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Welfare Analysis of the Universal Health Care Program in Thailand

by

Natt Hongdilokkul

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Natt Hongdilokkul†

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Abstract

I estimate and decompose the welfare benefit of Thailand's universal health care policy, also known as the "30 Baht program". The total welfare impact of the 30 Baht program is defined as the amount of consumption that an enrollee would need to give up that would leave her at the same expected utility as without the 30 Baht program. I find that the total welfare benefit is approximately 75 cents per one dollar of government spending. The main source of the welfare effect can be attributed to improved consumption smoothing rather than increases in the consumption level. Using difference in differences method, I find that the effect of the 30 Baht program on income is significantly positive, while the effect on consumption is slightly negative but not significant. This implies that the 30 Baht program has a positive impact on savings and future consumption, rather than current consumption.

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†Simon Fraser University Department of Economics, 8888 University Drive, Burnaby, B.C., Canada, V5A 1S6, nhongdil@sfu.ca

1 Introduction

The universal health care program in Thailand, also known as the 30 Bath program, was initiated in 2001. Gruber, Hendren and Townsend (2014) summarize the 30 Baht program, the biggest health reform ever in Thailand, in two key features: replacing most of the pre-existing health care schemes with a fixed capitation[1] of 1,200 Baht (approximately USD[2] 35) and replacing out-of-pocket medical fees with a 30 Baht (approximately USD 0.85) flat rate co-payment. In 2002, the government of Thailand spent 4.7% of its total expenditure on the 30 Baht program.[3] Since universal health care takes a big part of government expenditure, it is crucial to evaluate how well the government's health care spending transfer into the welfare gain of its reciepients.

The efficiency of the 30 Baht program depends not only on how much the total budget is, but also on how the government spends it on the program. Since the 30 Baht program may affect its enrollees' welfare through several channels, I also study the decomposition of welfare benefit in order to understand the mechanism of the welfare effect of the program. The 30 Baht program may improve welfare through an increase in consumption level because publicly-provided health care program may be interpreted as an in-kind transfer. It may improve welfare through improved consumption smoothing because the fixed and low flat rate co-payment alleviates the need for expensive medical payments. Since it increases health care utilization (Gruber, Hendren and Townsend (2014) and Limwattananon et al (2015)), the 30 Baht program may also improve welfare through improved health. In this paper, I decompose the total welfare effect into the

[1] In the 30 Baht program, the capitation payment is the payment to a hospital, such that the amount paid is determined by the number of its enrollee in the 30 Baht program.

[2] One US dollar is approximately 35 Bahts

[3] In 2002, the total government expenditure was 1,023 billion Bahts, and the expenditure on the 30 Baht program was 48.1 billions Bahts. source: http://www.bb.go.th/budget/inbrveT/B45/1/1_doc.htm

welfare effect through improved consumption and the welfare effect through improved health, which is measured by the number of days an individual stops working due to sickness. The welfare effect through consumption can be further decomposed into the transfer component, which is measured by an increase in consumption level, and the insurance component, which represents improved consumption smoothing.

I estimate that the welfare benefit of the 30 Baht program is 831 Baht (approximately USD 24) per person per year. Most of the welfare effect is through consumption, and most of the welfare effect through consumption is from improved consumption smoothing, rather than an increase in consumption level. To evaluate the efficiency of the 30 Baht program, I calculate the ratio of the welfare benefit to the cost paid by government. My estimate of the 30 Baht program's welfare benefit to enrollees per dollar of government spending is 75 cents, implying that the welfare benefit to enrollees is below the cost of the program.

Although the estimates suggest that the cost of the 30 Baht program exceeds its welfare benefit, my estimate of the total welfare effect of the 30 Baht program is larger than that of Medicaid, which is estimated to be 44 cents per dollar of government spending by Finkelstein, Hendren and Luttmer (2015), FHL (2015) henceforth. While the sources of welfare benefit of Medicaid are from a balance of increased consumption level, improved consumption smoothing and improved health (FHL (2015)), my estimates suggest that improved consumption smoothing is the only non-trivial source of the welfare benefit of the 30 Baht program. In contrast, in another study on the welfare benefit from the 30 Baht program, Limwattananon et al (2015) estimate that the welfare benefit through improved consumption smoothing per dollar of government spending is only 15 cents, which is approximately two fifths of that of my estimate. The differences in the estimation results might be driven by the different proxies we use for consumption and

health. Due to the absence of directly observed consumption data, both FHL (2015) and Limwattananon et al (2015) use the difference between income and out-of-pocket medical spending as a proxy for consumption.

I argue that income is not a good proxy for consumption, especially in the context of developing countries. Health insurance may affect consumption and income differently because it also affects labour supply (Gruber and Madrian (2002)) and saving (Gruber and Yelowitz (1997), Starr-McCluer (1996) and Chou, Liu and Hammitt (2003)). The discrepancy between consumption and income is even larger for households in rural Thailand. The majority of those households are self-employed, eg. farmers, and consume a significant amount of household production. Self employment also leads to potentially negative reported household income. This is another important issue, since many of the households that report negative income due to business or farming losses actually have decent amount of consumption from household savings, which are often in a form of rice stocks, or borrowing from their kinship networks.

