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The Impact of a Universal Health Scheme on Precautionary Savings:Evidence from Thailand

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The Impact of a Universal Health Scheme on Precautionary Savings: Evidence from Thailand

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Abstract

This study examines the impact of Thailand's 30 baht universal health scheme on household savings behavior using Thai Socio-economic Survey data from 2000, 2001, and 2004. Two difference-in-differences (DID) approaches are employed: first, a simple approach using the eligibility of all health schemes and second, a more rigorous approach exploiting the phased introduction of the 30 baht scheme. The results show that savings behavior changed after the scheme was introduced. Simple DID analysis shows that the propensity to save out of permanent income decreases from about 14%–17%, which accounts for 24–30% of the propensity to save out of permanent income in 2004. More rigorous DID analysis shows that the propensity to save out of permanent income is reduced immediately after the introduction of the scheme. This means that even poor households have greatly reduced levels of permanent consumption in order to prepare for unpredictable health risks.

Keywords: Thailand, 30 baht scheme, precautionary savings, developing countries, health care reforms

JEL classification: D1; H4; I1

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1 Introduction

In many developing countries, household health care expenditure is funded mainly by out-of-pocket payments because health insurance is rarely provided. Furthermore, out-of-pocket payments for health care can be large relative to total household expenditure because household income is low in these countries. If households are unprepared for sudden illnesses and cannot borrow to cover unexpected medical costs, they may have to sell assets or reduce living expenses in order to finance out-of-pocket payments. Even if households do not choose treatment for disease, their permanent income may possibly decrease via reduced human capital arising from disease. As a result, households fall into poverty or lose opportunities to escape poverty. To make matters worse, poor households have a greater tendency to fall ill than rich households (Case, 2004).

Previous theoretical models show that households increase their savings when future consumption or future income becomes more uncertain (Kimball, 1990; Leland, 1968). In addition, an unpredictable disease affecting a family member is a factor of economic uncertainty. Hence, uninsured households have a precautionary motive to restrain consumption and to save. Conversely, the introduction of public health insurance for uninsured households can reduce the precautionary motive by reducing the risk of unexpected medical expenses. Some empirical studies analyze the relationship between health insurance and precautionary savings in developed countries. However, the empirical evidence is mixed on the relationship between savings behavior and insurance.

The aim of this study is to assess the impact of Thailand's universal health scheme, known as the 30 baht scheme, on household savings behavior by using the Thai Socio-economic Survey (SES). The 30 baht scheme, which was introduced by the Thai government in four phases from April 2001 to April 2002, guarantees comprehensive outpatient and inpatient care. Beneficiaries pay just 30 baht (approximately 0.75 USD in January 2004) per visit to a registered primary care unit[1]. Thus, the main purpose of the 30 baht scheme is to ensure that the whole Thai nation can access medical services cheaply and sufficiently. Somkotra and Lagrada (2008) show that the 30 baht scheme reduces the risk of catastrophic medical expenses. As a result, it could reduce the risk of unexpected medical expenses. However, the effect of the scheme on savings behavior is under-researched.

In order to measure the impact of the 30 baht scheme on household savings, this study employs two difference-in-differences (DID) approaches. In the first approach, define a treatment group and a

[1] Beneficiaries who were eligible for the Medical Welfare Scheme (MWS, see Subsection 2.2) before the introduction of the 30 baht scheme were exempt from this payment.

control group are defined based on eligibility for the 30 baht scheme. This approach assumes that changing savings behavior over time is equal in both groups. On the other hand, in the second approach, the timing of the phased introduction of the scheme is exploited. This second approach allows us to estimate without the assumptions of the first DID approach. In employing these methods, I attempt to avoid the estimation results bias suffered by many similar previous studies.

This study is one of the first in a developing country about the relationship between health insurance and precautionary savings. Even though the expected damage that poor households suffer from health risk is bigger than rich households, empirical studies in developing countries have been researched insufficiently. The 30 baht scheme, which is one of the first universal coverage health schemes in lower middle-income countries, allows us to study this theme. Furthermore, because the 30 bath scheme has features as natural experiments, it is possible to avoid some empirical problems.

The presented empirical results suggest that the 30 baht scheme has changed household savings behavior. Based on both DID approaches in analyses of treatment subgroups without the richest groups, the results show that the 30 baht scheme decreases precautionary savings. In detail, a comparison of saving behavior before and after the introduction of the 30 baht scheme using the simple DID approach shows the propensity to save out of permanent income decreases from about 14 % – 17 %. This magnitude accounts for 24–30% of the propensity to save out of permanent income. Moreover, the results of the rigorous DID approach show that the propensity to save out of permanent income decreases statistically significantly in two treatment subgroups, even immediately after the introduction of the 30 baht scheme. These results imply that informal sector households prepare for their health risks, and the health risks lower the level of permanent consumption. That is, the 30 baht scheme improves the living standards of households but not richer households, in the informal sector.

The remainder of the paper is organized as follows. Section 2 presents the institutional setting and reviews previous studies of the relationship between health insurance and savings. Section 3 describes the estimation strategy used in the present study. Section 4 provides an overview of the data set. Section 5 reports the estimation results and Section 6 discusses their robustness. Section 7 concludes.

2 Background

2.1 The 30 baht scheme's place in Thailand's health care schemes

One of the goals of the 30 baht scheme is to remove the risk of catastrophic medical payments from the whole nation. If health risk can be removed, it is expected that households reduce precautionary saving for this risk. The purpose of this study is to examine this precautionary saving reduction. For our evaluation, we focus on the two settings, as natural experiments, of the introduction of the 30 baht scheme.

There are two natural experiment situations for the introduction of the 30 baht scheme. First, the beneficiaries of the 30 baht scheme were automatically registered on the scheme. Second, because the introduction of the 30 baht scheme was carried out in stages, the period of beneficiary enrollment in the 30 baht scheme can be regarded as random. Using these two features, we can avoid the empirical problem of the endogeneity of health insurance participation.

The history of health insurance schemes in Thailand explains the reason why the 30 baht scheme has features as natural experiments. The government has aimed for universal coverage of public health insurance since the birth of the first Thai democratic government in 1973. Four medical schemes were introduced before the introduction of the 30 baht scheme. The first was the Medical Welfare Scheme (MWS), which was introduced in 1975 and aimed to provide free medical care to low-income households. However, this scheme suffered problems related to funding and targeting. The second scheme, the Civil Servant Medical Benefit Scheme (CSMBS), was introduced in 1978 to provide health benefits to civil servants and their dependents. Beneficiaries were free to choose private or public providers. The CSMBS remains as a superior health care scheme after the introduction of the 30 baht scheme. The third scheme, the Social Security Scheme (SSS), was introduced in 1990. The SSS can be used in both private and public hospitals but covers only formal sector employees (their families are excluded). The fourth scheme, the Voluntary Health Card Scheme (VHCS), was introduced in 1993 to cover those ineligible for any of the other schemes. However, there were concerns that the VHCS was not reaching its intended target population and suffered from a classic adverse selection problem because the purchase of health cards was not compulsory. In addition, 21% of nationals did not receive any medical schemes in 2001.

The 30 baht scheme was introduced to solve the problem of the medical schemes for the informal sector, the MWS and the VHCS, and to provide health security for uninsured nationals. In other words, all Thais who were ineligible for the CSMBS and the SSS automatically became beneficiaries of the 30 baht scheme. Following its introduction in April 2002, its coverage spread rapidly to 74.7% in 2003, from when the number of uninsured has gradually decreased (Table 1)[2,3]. In addition, the budget per person of the 30 baht scheme is larger than any previous scheme[4]. By using this feature, Gruber et al., (2013) show that the 30 baht scheme increased health care utilization and decreased infant mortality. Their results signify that informal sector households could not receive sufficient medical services even if they receive the MWS.

