-52.31*
	[32.83]	[25.90]
Upper Quintile × Treatment Group × Y2002	-234.05*	-111.58
	[110.99]	[83.71]
# of Enrollees	8269	15559

Notes: Robust standard errors are in brackets. * and ** indicate significance at 5% and 1% level two tail t-test. We only report the coefficient of interest in the table. For the first sample, the treatment group is the cohort 1969 and the comparison group is the cohort 1968. For the second sample, the treatment group is cohorts 1969&1970 and the comparison group is cohorts 1967&1968. The pre-treatment period is 2001 and post-treatment period is 2002.

Table 4: The Effects of a Shock in MSA on Total Medical Expenditures (Covariate Matching)

	# of Enrollees in the Treatment Group	# of Enrollees in the Comparison Group	# of Neighbors Matched		
			1	5	10
Panel A: Cohorts 1969 vs. Cohort 1968					
Full Sample	3896	4373	-102.81* [52.18]	-117.71** [44.76]	-117.43** [45.09]
MSA Subsample	2525	2784	-19.08 [28.77]	-13.08 [25.04]	-6.91 [23.37]
Deductible Subsample	1037	1197	-169.97* [79.85]	-219.78** [64.88]	-217.24** [60.35]
SPA Subsample	334	392	-741.35 [454.43]	-889.5* [373.53]	-799.2* [359.09]
Panel B: Cohorts 1969&1970 vs. Cohort 1967&1968					
Full Sample	7786	7773	-63.07 [37.36]	-66.51* [33.36]	-74.62* [34.02]
MSA Subsample	4897	4893	-17.43 [21.85]	-17.07 [19.71]	-18.58 [18.41]
Deductible Subsample	2224	2170	-149.44* [69.95]	-172.52** [55.63]	-174.74** [53.97]
SPA Subsample	665	710	-671.26 [432.99]	-657.08 [409.15]	-510.09 [319.93]

Notes: Bias adjusted robust standard errors are in brackets. * and ** indicate significance at 5% and 1% level two tail t-test. For the first sample, the treatment group is the cohort 1969 and the comparison group is the cohort 1968. For the second sample, the treatment group is cohorts 1969&1970 and the comparison group is cohorts 1967&1968. The pre-treatment period is 2001 and post-treatment period is 2002.

Table 5: Placebo Law I: Comparing Changes in Total Medical Expenditures for Cohorts Both Treated or Not Treated

	Difference-in-Difference		Covariate Matching		
# of Neighbors Matched			1	5	10
Panel A: Cohort 1969 vs. Cohort 1970					
MSA × Treatment Group × Y2002	-18.78	MSA Subsample	-41.33	-25.45	-24.09
	[24.53]		[30.9]	[26.41]	[25.45]
Deductible × Treatment Group × Y2002	-55.51	Deductible Subsample	-61.24	-71.11	-58.52
	[48.4]		[68.59]	[52.65]	[52.04]
SPA × Treatment Group × Y2002	-517.81	SPA Subsample	-880.01	-682.04	-631.77
	[423.94]		[473.47]	[401.31]	[401.82]
Panel B: Cohorts 1967 vs. Cohort 1968					
MSA × Treatment Group × Y2002	-46.58	MSA Subsample	-50.79	-48	-45.47
	[27.24]		[32.1]	[28.64]	[25.84]
Deductible × Treatment Group × Y2002	79.60	Deductible Subsample	63.81	49.83	59.27
	[74.42]		[108.92]	[93.87]	[92.45]
SPA × Treatment Group × Y2002	406.85	SPA Subsample	345.62	800.47	441.32
	[369.51]		[804.24]	[556.31]	[446.73]

Notes: Robust standard errors are in brackets for the Difference-in-Difference model. Bias adjusted robust standard errors are in brackets for matching. For panel A, both cohorts suffer from a reduction of 1% of their annual salaries in 2002. We randomly assign the treatment status to the cohort 1969. For panel B, neither cohort is affected by the policy change. We randomly assign the treatment status to the cohort 1968. The pre-treatment period is 2001 and post-treatment period is 2002.