For the accuracy of consumption, I use panel data from Townsend Thai Project Household monthly surveys. More than 600 of the sampled households are interviewed on a monthly basis. However, the survey teams make the household visits on a weekly basis to collect consumption data. The surveys also provide extensive health data, including out-of-pocket medical spending, health care utilization and days of suffering from sickness. Folllowing the theoretical framework of FHL (2015)[4], I define the welfare effect of the 30 Baht program as the amount of consumption that an individual would need to give up in the world with the 30 Bath program coverage that would leave his or her at the same expected utility as in the world without the 30 Baht program. An

[4]Their main idea is that public-provided health care program is not traded in a free market, therefore its welfare effect is measured by how an individual values it when its price is unobservable.

estimation challenge is that the latter situation is a counterfactual. To address the challenge, I categorize households covered by the 30 Baht program and those that are not into different groups , exploiting the fact that the health coverage for government employees does not change after the 2001 health reform. I estimate counterfactual consumption of the households covered by the 30 Baht program based on the assumption that households with the same consumptions prior to the program would have had the same consumption growth rate in the absence of the 30 Baht program.

Are the estimates of welfare benefit underestimated or overestimated? To answer this question, I investigate the effect of the 30 Baht program on income, consumption and saving. From my difference-in-differences estimation, the 30 Baht program significantly increases household income, while current consumption slightly decreases, though insignificantly. These results are possibly driven by increased life expectancy after the 30 Baht program. I define a household's saving as its income minus its consumption. Thus, I conclude that households covered by the 30 Baht program increase their savings and future consumptions. Since health insurance's welfare benefit through future consumption is not accounted for in the methodology used in all three studies, the estimates of the total welfare benefit might be underestimated as a result.

The rest of the paper is organized as follows. In section 2, I provide a brief history of the health care schemes in Thailand before the 2001 health care reform, so that readers understand how I identify the control group and the treatment group of the 30 Baht program. I explain the welfare effect framework in section 3, in which I define the total welfare effect and its components. In section 4, I desbribe the dataset and how I apply the theoretical framework to its empirical counterpart. In particular, I explain how and why the effect of the 30 Baht program can be identified using occupations prior to the initiation of the 30 Baht program. Then, I state the empirical definition of each variable

in the theoretical framework. Since it is a crucial part of the estimation, this section also sheds light on how to estimate the counterfactual consumption in the absence of the 30 Baht program. The counterfactual estimation is based on the assumption I mentioned earlier. I also show that this assumption holds, at least prior to the reform, and describe the characteristics of the treatment group and the control group. Finally, I provide estimation results and their discussion in section 5 and section 6, respectively.

2 The Background of the Universal Health Care Program in Thailand

In order to identify the beneficiaries from the 30 Baht program and to estimate the welfare effect on them, it is necessary to understand a brief history of health care schemes in Thailand around 2001, the year of the initiation of the 30 Baht program. Although the 30 Baht program is ussually considered and mentioned as a univeral health care, not all the Thai citizens are covered by the 30 Baht program. Before the health reform in 2001, there were many health care schemes in Thailand, for example, Medical Welfare Scheme (MWS), which provided free care for low income households. After 2001, all of these schemes were merged into the 30 Baht program, except the Social Security Scheme (SSS) and the Civil Servant Medical Beneciary Scheme (CSMBS). Therefore, the 30 Baht program does not cover workers in the formal sector, in which employers are obliged to pay one-third of their employee's Social Security premium, or civil servants. While the Social Security Scheme (SSS) covers only the employees, the Civil Servant Medical Beneciary Scheme (CSMBS) provides free care to everyone in a civil servant's immediate family, including his or her spouse, children under the age of 18, and the civil servant's parents. Besides those who are covered by these two health

Table 1: Distributition of population covered by different health care schemes before and after 2001

Health care Schemes

Before 2001	After 2001	Pop %
Uninsured[5] (self-employed, small business)	The 30 Baht Program	50%
MWS (the poor)		30%
SSS (formal sector)	SSS (formal sector)	20%
CSMBS (civil servants)	CSMBS (civil servants)	

source: Gruber, Hendren and Townsend (2014)

care schemes, all other of Thai citizens became covered by the 30 Baht program after 2001. Gruber, Hendren and Townsend (2014) summarize Thailand's health care scheme timeline and the distribution of population covered by different health care schemes in table 1.