The 30 baht scheme has influenced not only the coverage but also the medical expenses of households. Somkotra and Lagrada (2008) examine the financial implications of such payments using SES data, especially when payments exceed certain threshold values, such as the fraction of total household consumption or non-food consumption. Somkotra and Lagrada (2008) conclude that unexpected out-of-pocket payments for medical care decreased following the introduction of the 30 baht scheme. This means that its introduction could automatically decrease the precautionary savings motive for the health risk of beneficiaries.

The phased introduction of the 30 baht scheme can be regarded as an exogenous shock to household saving behavior. The 30 baht scheme was introduced nationwide from April 2002, having been introduced in four phases from April 2001. It was introduced in 6 provinces in the first phase of April 2001; 17 provinces in the second phase of July 2001; all remaining provinces, but not some areas in Bangkok in the third phase of October 2001; and in the remaining areas of Bangkok in the last phase of April 2002. Surprisingly, the socioeconomic background of households enrolled in the 30 baht scheme in each stage is hardly statistically different. Moreover, the health care resources of each province are not significantly different[5]. That is, the introduction of the 30 baht scheme is considered as a natural experimental situation for household saving behavior.

2.2 Precautionary savings and health insurance

Some theoretical studies focus on the relationship between household savings and insurance (e.g., Hubbard et al., 1995). The precautionary motive diminishes if households join insurance schemes by lowering economic uncertainty. In addition, health insurance shrinks household precautionary savings in theory. Decreasing unexpected out-of-pocket medical expenses by joining the health

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2 It is important to note that it is rare for beneficiaries of the CSMBS and SSS change to the 30 baht scheme because the contents of health care security in the CSMBS and the SSS are richer than those in the 30 baht scheme. That is, the beneficiallies of the 30 baht scheme could not join the CSMBS or the SSS before the introduction.

3 Although the 30 baht scheme is universal, 5% of nationals do not take it up. One of the reasons for this is that beneficiaries can use the program only in an area in which they are registered as residents.

4 This scheme is financed almost solely from tax revenue and public hospitals are the main providers, covering more than 95% of beneficiaries (Wibulpolprasert and Thaiprayoon, 2008).

5 See Table 3.

insurance reduce the precautionary savings motive (Kotlikoff, 1989).

Some empirical studies confirm the theoretical conclusion. Levin (1995) finds that precautionary savings are made by many elderly households that do not have private health care insurance. Gruber and Yelowitz (1999) use panel data to assess the relationship between eligibility for the US social insurance program Medicaid and household savings behavior. They find that Medicaid eligibility has a significant positive effect on consumption expenditure. In other words, Medicaid eligibility has a negative effect on household savings.

Few studies do not support the theory of precautionary savings. Starr-McCluer (1996) finds a positive correlation between health insurance and wealth holdings. Guariglia and Rossi (2004) investigate whether uninsured individuals tend to save more than insured individuals, but find that this hypothesis does not hold, even after controlling for the endogeneity of insurance purchases. Empirical evidence is mixed on theoretical predictions.

These previous studies suffer from three empirical problems. First is the endogeneity of savings behavior and insurance purchases. For example, in the case of private insurance, a household's preference to join a private insurance may be associated with savings behavior. A problem with this approach is that insurance status is an outcome of the same choice process that determines savings decisions (Gruber and Yelowitz, 1999). The second problem is peculiar to means-tested social insurance, such as Medicaid in the US. Hubbard et al. (1995) argue that asset-tested social insurance programs affect savings in two ways: one is that social insurance reduces the precautionary savings motive by decreasing unexpected out-of-pocket payments and the other is that social insurance reduces household savings in order to meet the eligibility criteria for asset-tested social insurance. Consequently, it is difficult to identify the effect on precautionary savings.

Chou et al. (2003) avoid the first and the second empirical problems by focusing on the national health insurance (NHI) scheme that was introduced in 1995 in Taiwan, which is available to all nationals. This full availability means that we can identify the effect of the introduction of the NHI scheme on household savings without self-selection bias. They use the DID estimation strategy and define the control and treatment groups based on the eligibility of government insurance programs before the introduction of the NHI. They find that the introduction of the NHI reduces savings for treatment groups. However, this method could have caused the third problem, which is sample selection bias because the participants of health insurance do not assign randomly.

Under the DID method, it is assumed that the treatment and control groups have the same time trend. To satisfy this assumption, random assignment to each group is ideal. However, it is unlikely that the definition of each group in Chou et al. (2003) satisfies the DID assumption because the eligibility of health insurance before the introduction of the NHI is defined by the socioeconomic backgrounds of the population. Thus, the socioeconomic background of the new beneficiaries differs from that of the continuing beneficiaries. Because there is the possibility of sample selection, the estimation results may have been biased.

In this study, the 30 baht scheme can avoid these issues because it has rare features. However, the new beneficiaries are not selected randomly, like in Chou et al. (2003). Accordingly, the first DID approach in this study could face potential bias caused by this third problem. On the other hand, we can assume that the phased introduction of the 30 baht scheme is exogenous to household saving. As mentioned in Subsection 2.1, the 30 baht scheme was introduced in four stages. Surprisingly, there is no statistical difference in medical resources and socioeconomic status of living households between provinces of each phase. Because this situation allows us to regard the selection of the treatment as random, this study can avoid these three empirical problems.

3 Estimation Strategy

This study investigates the relationship between savings and health insurance using the theory of optimal choice under uncertainty, as in Chou et al. (2003). However, it should be noted that households balance out spending and savings to smooth consumption, which is shown in Paxson (1992). If savings for consumption smoothing are not separated from precautionary savings, it would be impossible to identify the effects of the 30 baht scheme on household savings. In this study, a model is used that measures precautionary savings from permanent income and consumption smoothing from transitory income based on the permanent income hypothesis in order to separate these savings.

I assume that the savings of household i (S_i) are a linear function of permanent income ($Y^P{}_i$), transitory income ($Y^T{}_i$), the income variability of the household (VAR_i), and the variables ($\mathbf{W}_i$) that measure the household life-cycle stage:

$$S_i = \alpha + Y_i^P \alpha_1 + Y_i^T \alpha_2 + \mathbf{W}_i \alpha_3 + \mathrm{VAR}_i \alpha_4 + \varepsilon_i. \quad (1)$$

If households behave completely according to the permanent income hypothesis, the coefficient of permanent income (α_1) should be 0 and the coefficient of transitory income (α_2) should be 1. If households save as a precaution, it is expected that the propensity to save out of permanent income (α_1) is significantly positive.

Now, we focus on the propensity to save out of permanent income (α_1) in order to investigate the impact of the 30 baht scheme on household saving. The propensity to save out of permanent income (α_1) decreases if precautionary savings decrease. Thus, the reason for using this method is because savings and the uncertainty of medical expenditure are endogenous. If out-of-pocket payments are exogenous, as implicitly assumed by Chou et al. (2003), we can analyze them using the variables related to medical expenses, as VAR_i. However, in Thailand, health care spending would not be exogenous to total household expenditure. Therefore, I suppose that precautionary savings for health risk are included in the savings from permanent income.

3.1 Estimation framework

Although information on permanent income and transitory income is necessary in order to estimate the saving function (1), it is generally unavailable. Hence, this study employs the estimation framework of Paxson (1992). Paxson (1992) uses a sample of farmers in Thailand to investigate whether households are able to balance out spending and savings in order to smooth consumption. She assumes that the change in annual rainfall is orthogonal to permanent income and then divides household income into permanent income and transitory income by assuming that the variables measuring the change in rainfall are instrumental variables of transitory income.

Following this approach, we first assume that the total income of household i at time t is the sum of permanent income and transitory income. In other words,

$$Y_{it} = Y_{it}^P + Y_{it}^T . \tag{2}$$

Next, we assume that permanent income is expressed as:

$$Y_{it}^P = \beta_t^P + \beta_c + \mathbf{X}_{it}^P \beta^P + \varepsilon_{it}^P . \tag{3}$$

$\mathbf{X}^P_{it}$ is a vector of household characteristics that are determinants of permanent income. These include 15 dummy variables indicating household socioeconomic classification and the composition of household members in 17 age/sex/education categories. β_c represents a province fixed effect of households living in province c. β^P_t represents a year fixed effect of permanent income. ε^P_{it} is a residual of permanent income.