Table 6: Placebo Law II: Comparing Changes in Total Medical Expenditures between 2000 and 2001

# of Neighbors Matched	Difference-in-Difference		Covariate Matching		
			1	5	10
Panel A: Cohort 1968 vs. Cohort 1969					
MSA × Treatment Group × Y2002	2.08 [29.63]	MSA Subsample	10.69 [51.58]	-6.73 [35.92]	-17.14 [35.6]
Deductible × Treatment Group × Y2002	-109.55 [96.00]	Deductible Subsample	171.08 [96.62]	114.18 [90.94]	127.75 [89.91]
SPA × Treatment Group × Y2002	-516.74 [334.92]	SPA Subsample	658.39 [544.83]	425.51 [517.47]	348.04 [402.72]
Panel B: Cohort 1967 vs. Cohort 1968					
MSA × Treatment Group × Y2002	7.23 [23.03]	MSA Subsample	5.96 [30.66]	13.93 [27.1]	4.47 [26.31]
Deductible × Treatment Group × Y2002	7.87 [56.52]	Deductible Subsample	44.52 [61.78]	42.6 [54.74]	25.38 [54.23]
SPA × Treatment Group × Y2002	53.47 [329.32]	SPA Subsample	-67.03 [389.32]	-244.32 [334.7]	-184.85 [317.45]
Panel C: Cohorts 1969 vs. Cohort 1970					
MSA × Treatment Group × Y2002	0.16 [34.18]	MSA Subsample	-2.72 [49.37]	-20.4 [39.11]	-11.42 [38.87]
Deductible × Treatment Group × Y2002	-90.97 [101.19]	Deductible Subsample	-156.36 [224.36]	-179.06 [187.94]	-158.1 [160.56]
SPA × Treatment Group × Y2002	0.45 [333.52]	SPA Subsample	224.51 [353.57]	-22.15 [354.26]	97.01 [352.61]

Notes: Robust standard errors are in brackets for the Difference-in-Difference model. Bias adjusted robust standard errors are in brackets for matching. For this placebo law, the pre-treatment period is 2000 and post-treatment period is 2001. In other words, we estimate the Difference-in-Difference model and matching as if the change is made in 2001. For panel A, the treatment group is the cohort 1969 and the comparison group is the cohort 1968. For panel B, the treatment group is the cohort 1968 and the comparison group is the cohort 1967. For panel C, the treatment group is the cohort 1970 and the comparison group is the cohort 1969.

Table 7: Decomposition of The Effects of a Shock in MSA on Total Medical Expenditures (Difference-in-Difference)

	(1)			(2)			(3)		
	Cohort 1969 vs. Cohort 1968			Cohort 1969 vs. Cohort 1970			Cohort 1967 vs. Cohort 1968		
	MSA Payment	Deductible Payment	SPA Payment	MSA Payment	Deductible Payment	SPA Payment	MSA Payment	Deductible Payment	SPA Payment
	Panel A								
Treatment Group× Y2002	-11.01*	-19.37**	-76.78*	-2.36	-1.96	-70.50	-1.99	1.49	33.61
	[4.48]	[5.16]	[37.85]	[4.30]	[5.30]	[39.80]	[4.96]	[5.78]	[41.13]
	Panel B								
MSA × Treatment Group× Y2002	-13.32*	-8.40*	17.37	-3.42	-3.38	-11.98	-4.36	-6.30	-35.93
	[6.54]	[4.18]	[17.60]	[6.37]	[4.80]	[19.79]	[7.29]	[4.50]	[22.38]
Deductible × Treatment Group× Y2002	-8.90	-54.23**	-122.32*	-2.38	-5.13	-48.00	-3.36	4.48	78.47
	[5.05]	[10.60]	[58.55]	[4.86]	[9.81]	[42.57]	[5.87]	[10.70]	[68.04]
SPA × Treatment Group× Y2002	-4.32	-1.57	-656.59	-8.83	13.48	-522.46	16.77	34.33	355.75
	[8.06]	[33.76]	[361.03]	[7.65]	[34.86]	[408.27]	[10.78]	[38.94]	[354.08]
# of Enrollees	8269	8269	8269	7786	7786	7786	7773	7773	7773