3 Frameworks for Welfare Analysis

The welfare analysis in this paper is mainly based on the framework formulated by Finkelstein, Hendren and Luttmer (2015), FHL (2015) henceforth. A representative agent's welfare is determined by the consumption of non-medical goods, c, and from health, $\mathbf{h}$, where $\mathbf{h}$ is a $k \times 1$ vector. Assume that the utilitly function has the following form:

$$u(c, h) = \frac{c^{1-\sigma}}{1-\sigma} + \tilde{\Phi}\mathbf{h} \tag{1}$$

, where σdenotes the constant coefficients of relative risk aversion and $\Phi = \frac{\tilde{\Phi}}{E[c^{-\sigma}]}$, where Φ is a $1 \times k$ vector of the marginal value of health in units of consumption. Assume that the individual health is determined by medical spending, m, and the individual's health-related states of the world,θ, medical condition for an instance. The production function of health is described by $\mathbf{h} = f(m; \theta)$. FHL (2015) explains that θ includes

all the factors affecting health, medical condition for example, and the productivity of medical spending. The representative agent recieves the benefit of the 30 Baht program exogenously. It is important to note that the medical spending m include not only the out-of-pocket spending, but also all other medical expenses paid by third parties, eg. the government. Let q denote the individual's 30 Bath program status. $q = 0$ if the individual is not covered by the program and $q = 1$if the individual is covered by the program. Since consumption and health depend on two state variables, I can rewrite them as $c(q;\theta)$ and $\mathbf{h}(q;\theta)$, where $\mathbf{h}(q;\theta) \equiv f(m(q,\theta);\theta)$.

The welfare impact of the 30 Bath program is defined by γ,where

$$E\left[\frac{c(0;\theta)^{1-\sigma}}{1-\sigma} + \tilde{\Phi}\mathbf{h}(0;\theta)\right] = E\left[\frac{(c(1;\theta)-\gamma)^{1-\sigma}}{1-\sigma} + \tilde{\Phi}\mathbf{h}(1;\theta)\right] \tag{2}$$

The term $E(\bullet)$ is the expectation over θ. The term γ refers to the amount of consumption that the individual would need to give up in the world with the 30 Bath program coverage ($q = 1$) that would leave his or her at the same expected utility as in the world without the 30 Baht program ($q = 0$). Note that $c(0;\theta)$, which represents the amount that an insured person would have consumed if the one were not covered by the 30 Baht program, is unobservable.

Since a health insurance scheme, which reduces out-of-pocket medical spending, may affect welfare through both an increase in consumption and better health, I decompose the welfare effect of health insurance into the consumption component and the health component, i.e. $\gamma = \gamma_C + \gamma_M$, where γ_C and γ_M denote the welfare components associated with the change in consumption and health respectively. Therefore the equation 2 can be rewritten as

$$E\left[\frac{c(0;\theta)^{1-\sigma}}{1-\sigma}+\tilde{\Phi}\mathbf{h}(0;\theta)\right]=E\left[\frac{(c(1;\theta)-\gamma_C-\gamma_M)^{1-\sigma}}{1-\sigma}+\tilde{\Phi}\mathbf{h}(1;\theta)\right] \tag{3}$$

The term γ_C is estimated from

$$E\left[\frac{c(0;\theta)^{1-\sigma}}{1-\sigma}\right]=E\left[\frac{(c(1;\theta)-\gamma_C)^{1-\sigma}}{1-\sigma}\right] \tag{4}$$

In other words, γ_C is the amount consumption that an insured agent is willing to give up when health outcomes are held constant. Note that the health term is not relevant in the estimation of γ_C because the $\frac{\partial^2 u}{\partial c \partial h}=0$, $\forall h \in \mathbf{h}$, according to additive separability of the utility function. By definition, the term γ_M is estimated from$\gamma_M \equiv \gamma - \gamma_C$.

Moreover, the term γ_C is also decomposed into a transfer component and a pure-insurance component. The tranfer component in consumption, γ_{CT}, can be estimated from the mean increase in consumption , i.e.

$$\gamma_{CT}=E[c(1;\theta)-c(0;\theta)]$$

. For example, if the mean consumption for those covered by the 30 Baht program is equal to the amount they would have expected to consume in the absence of the program, then the estimated γ_{CT} is zero. The consumption pure-insurance component, γ_{CI}, is therefore estimated from $\gamma_{CI}=\gamma_C-\gamma_{CT}$.

To visualize the concept of the welfare effect decomposition, let me give an example in which the consumption across health-related states of the world is normally distributed. Given the utility function as in equation 1, the 30 Baht program may affect an agent's expected utility either through an increase in the mean of consumption or through a

decrease in variance of consumption. In this case,γ_{CT} is the fixed amount of consumption that the agent is willing to give up regarding to the increased expected utility from an increase in the mean of consumption, while γ_{CI} is its counterpart associated with a decrease in the variance of consumption.