In a similar way, transitory income is defined as a linear function of $\mathbf{X}^T_{rt}$, a vector of the region-specific variables that are determinants of transitory income. Transitory income is expressed as

$$Y_{it}^{T} = \beta_{t}^{T} + \mathbf{X}_{rt}^{T}\beta^{T} + \varepsilon_{it}^{T}, \tag{4}$$

where $\mathbf{X}^{T}_{rt}$ includes deviations from the amount of average rainfall each month and its squared. Ideally, it is necessary to contain the variable, such as the health conditions of household members, which influences a household's transitory income in $\mathbf{X}^{T}$, but such information as sickness is not freely available. However, this is not a serious problem because this study focuses on the change in the propensity to save out of permanent income. Because the factors of unexpected income fluctuation are orthogonal to permanent income, the accuracy of the estimation of transitory income does not affect the accuracy of the estimation of permanent income. β^{T}_{t} represents a year effect of transitory income. The residual ε^{T}_{it} includes all the transitory income of household *i* that is not explained by $\mathbf{X}^{T}_{rt}$.

As previously stated, Equations (3) and (4) cannot be estimated, because permanent income Y^{P}_{it} and transitory income Y^{T}_{it} cannot be observed. Then, the income equation is derived by substituting Equations (3) and (4) for Equation (2), and permanent income and transitory income are obtained based on the estimated result. Then, the income equation is expressed as

$$Y_{it} = \beta_{t} + \beta_{c} + \boldsymbol{X}_{it}^{P}\beta^{P} + \boldsymbol{X}_{rt}^{T}\beta^{T} + \nu_{it}, \tag{5}$$

where $\beta_t = \beta^{P}_{t} + \beta^{T}_{t}$. The income of household *i*, Y_{it}, uses average monthly income, which is annual income divided by 12.

The estimated result of income equation (5) is shown as the sum of three components, namely permanent income, transitory income, and unexplained income. The unexplained income is constructed from unestimated permanent income and unestimated transitory income, and also includes year fixed effect, β_t, because the year fixed effect is constructed from components of permanent and transitory income in this study. In addition, unexplained income includes household fixed effects as an element of permanent income, and the health conditions of household members and short-term unemployment as elements of transitory income.

The saving equation is derived from the estimation result of the income function (5). In this estimation, permanent income, transitory income, and unexplained income are added to the saving equation as an explanatory variable. As a result, the base model is shown by the following expressions

$$S_{it} = \alpha_t + \left[\hat{\beta}_c + \boldsymbol{X}_{it}^P \hat{\beta}^P \right] \alpha_1 + \left[\boldsymbol{X}_{rt}^T \hat{\beta}^T \right] \alpha_2 + \left[\hat{\beta}_t + \hat{v}_{it} \right] \alpha_3 + Y_{it}^O \alpha_4 + \boldsymbol{W}_{it} \alpha_5 + \text{VAR}_r \alpha_6 + \varepsilon_{it}, \quad (6)$$

where $\alpha_t = \alpha + \beta^P{}_t\alpha_1 + \beta^T{}_t\alpha_2$. In this study, S_{it} is calculated as the difference between total income and total expenditure. Total income is the sum of average monthly income Y_{it} and other money receipts $Y^O{}_{it}$. $Y^O{}_{it}$ is average monthly money receipts, which comprises inheritance, proceeds from insurance, and lottery winnings. Thus, $Y^O{}_{it}$ is not included in income equation (5) and is added to the saving equation, because $Y^O{}_{it}$ does not correlate with average income and does not have a reverse causality relationship with monthly expenditure before the investigation month. Total expenditure is the sum of monthly expenditure, which is deflated using the monthly consumer price index by region in order to adjust average monthly income and average non-consumption expenditure, such as taxes. The standard deviation of rainfall, VAR_r, is used as a proxy of income fluctuation. Observed weather information uses the regional variable, VAR_r, to become the same value by household in region r.

3.2 DID approach

This study estimates the change in the propensity to save out of permanent income using two DID approaches developed for the saving equation (6). The first DID approach is to compare changes in the propensity to save out of permanent income between treatment and control groups. The beneficiaries of the 30 baht scheme are all nationals not covered by the CSMBS or the SSS. That is, the treatment group and control group are defined based on the eligibility of medical schemes. Because the CSMBS covers all family members of beneficiaries, the control group is composed of households in which at least one member receives the CSMBS[6]. The treatment group is composed of households in which no members receive the CSMBS or the SSS.

A decrease in the precautionary savings of the treatment group is shown as a change in the coefficient of estimated permanent income, (α_1), in Equation (6). Then, in order to identify the change in the coefficient of permanent income, permanent income and the DID term interact as per the following equation

$$S_{it} = \alpha_t + \left[\hat{\beta}_c + \boldsymbol{X}_{it}^P \hat{\beta}^P \right] \times \text{DID} + \left[\boldsymbol{X}_{rt}^T \hat{\beta}^T \right] \alpha_2 + \left[\hat{\beta}_t + \hat{v}_{it} \right] \alpha_3 + Y_{it}^O \alpha_4 + \boldsymbol{W}_{it} \alpha_5 + \text{VAR}_r \alpha_6 + \text{Treat}_{it} \alpha_7 + \varepsilon_{it}. \quad (7)$$

[6] On the other hand, the SSS covers only beneficiaries and does not cover family. Then, a household may benefit from the 30 baht scheme as long as not all its members have joined SSS. Thus, the treatment and control groups do not include beneficiaries of SSS.

In the first DID model,

$$\text{DID} = \alpha_1 + D^{2004}{}_{it}\gamma_1 + \text{Treat}_{it}\gamma_2 + \left(D^{2004}{}_{it} \times \text{Treat}_{it}\right)\gamma_3.$$

D^{2004} is an indicator variable for the period after the introduction of the 30 baht scheme. Treat_{it} is an indicator variable for the treatment group. The other variables in Equation (7) are similar to those in Equation (6). The effects of the introduction of the 30 baht scheme on household savings, $\Delta^{30\text{baht}}$, can be expressed as follows

$$\Delta^{30\text{baht}} = \left[(\gamma_1 + \gamma_2 + \gamma_3) - \gamma_2\right] - \left[\gamma_1 - 0\right] = \gamma_3.$$

This equation means that γ_3 is the difference between a change in the propensity to save out of permanent income in the treatment and control groups. If precautionary savings for a health risk of the treatment group decreased following the introduction of the 30 baht scheme, γ_3 would be significantly negative.

To estimate the saving equation (7), it is necessary to develop the income equation (5) and the saving equation (6). There are two steps to develop the income equation (5). First, it is developed into a model that expresses changing income structure from 2000 to 2004. For instance, there is a possibility that changing income structure results in permanent income increases as a result of the improvement in health following the introduction of the health insurance scheme. Nevertheless, the DID estimator γ_3 might include the change in household savings, according to changing income structures peculiar to the treatment group, if the explicit measurement of permanent income were constant throughout the sample period. Then, interaction terms of the socio-economic classification dummy variables are made with the instrumental variables of permanent income that are included in $X^{P}{}_{it}$ and the year dummy variables. Second, we consider the possibility that the influence of rainfall is different in the control group and in the treatment group. Ersado et al. (2003) estimate transitory income using the interaction terms urban area dummy and rainfall deviation from the long-range average in order to control for the possibility that a rainfall shock has a different influence on urban areas to rural areas. Many treatment group households reside in rural areas, whereas half the control group households reside in urban areas. Then, the interaction term of $X^{T}{}_{rt}$ is added, as well as a control group dummy.

In addition, the saving equation is developed. Consumption (savings) behavior in the life-cycle stage could be different for the treatment group and for the control group. For example, expenditure in the formal sector is higher than it is in the informal sector because formal sector workers are required to demonstrate suitable levels of consumption in order to maintain their social positions. To control for different consumption behavior in each group, interaction terms of the variables of household life-cycle stage, $\mathbf{W}_{it}$, are made with each group dummy variable.