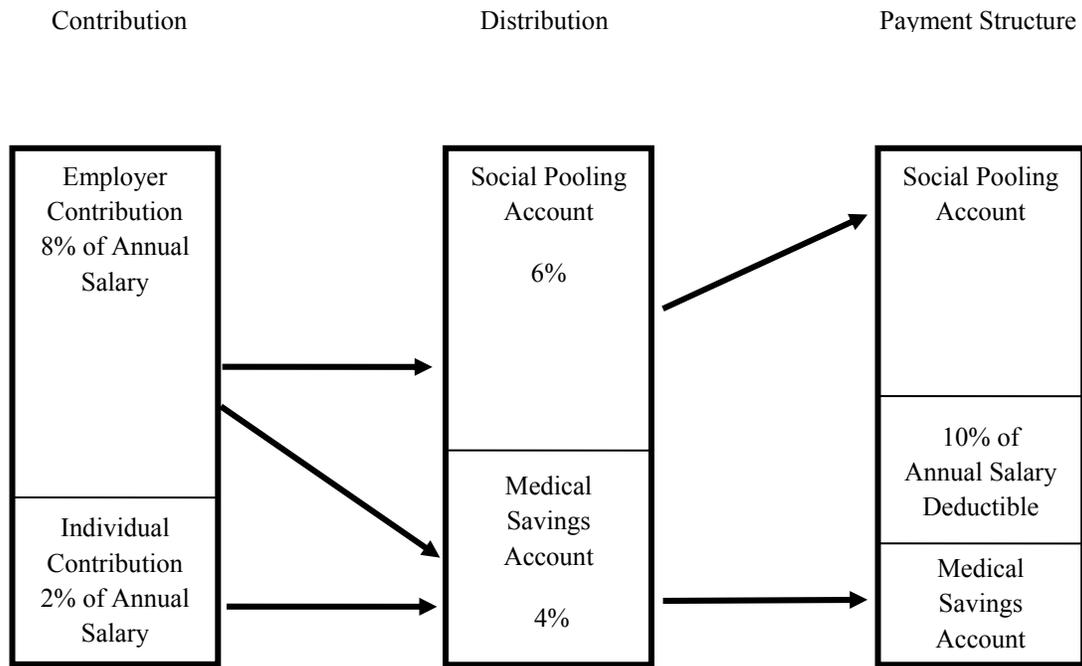
Notes: Robust standard errors are in brackets for Difference-in-Difference. Results using equation (9) are presented in panel A. Results using equation (10) are presented in panel B. For the first sample, the treatment group is the cohort 1969 and the comparison group is the cohort 1968. For the second sample, the treatment group is the cohort 1969 and the comparison group is the cohort 1970. For the third sample, the treatment group is the cohort 1968 and the comparison group is the cohort 1967.

Table 8: Estimates of Substitution Effects (Difference-in-Difference: 2001 vs. 2003)

	(1)	(2)
	Cohort 1969 vs. Cohort 1968	Cohorts 1969&1970 vs. Cohorts 1967&1968
	Panel A	
Treatment Group × Y2002	-38.18 [42.15]	-2.25 [33.79]
	Panel B	
MSA × Treatment Group × Y2002	23.94 [25.33]	26.62 [21.18]
Deductible × Treatment Group × Y2002	27.95 [53.74]	52.30 [55.97]
SPA × Treatment Group × Y2002	-814.02* [405.52]	-498.68 [294.74]
	Panel C	
Lower Quintile × Treatment Group × Y2002	35.92 [41.17]	22.11 [29.45]
Middle Quintile × Treatment Group × Y2002	-15.69 [39.97]	2.51 [41.34]
Upper Quintile × Treatment Group × Y2002	-177.12 [112.47]	-68.34 [86.24]
# of Enrollees	7884	14802

Notes: Bias adjusted robust standard errors are in brackets. * and ** indicate significance at 5% and 1% level two tail t-test. For the first sample, the treatment group is the cohort 1969 and the comparison group is the cohort 1968. For the second sample, the treatment group is cohorts 1969&1970 and the comparison group is cohorts 1967&1968. The pre-treatment period is 2001. The post-treatment period is 2003 rather than 2002. We investigate whether enrollees substitute medical expenditures in 2002 with those in 2003.

Figure 1. Zhenjiang Health Care Financing System



Note: This graph shows the health insurance for enrollees younger than 44 years old in Zhejiang in 2001.

Figure 2. Enrollees Discount the MSA Money (e.g. 100%)