4 Data and Estimation

There are two points I have to clarify when I move from the theoretical model to its statistical counterpart which is used for the estimation of the welfare effect. Firstly, in the theoretical model, the 30 Baht program status, which is called the treatment status from now on, takes the value $q = 1$ if an individual is covered by the 30 Baht program and takes the value $q = 0$ for the counterfactual case in which the same individual were not covered by the program. Empirically, I can only observe the outcomes with the treatment status $q = 1$ from the households covered by the 30 Baht program after the 30 Baht program was implemented, but I cannot directly observe the outcomes with the treatment status $q = 0$ unless I make some assumptions that will be explained later. Secondly, all the expectation terms in the theoretical framework in the previous section are taken with respect to the possible health-related states of the world, θ. Empirically, for each treatment status q, I use an average value over households in the data as its empirical counterpart.

I use data from several sources for the estimation. The main source of data is collected from the panel data in individual and household level from Townsend Thai Project Household monthly surveys. More than 600 households were randomly selected from the rural areas of two provinces, namely Chachoengsao and Lopburi , in the central

region, and the provinces of Buriram and Srisaket in the Northeastern region of Thailand. A province consists of several districts. Each of the districts is a collection of villages with at least one urbanized area at its centre. These four provinces are different in term of economic conditions and activities, but villages within the same district are similar. The sampled households were interviewed on a monthly basis, with the questions regarding household consumption being asked on a weekly basis. The survey was initiated in September 1998. Since the data regarding household consumption, income, assets, liabilities and wealth need to be calculated carefully, instead of using my own calculation, I use the Monthly Survey Household Financial Accounting, which is publicly provided by the Research Institute for Policy Evaluation and Design (RIPED) at the University of the Thai Chamber of Commerce. This dataset is also based on Townsend Thai project household monthly surveys.

The advantage of Townsend Thai project household monthly surveys is that they provide credible reported consumption. Most of national household surveys provide only reported household income. For the estimate of the welfare benefit from the 30 Baht program, income is not a good proxy for consumption. First, the 30 Baht program may affect consumption and income differently. Second, many households in the dataset report negative income. Since many of them are self-employed, households in developing countries do not seperate their own income from their business, farming or livestock income. In many cases these incomes are negative, since it takes time until self-employed households receive returns from their spending on business or farming investment. Samphantharak and Townsend (2010) call this characteristic as "household as coporate firms". In the dataset I use for the estimation, in each year approximate 20% of households report negative or zero income. As FHL (2015) mention that "welfare estimates are sensitive to consumption at the low values", it is necessary to drop

observations with very low values of consumption, and the estimation is proned to be biased if I drop significant number of obervations.

The estimation requires data from both the pre-30 Baht period and the post-30 Baht period. Henceforth, the post-30 Bath period refers to the period from June 2002 to May 2004, and the pre-30 Baht period refers to the period from June 1999 to May 2001. Please note that transition period of the 30 Baht program took about a year. Among 4 provinces in the surveys, all hospitals in the province of Srisaket began the 30 Baht program on June 1st, 2001, while hospitals in the other 3 provinces launched the program at unkown times between October 1st, 2001 and April 1st 2002.

Treatment group vs. Treatment status (q)

It is crucial to distinguish the empirical definition of treatment group from that of treatment status. Let me begin with clarifying the definitions of the treatment group and the control group, since the empirical definition of treatment status is based on them. I categorize households in the surveys into 3 groups: the control group, the treatment group, and the group that is excluded from this study. The control group consists of the households whose **at least one** of their members was a government worker prior to June 2001. Any household whose **at least one** of its members reported receive a free health care paid by the Social Security Scheme prior to June 2001 will be excluded from the study. The treatment group consists of the other households in the survey. The definitions of these groups are summarized in table 2.

Since I cannot observe health insurance status, the definitions of the treatment group and the control group are based on household members' occupations prior to the health care reform, exploiting the fact that the health coverage of government workers, who

Table 2: Treatment group vs Control group

Group	Criteria	% of total households in the survey
Control	At least one member is a government worker (No member is covered by the program)	19.4%
Excluded	Some members are covered by the Social Security (Some members are covered by the program)	4.2%
Treatment	The rest (All members are covered by the program)	76.4%

are covered by the Civil Servant Medical Beneciary Scheme (CSMBS), and workers in the formal sector, in which they are obliged to enroll in the Social Security Scheme (SSS), was not affected by the 30 Baht program. Because the Civil Servant Medical Beneciary Scheme (CSMBS) extends its health coverage to the whole family of each enrollee, no household member in the control group is covered by the 30 Baht program. On the other hand, I exclude the households in which some of its members are enrolled in the Social Security Scheme since not all of its members are covered by the 30 Baht program. This paper is not the first paper using occupations to define the treatment group. Chou, Liu and Hammitt (2003) used variation in occupations to identify the average treatment effect of the national health care in Taiwan, and Limwattananon et al (2015) applied the similar strategy to identify the effect of the 30 Baht program in Thailand.