Furthermore, it is necessary to consider measurement error as an econometric issue. The household survey data on income and consumption could contain measurement errors. If so, a measurement error is included in the error term, ε_{it}, and unexplained income, v_{it}, of the savings function. As a result, α_3 will be biased because the measurement error correlates with unexplained income. If the original model of Paxson (1992) is used, the coefficients of permanent income and transitory income are not affected measurement errors because unexplained income is orthogonal to permanent income and transitory income. However, the interaction term of permanent income and the DID term are not orthogonal to unexplained income. Thus, this study confirms the strength of the correlation of the interaction term and unexplained income by comparing the coefficients of unexplained income in the estimation result in Equations (6) and (7).

3.3 Analysis exploiting the phased introduction of the 30 baht scheme

In order to check the robustness of the first DID approach, this study additionally estimates the saving equation, which exploits the introduction of the 30 baht scheme in four phases, using SES 2001. The standard SES in Thailand is constructed from data collection processes that are carried out every month. SES 2001 was a smaller survey than the standard SES, with data collected in February, March, April, July, August, and September. SES collects the information about consumption and income in the month (or year) before the survey. Therefore, investigations from February to April collected information before the introduction of the 30 baht scheme in all provinces. On the other hand, investigations from July to September collected information after the introduction of phases 1 and 2 in provinces, and collected information before the introduction in other provinces. Therefore, this analysis examines whether the precautionary savings of households decreased in provinces where the 30 baht scheme was introduced in phase 1 or phase 2.

The following DID term is used with Equation (7),

$$S_{im} = \alpha_m + \left[\hat{\beta}_c + \mathbf{X}^P_{im}\hat{\beta}^P\right] DID' \\ + \left[\mathbf{X}^T_{rm}\hat{\beta}^T\right]\alpha_2 + \left[\hat{\beta}_m + \hat{v}_{im}\right]\alpha_3 + Y^O_{im}\alpha_4 + \mathbf{W}_{im}\alpha_5 + \mathrm{VAR}_r\alpha_6 + \mathrm{Treat}_c\alpha_7 + \varepsilon_i,$$

$$\mathrm{DID}' = \alpha_1 + D^{After}\gamma_1 + \mathrm{Treat}_c\gamma_2 + \left(D^{After} \times \mathrm{Treat}_c\right)\gamma_3.$$

where Treat_c is a dummy variable that takes a value of 1 if the household lived in province c, which introduced the 30 baht scheme in phase 1 or phase 2, and 0 otherwise. D^{After} is a dummy variable for the period after the introduction of the 30 baht scheme introduced in phase 1 or phase 2, that is, the household was investigated after August. If households undertake precautionary savings in provinces in which phases 1 or 2 is introduced, it is expected that γ_3 will be negative. The fixed effects of the investigation month, α_m, are added in order to control for the seasonality of expenditure because the analysis focuses on the change in monthly savings behavior.

The second DID approach focuses on the 30 baht scheme introduced in provinces, compared with the first DID approach that focuses on individual eligibility of the scheme. There is a possibility that in the second approach, many households included in the treatment grouphad not yet registered for the 30 baht scheme, since immediately after the introduction. In addition, if households do not trust the sustainability and effectiveness of the 30 baht scheme, household saving behavior would not change much immediately after the introduction. For these reasons, it is expected that the magnitude of the second DID estimator, γ_3, becomes smaller than that of the results of the first DID estimator.

4 Data

4.1 SES data

This study uses three types of data sets in order to undertake the estimation. The first data sets are SES2000, SES2001, and SES2004, which collect detailed socioeconomic information on households, such as income, expenditure, and members' characteristics, such as age, sex, occupation, and educational attainment. SES collects information by two-stage stratified sampling and reports a national representative household's sampling weight. All the descriptive statistics and estimation results of this study are the values that are considered as survey design. Household panel data cannot be constructed because SES is a cross-sectional survey.

The most important point to enable analysis is the availability of detailed individual information on medical scheme coverage. Generally, it is difficult to know what kinds of insurance one receives. To make matters worse, in the case of Thailand, health scheme eligibility is determined in principle by individual occupation but exceptional cases exist. For example, 24.5% of civil servants do not receive CSMBS; on the other hand, 10.5% of non-civil servants receive CSMBS in 2004. If we simply assign to the control group and the treatment group individuals according to work status, one who does not receive the 30 baht scheme is included in the treatment group and one who receives the 30 baht scheme is included in the control group. If this group misassignment is not solved, the effect of the 30 baht scheme is underestimated.

Fortunately, we can identify one's medical insurance scheme because this information is reported in SES 2004. However, SESS2000 and SES2001 do not collect this information. Thus, as a first step, the probability of individuals receiving the CSMBS or the SSS in each occupational status is estimated using SES 2004[7]. Next, based on the estimator in the first step, the probability of individuals receiving any medical scheme is calculated in SES 2000 and SES 2001. Finally, the control group and the treatment group are defined on the basis of the predicted value. The treatment group comprises people who have a probability of receiving CSMBS or SSS of less than 10% and none have a civil servant in their family. The control group comprises people with at least one person in the family who is a civil servant or has a probability of receiving CSMBS of more than 90%. By this sample selection, the proportion of CSMBS beneficiaries who are included in the treatment group becomes 3.5% and the proportion of non-beneficiaries of CSMBS who are included in the control group becomes 3.24% in the individual level dataset of SES2004.

4.2 Inflation bias

Household savings are measured as the difference between total income and total expenditure because SES does not ask direct questions about savings. However, reported household income is the average monthly income that is based on income during the year or month before the investigation, whereas household expenditure is a value based on expenditure during the month before the investigation added to the other average monthly expenditure led by annual costs, such as tax. If there is inflation over the survey year, savings would have a downward bias (Paxson, 1992). Using the monthly consumer price index as the second data set, this study adjusts for inflation bias in a manner similar to Paxson (1992)[8].

4.3 Constructing the rainfall variable

[7] The reason for estimating the receiving probability of health scheme by each classification is to improve the estimation accuracy. For example, there are many recipients of SSS at a specific occupational classification, and there is an occupational classification that is often live with civil servants. As explanatory variables for the prediction, occupation, age, area of residence, gender, and the number of civil servants within the family are used.

[8] Monthly consumer price index by region can be downloaded from the homepage of the Thai Bureau of Trade and Economic Indices (as of May 25, 2009).

In order to construct the rainfall variable, this study uses daily rainfall data derived from meteorological observatories across the whole country. The National Climate Data Center releases observed meteorological data every day on more than 20,000 observatories in many parts of the world[9]. In Thailand, there are 114 meteorological observatories where observation data have been collected from 1973 to 2004[10]. However, owing to data limitations for some observatories, in this study, we use weather data observed in 52 weather stations and their geolocations. These weather stations are distributed uniformly across Thailand, as shown in Figure 1.

Households are matched to these 52 weather stations by choosing the station closest to the gravity point of the province in which the household resides. SES collects the residential information and the National Climate Data Center data includes the latitude and longitude of weather stations. ArcGIS allows us to calculate the gravity point of the province in order to find the closest weather station. The variables, $\mathbf{X}^{T}_{rt}$ and VAR_r, are constructed based on this rainfall information.

$\mathbf{X}^{T}_{rt}$ represents transitory income. If deviation from the average rainfall were serially correlated, $\mathbf{X}^{T}_{rt}$ would be inappropriate as an instrument of transitory income because one can expect the value of rainfall. The Portmanteau test shows that deviation from the average rainfall in almost all months of all weather stations follows a white noise process.