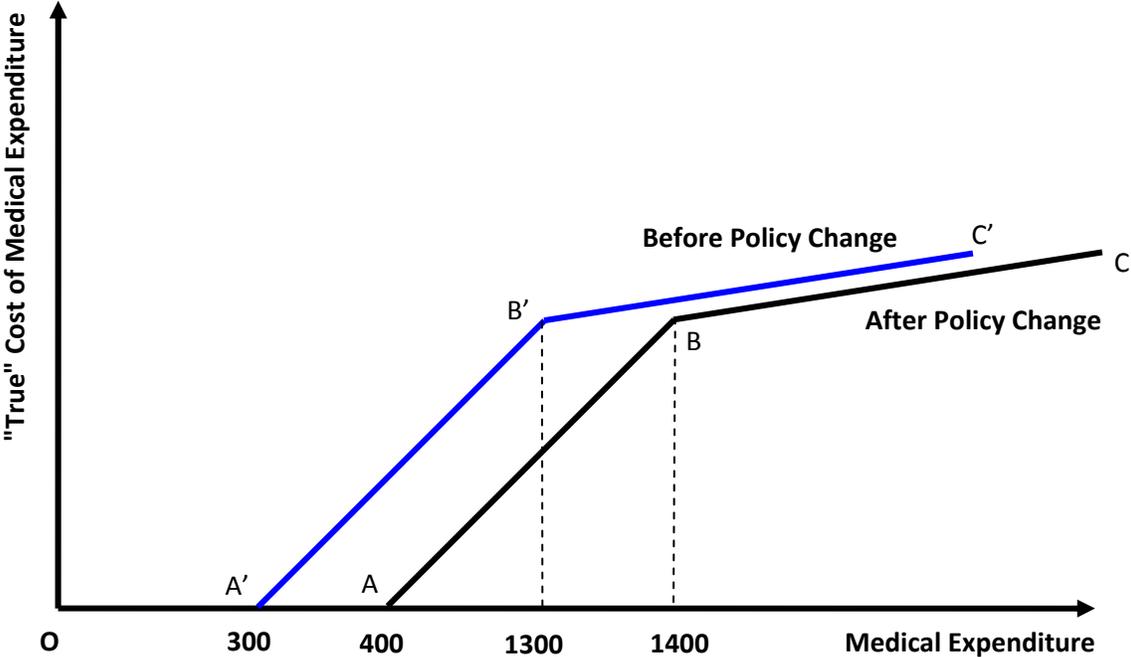


Figure 3. Enrollees Treat the MSA Money the Same as Out-of-pocket Money

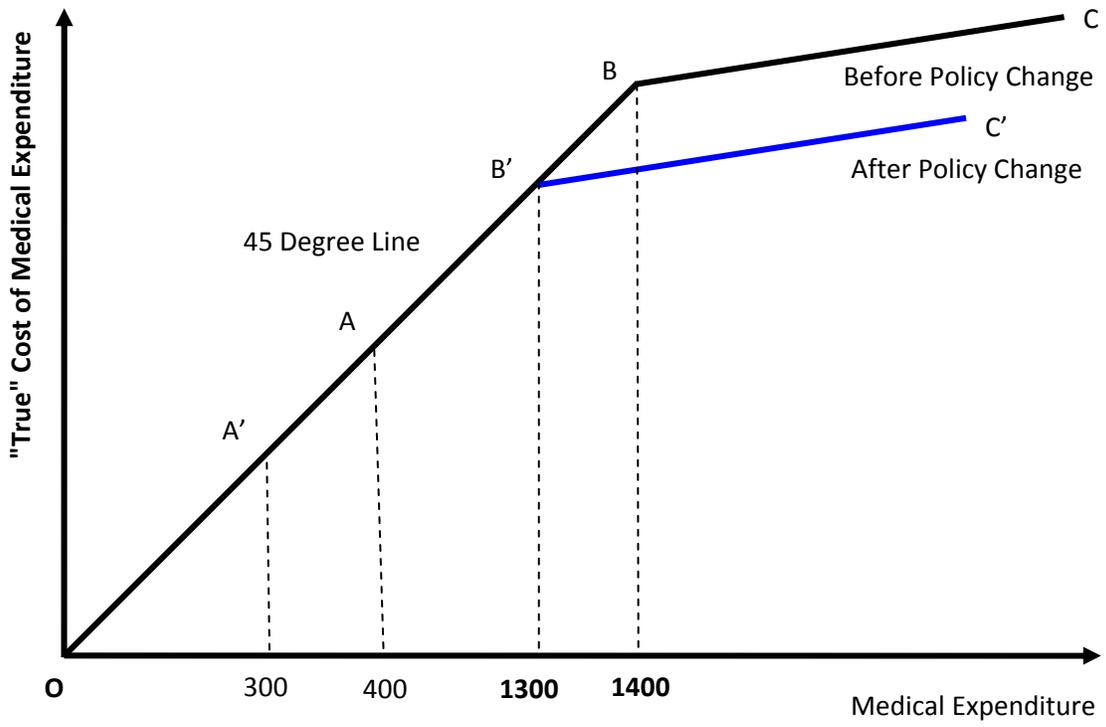


Figure 4. MSA Contribution, MSA Balance and Total Medical Expenditure (2000-2003)