The identification of the treatment group is based on the assumptions that the 30 Baht program did not create either spillover or the crowding out effects for the households in the control group. Limwattananon et al (2015) argue that the case in which the 30 baht program crowded out care at public facilities for those who covered by the CSMBS was not likely. The per capita expenditure on the CSMBS was "2.5 times greater" than that on the 30 Baht program when the latter was introduced. Also, the CSMBS "pays

fee-for-service with no cap on expenditures". Combining these two facts, health care providers have no incentives to priortize 30 Baht program insurees over government workers.

The treatment status is assigned according to household members' occupations in the pre-30 Baht period rather than those in the post-30 Baht period. Since it gives self-employed persons better health coverage than that they received before the health care reform, the 30 Baht program might incentive to employed persons to switch to be self-employed after the reform. This implies that an occupation choice observed in the post-30 Baht program period does not well identify a treatment effect of the 30 Baht program due to selection bias. One might still be concerned that if household members did change their occupational choice after the program, the treatment group, which is defined by occupations before the program, may fail to map to the actual treatment group after the program. I argue that this is not an important issue, according to Limwattananon et al (2015). Similar to my definition, they define the treatment group as the group consisting of "households in which there are no public sector employees and not every member is a private sector salaried employee" using the survey in 2000 (pre-30 Baht period). They checked the validity of this approximation using household member's insurance status in the survey in 2004 (post-30 Baht period), and found that "over four-fifths of individuals in households assigned to the treatment group" were indeed covered by the 30 Baht program.

Based on the definition of the treatment group, I can now define the treatment status. I define the treatment status as "being covered by the 30 Baht program", indicated by $q = 1$, to actual outcomes of the households in the treatment group, as defined in table 2, in the post-30 Baht period, and define the treatment status as "not being covered by the 30 Baht program", indicated by $q = 0$, to the counterfactual outcomes of the

households in the treatment group in the post-30 Baht period in the absence of the 30 Baht program. The counterfactual outcomes will be estimated using the outcomes of the control group.

Consumption (c)

Household consumption $c(q;\theta)$ is calculated from an average annual household per-capita consumption on non-medical goods and services over 24 months. The household consumption consists of consumption expenditure and consumption of household production. The unit of consumption is Baht per person per year. Let $c^T_{i,t}(q)$ denote the treatment group's consumption in year t of a household i with a treatment status q, and $c^C_{i,t}(q)$ are that of the control group. Without loss of generality, I assume that $t \in \{0,1\}$. We can interpret $t = 0$ as a pre-30 Baht program period, and Let $t = 1$ as a post-30 Baht program period.

The empirical counterparts of $c(0;\theta)$ and $c(1;\theta)$ are $c^T_{i,1}(0)$ and $c^T_{i,1}(1)$ respectively. The term $c^T_{i,1}(0)$ is not directly observable, but it can be estimated under an assumption. I assume that in the absence of the 30 Baht program, households with the same consumption level prior to the program would have had the same consumption growth rate. Please note that I need to make the assumption stronger than the standard parallel trend assumption, which is gennerally made for a difference in differences estimation, because the welfare estimation results depend not only on the average consumption, but also on its distribution. In practice, I categorize households in the control group and the treatment group into 5 groups based on their consumption brackets in the pre-30 Baht period. I summarize the consumption brackets and the distributions of the household in the control group and the treatment group over these brackets in the

Table 3: Distribution of households and consumption growth over consumption brackets in the pre-30 Baht period

Consumption (C) Brackets (unit: Baht/person/year)	Control Group		Treatment Group		Consumption growth of the control group
	no. of household	%	no. of household	%	
C < 8,000	26	18.6%	166	31.3%	35.6%
8,000≤C < 13,000	32	22.9%	183	34.5%	15.7%
13,000≤C < 18,000	32	22.9%	83	15.7%	13.6%
18,000≤C < 25,000	25	17.9%	50	9.4%	35.1%
C > 25,000	25	17.9%	48	9.1%	-6.2%
total	140	100%	530	100%	-

pre-30 Baht period in table 3. Under this assumption, the counterfactual consumption of household i in the bracket k is estimated from

$$c^T_{i,k,1}(0) = (1 + g_k)c^T_{i,k,0}(0)\,,\ \forall i\,\forall k \tag{5}$$

, where $g_k = \frac{\bar{c}^C_{k,1}(0) - \bar{c}^C_{k,0}(0)}{\bar{c}^C_{k,0}(0)}$ is percentage change of the control group's average consumption in the bracket k between pre- and post-30 Baht program periods.

One might be concerned that the assumption I made for the counterfactual estimation may be not realistic. I argue that the consumption growth rate of the control group and the treatment group in each bracket are similar in the pre-30 Baht period. I group the pre-30 Baht period into 3 periods: period 1 (between september 1998 and August 1999), period 2 (between september 1999 and August 2000) and period 3 (between september 2000 and August 2001). Using the same brackets as those in table 3, I categorize households in the treatment group and the control group into 5 groups based on their consumption brackets in period 1. In each bracket, I calculate the annual consumption growth from period 1 to period 2 and the growth from period 2 to period 3, and show the average growth rate in Table 4. According to table 4, the difference in consumption growth rate in each bracket is less than 4 percentage points, except for the middle one.