4.4 Sample

Table 2 shows the summary statistics of observations used for the first DID estimation[11]. Panel A reports the summary statistics of the sample of the first DID estimation. The average monthly income of the treatment group is 7,015 baht in 2000 and 8,279 baht in 2004. The average income per capita of the treatment group is about 67 baht per day in 2000 and 80 baht per day in 2004 (approximately 2–3 dollars). Although Thailand is classified as a lower middle-income country by the World Bank, the living standards of the treatment group are not expected to be high. In contrast, the average monthly income of the control group is more than four times that of the treatment group.

The treatment group is constructed from four subgroups based on a socioeconomic classification of the SES, namely farmers, economically inactive households, production/construction worker

[9] National Climate Data Center Online: http://lwf.ncdc.noaa.gov/cgi-bin/res40.pl?page=gsod.html (accessed January 14, 2009).

[10] Because only seven weather stations show weather information from 1966 to 1972, observation data after 1973 are used.

[11] In order to remove outliers, the observations of the top 1% of income and expenditure are dropped. The estimation results are almost the same when the top 0.5% is dropped, or when the top 2% is dropped.

households, and other households[12]. The features of each subgroup are summarized as follows. Although the average monthly income of farmers is similar to that of economically inactive households or production/construction workers' households (See Table 2), farmers are more affected by the weather, and therefore, face strong seasonality in comparison with the other subgroups (Paxson, 1993). Income seasonality increases the incentive to treat diseases in farming seasons because farming is labor-intensive work, and thus, health-intensive work. Behrman and Deolalikar (1989) show that farmers' short-run health conditions during the farming season affect their labor productivity. The rate of return on health investment in the farming season is high. Therefore, farmers could have stronger precautionary savings motives against health risks than other groups.

The economically inactive households depend on remittances. If remittances play the role of insurance, economically inactive households that depend on remittances might have weak precautionary motives (Yang and Choi, 2007). Conversely, it is possible that to be dependent on remittances leads to greater economic uncertainty because the remitter may be poor to begin with. Returns on health investment as labor income should be lower than other sub-groups if households depend on remittances but the ratio of medical expenditure to income is relatively higher. The precautionary saving motive of the economically inactive households might be strong.

On the other hand, it is possible that precautionary savings have not been reduced by the introduction of the 30 baht scheme for households that cannot be satisfied with the medical services available under the scheme. The scheme decreases unpredictable medical expenditure only if a beneficiary visits a primary care unit that has registered each person. In addition, the 30 baht scheme does not apply if a beneficiary wants to receive a medical service in a medical institution other than a primary care unit. The medical expenditure and income of the entrepreneur, trade, and industry household is the highest in the treatment subgroup. It is possible that their health investment preference differs from other treatment subgroup households.

In Table 2, panel B provides descriptive statistics of household medical expenditure. This is constructed from expenditure for medical supplies, outpatient fees, and inpatient fees. The samples of each group are conditional on a positive level of medical expenditure for each household and this accounts for between 58.8% and 71.3% of the observations of each group in panel A. Table 2 allows us to compare the ratio of medical expenditure in household income in 2000 with that in 2004. In all treatment subgroups, this ratio following the introduction of the 30 baht scheme decreases

[12] There are other socioeconomic classifications of beneficiary households (e.g., forestry, fishers, and unpaid workers). However, only about 3% of the total samples belong to these classifications.

statistically significantly at the 5% level. Furthermore, the observation ratio of panel B to panel A not only tends to decrease, the standard deviation of the ratio of medical expenditure in household income in all groups also decreases. These statistics suggest that the uncertainty of medical expenditure decreases in the treatment group. By contrast, the ratio of medical expenditure to income for the control group does not change.

Table 3 compares some features of provinces in which the 30 baht scheme was introduced in phases 1 and 2 and provinces in which it was introduced in phases 3 and 4. This is because we define provinces in which it was introduced in phases 1 or 2 as the treatment group, and provinces in which it was introduced in phases 3 or 4 as the control group in the second DID estimation. This table reports household attributes using SES2000 in panels A and B, and health resources of provinces using Thai public health (2002) in panel C. Column (1) reports summary statistics of the treatment group. Column (2) reports summary statistics of the control group. Column (3) reports the differences between treatment group provinces and control group provinces.

Because a phased introduction does not mean random assignment in general, the second DID estimation does not necessarily meet DID assumptions directly. Moreover, in developing countries, it is very rare for a phased introduction to be regarded as a random assignment. However, surprisingly, Table 3 shows balance between the treatment and control groups in terms of household status and health resources in provinces[13]. Household income is statistically significant at the10% level. The reason why differences in income are statistically significant is that phase 3 and 4 provinces include the Bangkok metropolitan area. This significant difference is lost if households that live in Bangkok are removed from phases 3 and 4. In other statistics, the control group and treatment groups are balanced, even if Bangkok is included.

5 Empirical results

5.1 First DID estimation: using eligibility of health schemes

Table 4 shows the estimation results for the second stage of the first DID estimation. The first stage estimation results are shown in Appendix Table A.1. Column (1) shows the estimates of the saving function (7), which is the base model, column (2) shows the estimates of the saving function (8), which is the DID model, and column (3) shows the estimates of the saving function (7) using only a sample of the treatment group. The DID estimator, γ_3, reported in column (2), is not significantly

[13] More surprisingly, phase 1, 2, and 3 provinces are perfectly balanced in each. Phase 4 provinces are not balanced because the phase includes only richer areas of Bangkok.

negative. Thus, the introduction of the 30 baht scheme does not decrease the marginal propensity of the treatment group to save from permanent income.

The interaction terms of the DID term and permanent income may be orthogonal to unexplained income because the difference between the coefficients of unexplained income, α_3, in the base model (1) and in the DID model (3) are not statistically significant. As a result, we can ignore the correlation between the measurement error included in the error term and the interaction term of the DID term and permanent income.

Subgroups

The saving equation (7) is estimated for every subgroup in order to consider the possibility that the precautionary savings motive is different according to socioeconomic background. Table 5 presents the estimation results of each subgroup. The DID estimators are significantly negative in all subgroups without entrepreneurs, trade, and industry households. The magnitude of the significant coefficient is large. This indicates that the savings propensity of permanent income decreases from about 14% to 17%. This decrease accounts for between about 24% and 30% of the propensity to save out of permanent income in 2004. As stated previously in Subsection 2.2, the possibility that these estimators are biased cannot be denied because although DID estimation assumes common trends of the treatment and control groups, this assumption is not met. However, I believe that this bias is not large because the estimator of each subgroup is different, despite using the same control group in each estimation[14].

This result suggests that the 30 baht scheme has not only reduced the risk of catastrophic payment of out-of-pocket payments, but also reduced the motivation for precautionary savings to the health risk of households that are not rich among the beneficiaries. In other words, even poor households lower their living standards significantly in order to save as a precaution for health risk. The result that the effects of the 30 baht scheme are greater for poor households is consistent with the conclusion of Gruber et al., (2012), who show that the effect of the 30 baht scheme is greater in areas with a high subscriber ratio for MWS, which covers mainly poor households.

5.2 Second DID estimation: exploiting the phased introduction of the 30baht scheme

[14] The results in Table 5 may appear to be not consistent with the result in Table 4. This is probably because the estimated income function in the first stage is not well captured the differences in income structure between sub-groups.

As a robustness check for the first DID approach, the second DID approach, which exploits the phased introduction, is analyzed. The second DID approach defines the treatment and control groups depending on whether the 30 baht scheme was introduced in a household in a province in which the scheme was introduced the month before the investigation. Thus, households that were not registered in the 30 baht scheme at the time of investigation are also included in the treatment group. In addition, because immediately after the introduction of the 30 baht scheme, it is also possible that savings behavior of households has not yet changed. That is, the DID estimator of the second approach should be smaller than that of the first approach.

Table 6 reports the results of the second DID approach. According to the results for the whole sample, namely, column (1) of Table 6, the coefficient γ_3 indicates that the effect of the introduction of the 30 baht scheme on household savings is statistically insignificant, which is the same as the first DID approach. According to the results for each subgroup, shown in columns (2) – (5), DID estimators, γ_3, are almost consistent with the results in Table 5. In addition, the magnitude of the DID estimator of most groups is smaller than the first DID estimators in Table 5. The estimators of (3) Entrepreneurs, trade, and industry households and (5) Economically inactive households are significantly negative. The result that the estimator of (3) is significantly negative differs from the result of Table 5; however, this is not a great inconsistentcy because the magnitude of the estimators implies that savings from permanent income reduce by only 1.9%. Furthermore, the DID estimator of (2) Farmer and (4) Other work status households is negative but insignificant. The reason why the estimator of column (4) is not significant could be that the fit of the estimation model is poor.

This discussion is necessary because the estimator of column (2) seems to differ from the result in Table 5. The magnitude of the coefficient is as expected, but it is not statistically significant. I believe that this is due to the income seasonality of farmers. As discussed carefully in Paxson (1992, 1993), farmers faces income seasonality in Thailand. As discussed in Subsection 4.4, because of income seasonality, farmers have stronger motives to make precautionary savings for health risk than other groups. Immediately after the introduction of the 30 baht scheme, effects that weakens the precautionary motive do not appear because the 30 baht scheme has not spread fully across Thailand. These results are not inconsistent with those in Table 5.

6 Conclusion

This study provides the first evidence for the effect of the introduction of health insurance schemes on household precautionary savings in a developing country. The presented estimation results suggest that the savings behavior of many beneficiaries of Thailand's 30 baht scheme does not change following its introduction. However, in the results of the analysis of four subgroups, it was confirmed that household precautionary savings is reduced in all subgroups except the richest. Based on the result that compares the propensity to save in 2000 and 2004 using simple DID analysis, the study found that the propensity to save out of permanent income decreased from about 14%–17%. This decrease accounts for 24%–30% of the propensity to save out of permanent income in 2004. In addition, based on the result of more rigorous DID analysis, the study found that the propensity to save out of permanent income is reduced in spite of immediately after introduction of the 30 baht scheme. This means that even poor households have greatly reduced levels of permanent consumption, in order to prepare for an unpredictable health risk.

These results imply two things about the effect of the introduction of the 30 baht scheme. First, it not only improves health utilization and reduces household medical expenditure, but it also improves household living standards in the informal sector. Second, the security of the 30 baht scheme may not be sufficient because the effect of the 30 baht scheme on the richer treatment subgroup is small. What is important to note is that the 30 baht scheme has improved greatly the living standard of the informal sector, even if it does not provide enough security.

The results of this study suggest that poor households not only become ill more easily than rich households but also cut down their permanent living standards to prepare for unpredictable health risk. To deal with such a situation, in Thailand, the 30 baht scheme was introduced. It has improved the living standards of beneficiary households by decreasing precautionary savings, and it may have improved the health conditions of household members by increasing opportunities to treat diseases.

Appendix A: Constructing the rainfall variable

The weather information observed in Thailand has two types of missing data: a lack of observation days and a lack of rainfall data on rainy days. Because monthly rainfall data are constructed from a summation of daily rainfall data, monthly rainfall variables have a downward bias if observation days during a month are missing. Moreover, if rainfall data on rainy days are missing, monthly rainfall variables can easily become biased for any reason (e.g., instrument failure owing to bad weather). Because observation information is likely to be missing the older it becomes, the average monthly rainfall data derived from data from 1973 to 2004 could be lower than its true value. In other words, deviations from the amount of average rainfall, $\mathbf{X}^{T}_{rt}$, could have a large bias, probably upward, in the weather station when there has been a lot of missing data in the past. To make matters worse, the tendency for weather information to be lacking is different for each weather station.

First, the problem of this lack of daily information is solved. As mentioned in Section 4, there are 114 weather stations and 76 provinces in Thailand; therefore, the weather stations are distributed densely. For days when there were no observations at each weather station during 1973 to 2004, I complement the weather information with the observation from the nearest weather station.

Next, the problem of the lack of rainfall data on rainy days is solved. When rainfall cannot be used, the information remains available (e.g., observation day, mean temperature, mean dew point, and mean sea level pressure). First, I sort out only the information on rainy days from 1973 to 2004 and estimate a simple linear model with rainfall as an explained variable. Then, I predict unobservable rainfall and complement it.

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Table 1: Health Insurance Coverage (percentage)

	1998	2001	2003	2006
30 baht	-	-	74.7	74.3
MWS	45.1	32.4	-	-
CSBMS	10.8	8.5	8.9	8.0
SSS	8.5	7.2	9.6	11.4
VHCS	13.9	20.8	-	-
Private health insurance	2.0	2.1	1.7	2.3
Total insured	80.3	71.0	94.9	96.0
Uninsured	19.7	29.0	5.1	4.0

Sources: Wibulpolprasert and Thaiprayoon (2008)

Table 2: Summary Statistics (weighted)

			Treatment Group(Subroup)									
	Treatment Group		Farmer		Entrepreneurs, trade and industry		Other work status		Economically inactive households		Control Group	
Variable	Pre 30 Baht	Post 30 Baht	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Panel A												
Attributes of household												
Income (baht)	7015	8279	5599	7791	11638	12950	4976	6049	6901	6508	33380	35346
	(6030)	(6511)	(4566)	(5779)	(7833)	(8277)	(2991)	(3514)	(6111)	(5534)	(21056)	(21088)
Savings	489	2810	21	2802	1719	4531	0	1485	619	2397	10041	14464
	(4365)	(4936)	(3930)	(4822)	(5584)	(6499)	(2498)	(2752)	(5058)	(4473)	(13406)	(16641)
Savings/Income	-0.157	0.242	-0.241	0.239	-0.005	0.254	-0.144	0.199	-0.172	0.284	0.245	0.357
	(0.729)	(0.559)	(0.710)	(0.608)	(0.585)	(0.509)	(0.582)	(0.432)	(1.037)	(0.635)	(0.430)	(0.360)
Medical Expenditure	154	137	137	128	220	194	113	96	159	135	584	572
	(441)	(503)	(437)	(466)	(544)	(631)	(271)	(453)	(464)	(455)	(1676)	(1833)
The ratio of medical expenditure to income	0.027	0.018	0.028	0.019	0.023	0.015	0.026	0.016	0.029	0.023	0.018	0.017
	(0.072)	(0.054)	(0.075)	(0.061)	(0.067)	(0.039)	(0.069)	(0.046)	(0.073)	(0.063)	(0.089)	(0.044)
Sex of head(proprtion of men)	0.787	0.724	0.89	0.83	0.77	0.72	0.80	0.76	0.52	0.49	0.75	0.74
Age of head	44.6	48.3	45.5	49.3	43.4	45.3	44.2	46.1	44.3	52.1	48.0	49.3
Household size	3.5	3.3	3.8	3.7	3.4	3.2	3.5	3.5	2.9	2.7	3.7	3.5
Number of observations	7907	11290	2423	3252	2694	3723	1580	2434	1210	1881	2339	3289
Panel B : Conditional on a positive level of medical expenditure												
Medical Expenditure	217	200	188	179	314	290	156	139	243	213	917	973
	(510)	(597)	(502)	(543)	(628)	(753)	(308)	(539)	(555)	(558)	(2027)	(2308)
The ratio of medical expenditure to income	0.038	0.027	0.038	0.026	0.033	0.023	0.036	0.024	0.044	0.037	0.028	0.028
	(0.083)	(0.064)	(0.086)	(0.071)	(0.078)	(0.046)	(0.079)	(0.053)	(0.086)	(0.076)	(0.110)	(0.055)
Number of Observations	5465	7437	1727	2274	1845	2416	1123	1603	770	1144	1491	1934
Observations ratio*	0.691	0.659	0.713	0.699	0.685	0.649	0.711	0.659	0.636	0.608	0.637	0.588

Notes: Observations ratio is the ratio of N of observations in Panel B to N of observations in Panel A. Standard deviation corresponding survery design is reported in parentheses.