Table 4: Average annual consumption growth in the pre-30 Baht period

Consumption (C) Brackets	Consumption growth	
(unit: Baht/person/year)	Control Group	Treatment Group
C < 8,000	19.7%	23.3%
8,000≤C < 13,000	8.5%	11.2%
13,000≤C < 18,000	7.9%	1.1%
18,000≤C < 25,000	-5.9%	-4.7%
C ≥ 25,000	-13.5%	-10.9%

Moreover, to my knowledge, there was no policy that would have affected consumption of households in the control group differently from those in the treatment group in the post-30 Baht period.

According the welfare estimation framework, the welfare gain γ would be meaningless if it exceeds the consumption level. Therefore, I drop any observations with the annual consumption lower than 1,000 Baht/year/person.

Health (h)

Let the empirical counterpart of $\mathbf{h}(0;\theta)$ and $\mathbf{h}(1;\theta)$ be denoted by $h^T_{i,1}(0)$ and $h^T_{i,1}(1)$, where $h^T_{i,t}(j)$ is an average number of stop-working days from sickness per year per one member of household i that belongs to the treatment group over 24 months of period t. I assume that the average number of stop-working days would not have changed in the absence of the 30 Baht program, therefore the counterfactual $h^T_{i,1}(0)$ is simply calculated from $h^T_{i,0}(0)$ in the pre-30 Baht program period.

Parameters ($\sigma$and Φ)

Following FHL (2015), I assume that the coefficient of relative risk aversion $\sigma = 3$. Since the health outcome is proxied by a number of days suffering from sickness, the marginal (dis)values of sickness in term of unit of consumption, Φ ,are negative numbers of willingness of pay (WTP) for treatment. To my knowledge, Thavorncharoensap et al. (2013) are the only authors studying the WTP for treatment in Thailand. They found that the average WTP for treatment in 6 types of 5-year-lasting sickness are as follows: 99,600 Baht for unilateral blindness, 154,000 Baht for bilateral blindness, 117,900 Baht for paraplegia, 165,600 Baht for quadriplegia, 31,000 Baht for mild allergy and 39,000 Baht for moderate allergy. I assume that the discount rate is zero, therefore the WTP for one-day-lasting sickness treatment is the WTP for 5-year-lasting sickness treatment divided by 1825. As a result, the (dis)value of sickness is ranged from a minimum of -19.18 Baht per day per person to a maximum of -73.56 Baht per day per person. I use the midpoint of this range to represent the (dis)value of sickness. That is, Φ= -46.7 Baht per day per person.

Summary Statistics

I provide the summary statistics here in order to characterize and compare the control group and the treatment group. Table 5 shows the summary statistics of the control group and the treatment group in both the pre-30 Baht period and the post 30-Baht period. Summarily, in the pre- 30 Baht period, although the numbers of household members and the income sources of the control group and the treatment group are not very different, the control group has much higher wealths, incomes and expenditures than those of the treatment group. Note that household wealth is defined as the dif-

ference between holdhouse assets and household liabilities, and household savings is defined as the difference between household income and household consumption.

The first row of the table shows that the control group and the treatment group are not very different in term of numbers of household members. Occupations and source household incomes are represented from the second row to the sixth row of the table. The control group and the treatment group are not very different in term of income sources. These rows also imply that multiple occupations are common among the sampled households. One might be surprised by the multiple occupations of the control group, which is the group of government workers. There are at least two reasons attribute to this fact. First, it is common that spouses of government workers run businesses that are related to the government workers. For example, a janitor's wife sells food at the canteen of her husband government office building. Second, the definition of government workers in this paper includes those who do not actually receive salary from the government but are covered by the Civil Servant Medical Beneciary Scheme (CSMBS), for example, heads of village. It is not rare that these people are local wealthy and powerful businesspersons or farmers. The number of household members and income sources of the control group and those of the treatment group are similar in both the pre-30 Baht period and the post-30 Baht period, although it seems like the trends in business ownership between the control group and the treatment group are opposite.

The other rows of the table show that, in the pre-30 Baht period, the control group has much higher wealths, incomes, savings and expenditures than those of the treatment group. Inspite of a slight difference in average consumption, the average income and saving of the control group is more than 50% higher than that of the treatment group. The control group has approximately twice the assets and wealth of the treatment

group. Surprisingly, the control group spend on medical services more than two times of those of the treatment group, although they receive the best health care coverage. This might be explained by the fact that the control group is wealthier, and that the Civil Servant Medical Beneciary Scheme (CSMBS) does not cover luxurious medical services provided by private hospitals. After the 30 Baht program was introduced, the trends of these variables are diverse. The consumtpion growth rates of the control group and the treament group are almost the same, although the growth rate of medical spending of the control group is higher. While the average income and saving of the treatment group grows faster after the 30 Baht program, the control group beats the treatment group in term of asset and wealth growth.