Table 3: Treatment group's summary statistics by pahsed group in 2000

	Pahse 1&2		Phase 3&4		Difference		
	Mean	Std. Dev.	Mean	Std. Dev.	Coef.	P-value	
Panel A: Attributes of household (weighted)							
Income (baht)	6478	5398	7059	6077	-581	0.079	*
Savings	264.2	4074	507.0	4388	-242.8	0.298	
Observations	644		7263		7907		
Panel B: Medical expenditure of household conditioning on positive medical exp.(weighted)							
Medical Expenditure	221.7	497	216.4	511	5.3	0.870	
The ratio of medical expenditure to income	0.033	0.053	0.038	0.084	-0.005	0.144	
Observations	411		5054		5465		
Panel C: Average Health Resources of Provinces							
Number of population/physician	6251	4334	6918	3516	-666	0.523	
Number of hospitals	16.2	8.8	17.4	18.5	-1.14	0.721	
Number of population/patient bed	531	228	607	232	-76.4	0.191	
Number of new out-patients	366082	188576	396982	505228	-30900	0.703	
Number of in-patients	100744	59847	105838	147413	-5094	0.833	
Observations	23		53		76		

Notes : The differences are estimated by regresstion. In panel A and panel B, P-values are calclated corresponding to the survey design. * indicates statistically significant at the 10% level, ** indicates statistically significant at the 5% level, *** indicates statistically significant at the 1%level.

Table 4: Key Estimates of Saving Equation (weighted)

Variable	(1) Base Model			(2) DID			(3) Only treatment group		
	Coef.	Bootstrap Std. Err.		Coef.	Bootstrap Std. Err.		Coef.	Bootstrap Std. Err.	
Y^P (α_1)	0.452	(0.017)	***	0.463	(0.038)	***	0.327	(0.014)	***
Y^P×2004dummy (γ_1)				0.071	(0.028)	**	0.101	(0.018)	***
Y^P×Treatment group (γ_2)				-0.126	(0.042)	***			
Y^P×(Treatment group×2004dummy) (γ_3)				**0.024**	**(0.038)**				
Y^T (α_2)	0.386	(0.060)	***	0.466	(0.059)	***	0.397	(0.062)	***
Y^U (α_3)	0.587	(0.019)	***	0.582	(0.019)	***	0.680	(0.010)	***
Y^O(α_4)	0.404	(0.108)	***	0.417	(0.106)	***	0.431	(0.123)	**
2004dummy	1706.7	(88.1)	***	1836.5	(116.5)	***	1845.8	(114.8)	***
Treatment Group Dummy	-230.0	(864.8)		111.7	(850.7)				
Treatment group×2004dummy									
Constant	-1963.0	(990.2)	**	-3181.6	(1052.1)	***	-4473.0	(257.1)	***
R^2	0.627			0.631			0.624		
N	24825						19197		

Notes : Results show regresstion coefficients after controling for standerd deviatoin of rainfall by month, and life-cycle factor constructed from five categories by age by treatment and conrol group. Linearlized standard error corresponding survery design and bootstrapped standard errors are reported in parentheses. * indicates statistically significant at the 10% level, ** indicates statistically significant at the 5% level, *** indicates statistically significant at the 1%level.

Table 5: Key Estimates of Saving Equation : Subgroup (weighted)

Variable	Farmer			Entrepreneurs, trade and industry			Other work status			Economically inactive households		
	Coef.	Bootstrap Std. Err.		Coef.	Bootstrap Std. Err.		Coef.	Bootstrap Std. Err.		Coef.	Bootstrap Std. Err.	
Y^P (α_1)	0.429	(0.044)	***	0.452	(0.038)	***	0.438	(0.039)	***	0.444	(0.042)	***
Y^P×2004dummy (γ_1)	0.129	(0.047)	***	0.090	(0.028)	***	0.133	(0.048)	***	0.119	(0.048)	**
Y^P×Treatment group (γ_2)	0.082	(0.054)		-0.083	(0.044)	*	-0.004	(0.045)		0.003	(0.035)	
Y^P×(Treatment group×2004dummy) (γ_3)	**-0.155**	**(0.066)**	**	**0.044**	**(0.036)**		**-0.139**	**(0.066)**	**	**-0.167**	**(0.058)**	***
Y^T (α_2)	0.401	(0.065)	***	0.521	(0.071)	***	0.390	(0.076)	***	0.512	(0.073)	***
Y^U (α_3)	0.567	(0.024)	***	0.550	(0.020)	***	0.528	(0.025)	***	0.545	(0.025)	***
Y^O(α_4)	0.167	(0.101)	*	0.585	(0.148)	***	0.241	(0.126)	*	0.292	(0.130)	**
2004dummy	2241.4	(659.7)	***	1604.6	(192.1)	***	1854.1	(653.2)	***	3627.5	(905.5)	***
Treatment Group Dummy	1847.0	(744.8)	**	867.8	(780.7)		683.1	(964.8)		1044.6	(768.8)	
Constant	-4221.7	(1360.0)	***	-3550.2	(1162.0)	***	-3697.9	(1458.9)	**	-5132.7	(1629.1)	***
R^2	0.631			0.591			0.618			0.604		
N	11303			12045			9642			8719		

Notes : Results show regresstion coefficients after controling for standerd deviatoin of rainfall by month, and life-cycle factor constructed from five categories by age by treatment and conrol group. Linearlized standard error corresponding survery design and bootstrapped standard errors are reported in parentheses. * indicates statistically significant at the 10% level, ** indicates statistically significant at the 5% level, *** indicates statistically significant at the 1%level.

Table 6: Key Estimates of Saving Equation (8) (weighted)

Variable	(1) Treatment Group			Sub-group: (2) Farmer			(3) Entrepreneurs, trade and industry			(4) Other work status			(5) Economically inactive households		
	Coef.	Bootstrap Std. Err.		Coef.	Linearized Std. Err.		Coef.	Linearized Std. Err.		Coef.	Linearized Std. Err.		Coef.	Linearized Std. Err.	
Y^P (α_1)	0.403	(0.027)	***	0.639	(0.039)	***	0.450	(0.050)	***	0.257	(0.065)	***	0.531	(0.090)	***
Y^P×Post 30 baht (γ_1)	-0.002	(0.006)		-0.020	(0.035)		0.003	(0.005)		0.002	(0.001)		0.007	(0.007)	
Y^P×Treatment group (γ_2)	-0.020	(0.015)		-0.003	(0.048)		0.003	(0.006)		0.002	(0.002)		0.001	(0.009)	
Y^P×Treatment group ×Post 30 baht (γ_3)	**-0.010**	**(0.018)**		**-0.002**	**(0.051)**		**-0.016**	**(0.008)**	**	**-0.003**	**(0.003)**		**-0.020**	**(0.012)**	*
Y^T (α_2)	0.392	(0.026)	***	0.753	(0.044)	***	0.453	(0.050)	***	0.258	(0.065)	***	0.529	(0.087)	***
Y^U (α_3)	0.691	(0.020)	***	0.786	(0.022)	***	0.639	(0.032)	***	0.503	(0.063)	***	0.674	(0.056)	***
Y^O(α_4)	0.216	(0.142)		-0.352	(0.279)		0.384	(0.196)	*	0.410	(0.177)	**	0.127	(0.247)	
Treatment Group Dummy	251.1	(186.7)		279.4	(312.2)		6.4	(494.1)		24.2	(236.8)		435.2	(399.3)	
Constant	-323	(456)		-2913	(857)	***	4345	(1605)	***	-11156	(3896)	***	1719	(1981)	
R^2	0.614			0.700			0.592			0.257			0.658		
N	4088			1382			1276			809			621		

Notes : Results show regresstion coefficients after controling for standerd deviatoin of rainfall by month, life-cycle factor constructed from five categories by age by treatment and conrol group, and month dummy variables. Bootsrap standard error corresponding survery design and bootstrapped standard errors are reported in collumn (1) in parentheses. Linearlized standard error corrected for ckustering at primary sanmpling unit and sampling weight are reported in parentheses. Because there are some stratum with single sampling unit, linearized standerd error corresponding survery design can not calculate. As result, reporeted stander error is smaller than the corrected value. However, I think it does not matter enough to affect the inrerpretaion of the results. I check in the estimation of Table 5 on this issue, because it underestimate about 7%. * indicates statistically significant at the 10% level, ** indicates statistically significant at the 5% level, *** indicates statistically significant at the 1%level.