The bottom line is that, although the control group has much higher average income and average wealth, the difference in average consumption between two groups is not very high. Moreover, in order to estimate the counterfactual consumption of the treatment group in the post-30 Baht period, I map the growth rate of the control group to the treatment group within the same consumption bracket. Therefore, difference in average consumption is not an issue to my estimation of the welfare effect.

It is surprising that the out-of-pocket medical spending of the treatment group is actually higher after the 30 Baht prgram. These households might have spent on some medications or medical services that are not covered by the 30 Baht program, for example, Thai traditional treatment. Although the average out-of-pocket medical spending of the treatment group increases after the 30 Baht program, the spendings of the households in the high percentiles of medical spendings actually decreases. Table 6 and table 7 show that the out-of-pocket medical spendings per one visit of outpatient care and those of inpatient care decrease by 11% and 40% respectively. I may conclude that, although the 30 Baht program does not decrease out-of-pocket medical spendings on

Table 5: Summary Statistics

Variables	Control Group		Treatment Group	
	pre-30 Baht	Post- 30 Baht	pre-30 Baht	Post- 30 Baht
Average number of household members	4.5	4.3	4.0	3.9
Having non-zero farming income	77.1%	69.3%	75.9%	70.2%
Having non-zero livestocks income	60.7%	58.6%	74.8%	72.8%
Having non-zero fish or shrimp farming income	52.1%	34.3%	43.7%	31.2%
Having non-zero business income	41.4%	38.6%	31.4%	32.3%
Having non-zero labour income	96.4%	90.0%	81.8%	77.9%
average annual consumption	17,425	19,294	13,022	14,367
unit: Baht/year/person	(191.1)	(235.6)	(111.1)	(101.4)
average annual income	26,789	28,872	17,392	19,954
unit: Baht/year/person	(738.7)	(756.6)	(769.4)	(486.6)
average annual saving	8,474	8,405	3,996	5,142
unit: Baht/year/person	(726.7)	(727.3)	(769.4)	(466.6)
average assets	8,830,995	9,982,706	4,330,819	4,584,564
unit: Baht/person	(497,981)	(532,379)	(92,166)	(757,74)
average liabilities	498,786	606,186	212,433	298,698
unit: Baht/person	(21,365)	(22,157)	(4,867)	(7,127)
average wealth	8,332,210	9,376,520	4,118,385	4,285,866
unit: Baht/person	(498,275)	(532,279)	(90,235)	(73,083)
out-of-pocket medical spending per a visit as an outpatient unit: Baht/year/person/visit	278 (15.2)	325 (31.1)	124 (2.5)	177 (2.9)
out-of-pocket medical spending per a visit as an inpatient unit: Baht/year/person/visit	360 (15.2)	398 (39.1)	130 (6.2)	137 (13.6)
total out-of-pocket medical spending	890	1,172	375	444
unit: Baht/year/person	(27.5)	(114.9)	(9.0)	(15.9)

Note: standard errors in parentheses

Table 6: Distribution of out-of-pocket medical spendings on outpatient care of the treatment group (unit:Baht/year/person/visit)

percentiles of medical spendings	10%	25%	50%	75%	90%	max
pre-30 Baht program	4.75	19.4	55.8	181.5	455.5	2662.3
post-30 Baht program	10	25.9	67.2	204.2	405	3831.9
% change	+105%	+34%	+20%	+13%	-11%	-

Table 7: Distribution of out-of-pocket medical spendings on inpatient care of the treatment group (unit:Baht/year/person/visit)

percentiles of medical spendings	10%	25%	50%	75%	90%	max
pre-30 Baht program	5	12.5	33.3	203.3	1,466.7	9,553
post-30 Baht program	4.3	12.5	31.4	186.7	940	33,140
% change	-14%	+0%	-6%	-8%	-40%	-

average, it does decrease the spendings at the high percentiles.

5 Results

The Effect of the 30 Baht Program on Consumption, Income and Saving

Before showing the welfare estimation results, it is crucial to examine how the 30 Baht program affects consumption, income and saving in order to understand and evaluate the validity of the welfare estimation. While available literature uses income as a proxy for consumption, eg. FHL(2015) and Limwattananon (2015), this paper directly uses consumption to estimate the welfare gain from the health insurance. Since saving is equal to the difference between income and consumption by definition, it may explain the discrepancy in welfare estimation between this paper and other papers.

I use Difference in Differences to estimate the average treatment effect of the 30 Baht

program on outcomes, and the regression model is

$$y_{im} = \alpha_i + \beta_1 Treat_m + \beta_2 Post_t + \beta_3 Treat_i x Post_m + \epsilon_{im}$$

y_{im} is an outcome of household i in month m. α_i is the household fixed effect. $Treat_i$ is an indicator, where$Treat_i = 0$ if the household is belonged to the control, and $Treat_i = 1$ if the household is belonged to the treatment group. $Post_m$ is an indicator, where $Post_m = 0$ if month m is in the pre-30 Baht period and $Post_m = 1$ if month m is in the post-30 Baht period. $Treat_i x Post_m$ is an interaction term between $Treat_i$ and $Post_m$, and its coefficient, β_3 , is the coefficient of interest because it represents the average treatment effect of the 30 Baht program.