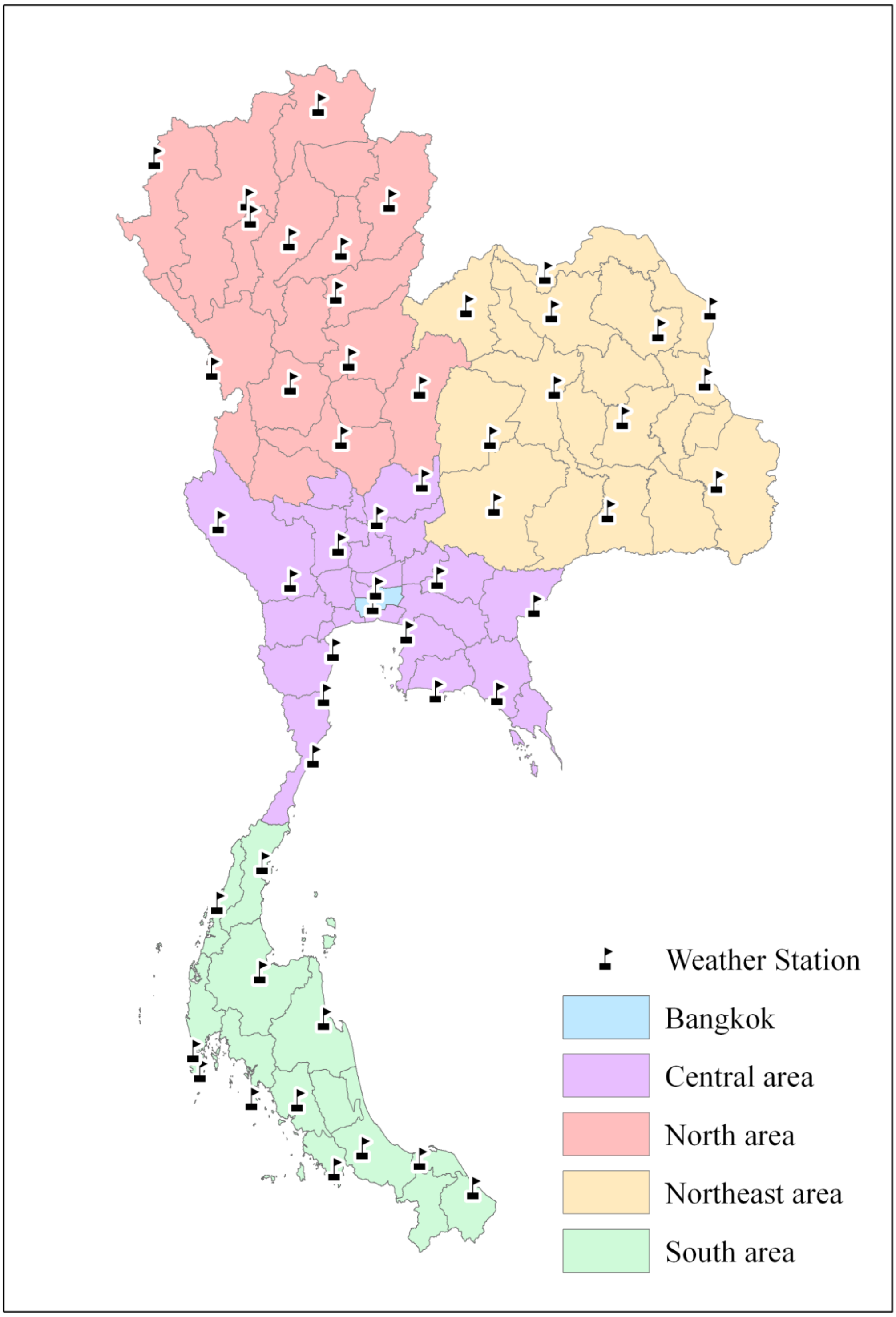

Figure 1: Weather Stations in Thailand

Table A.1.: Key Estimates of Income Equation (weighted)

Variable	Treatment Group			Control Group		
	Coef.	Linearized Std. Err.		Coef.	Linearized Std. Err.	
Socio-economic Classification dummy × year dummy 2000						
Farmer mainly owning land						
less than 2 rai	-3082.8	(685.3)	***	14212.1	(3708.0)	***
2-4 rai	-3949.8	(348.1)	***	-	-	-
5–9 rai	-3715.5	(286.2)	***	33843.5	(2645.9)	***
10–19 rai	-2967.2	(288.3)	***	24871.1	(2035.4)	***
20–39 rai	-1784.5	(356.6)	***	30845.9	(11012.4)	***
40 rai or more	1884.8	(817.5)	**	32683.5	(8849.7)	***
Farmer mainly renting land						
less than 5 rai	-3654.8	(773.2)	***	-	-	-
5–19 rai	-3570.3	(329.5)	***	-	-	-
20 rai or more	-1894.9	(477.6)	***	-4163.0	(2858.7)	
Entrepreneurs, trade and industry						
With paid workers	5737.4	(700.2)	***	17064.4	(4976.4)	***
Without paid workers	Base case			9771.1	(2936.7)	***
Other work status						
Employed by others	-1487.1	(738.3)	**	11585.6	(1378.9)	***
Farm workers	-3500.8	(267.3)	***	1729.9	(2276.8)	
Clerical, sales & Services workers	-2324.1	(411.3)	***	5795.0	(2004.3)	***
Production & Construction workers	-2204.1	(293.2)	***	6759.3	(3084.9)	**
Economically inactive households						
Receiving assistance or pensions	-1078.9	(334.1)	***	22682.4	(7334.3)	***
Socio-economic Classification dummy × year dummy 2004						
Farmer mainly owning land						
less than 2 rai	-1752.8	(651.0)	**	5559.2	(6904.3)	
2-4 rai	-3661.7	(447.6)	***	-	-	-
5–9 rai	-3435.9	(289.8)	***	9651.4	(3651.3)	***
10–19 rai	-2788.6	(283.5)	***	11905.1	(1789.3)	***
20–39 rai	-1136.7	(319.9)	***	6390.8	(5480.5)	
40 rai or more	1378.7	(497.0)	***	13595.4	(6459.2)	**
Farmer mainly renting land						
less than 5 rai	-3891.4	(476.1)	***	-	-	-
5–19 rai	-3276.6	(373.4)	***	-	-	-
20 rai or more	-628.1	(532.6)		-	-	-
Entrepreneurs, trade and industry						
With paid workers	5913.5	(652.8)	***	26084.1	(4517.9)	***
Without paid workers	Base case			12038.5	(4047.9)	***
Other work status						
Employed by others	-2204.8	(479.0)	***	18706.7	(1491.8)	***
Farm workers	-4186.3	(226.2)	***	52.9	(3463.1)	
Clerical, sales & Services workers	-2879.3	(428.1)	***	11014.4	(1925.3)	***
Production & Construction workers	-2966.0	(241.4)	***	9598.9	(2634.1)	***
Economically inactive households						
Receiving assistance or pensions	-1807.0	(285.4)	***	30708.6	(3545.7)	***
Other variables						
Age × Sex × Education (?? categolies)			○			
Rainfall (deviation)			○			
Rainfall ×Control group dummy			○			
Province fixed effects			○			
Year Dummy (2000 = 0, 2004 = 1)	1053.3	(353.7)	***			
Contstant	11636.4	(725.5)	***			
R^2			0.660			
N			24825			

Notes : Linearlized standard error corresponding survery design is reported in parentheses. * indicates statistically significant at the 10% level, ** indicates statistically significant at the 5% level, *** indicates statistically significant at the 1%level.