The regression is based on the assumption that the outcomes of the treatment group and the control group would have followed the same trend in the absence of the 30 Baht program. All theoutcomes are in the form of logarithm. Therefore, the assumption implies that, in the absence of the 30 Baht program, the outcomes of control group and the treatment would have had the same percentage growth rate, rather than the same change in level. One issue is that many observations of the outcomes, especially income and saving, are negative. These observations would be dropped by the log transformation, and the estimation results would be different. To solve this issue, instead of the log transformation, I use the inverse hyperbolic sine transformation. The inverse hyperbolic sine transformation of an observation y_{im} is $ln\left(y_{im} + \sqrt{y_{im}^2 + 1}\right)$. With the inverse hyperbolic transformation, the observations with zero or negative values are not dropped. Moreover, the hyperbolic sine transformation dependent variables can be interpreted in approximately the same way as logarithmic ones.

The estimation results are shown in table 6. The average treatment effect of the 30 Baht

Table 8: Difference in Differences estimation results

dependent variables	Consumption	Income	Saving
$TreatxPost$	-.0375 (.0303)	0.5941* (.3270)	0.3386 0.4108)
no. of observations	30,339	30,339	30,339

Note:
1) All standard errors are robust. All coefficients are estimated with household fixed effect.
2) * represents 10% significant level

program on consumption is estimated to be negative, but small and not statistically significant. The average treatment effects on income and saving are positive, but it is statistically significant only for the effect on income. The coefficient of the interaction term in the regression in which its dependent variable is household income is 0.5941. This can be interpreted that the 30 Baht program raises per capita household income of the treatment group by 81.14% on average[6]. I conclude that, inspite of the increase in income, the effect of the 30 Baht program on consumption might be small and negative, because households are more likely to increase their savings.

The Welfare Effect Estimation Results

Table 9 summarizes the estimation of welfare effect from the 30 Baht program. The estimated total welfare effect (γ) is 831 Baht per year per person. I decompose the welfare effect into the consumption component (γ_C) and the health component (γ_M). The consumption component of the welfare effect is estimated by holding the health outcome constant. The estimated consumption component of the welfare effect is 830 Baht per year per person. By definition, the health component is only 1 Baht per year per person. This is because the average stop-working days from sickness, which is a

[6]If a household switches from the control group to the treatment group , the percentage impact of the 30 Baht on per capita household income is $100[exp(\beta_3) - 1]$.

proxy of the health outcome, changes very little. The average stop-working days from sickness is 2.40 days per year per person in the pre-30 Baht period, and it is 2.33 days per year per person in the post-30 Baht period.

The consumption component (γ_C) is also decomposed into the transfer component and the pure-insurance component. The transfer component is define the the change in the average of counterfactual consumption $c^T_{i,1}(0)$ and the average of actual consumption $c^T_{i,1}(1)$. The average actual consumption of the treatment group in the post-30 Baht period is 15,533 Baht per year per person and the averge of its counterfactual counterpart is 15,544 Baht per year per person. Thus, γ_{CT} = -11 Baht per year per person because the average consumption decreases by 11 Baht per year person after the initiation of the 30 Baht program. By definition, γ_{CI} is equal to $\gamma_C - \gamma_{CT}$. Therefore γ_{CI} is equal to 841 Baht per year per person.

To evaluate efficiency of the 30 Baht program, I compare the welfare benefit with the increase in government spending on health coverage. According to table 1, 37.5% population in the treatment group were covered by the Medical Welfare Scheme (MWS), while the others in the treatment group were uninsured before 2001. Gruber, Hendren and Townsend (2014) documented that, under the MWS, the government gave "reimbursements to public hostipals of roughly 250 Baht per enrollee per year." Therefore, the average government health care funding to the treatment group in the pre-30 Baht program period was 93.75 Baht per year per person. At the beginning of the 30 Baht program, the government increased fundings to these hospitals to 1,200 Baht per year per person. Therefore, the increase in capitation payment is approximately 1,106.25 Baht per year per person.

Comparing with the increase in capitation payment, the welfare effect is approximate

Table 9: Welfare Effect (unit: Baht/year/person)

	gain	% of an increase in capitation payment
Total Welfare effect (γ)	831	75.1%
Decomposition of Welfare Effect		
Consumption (γ_C)	830	75.0%
—Transfer Component (γ_{CT})	-11	-1.0%
—Pure-Insurance Component (γ_{CI})	841	76.0%
Health (γ_M)	1	0.1%

Note: 1 USD is approximately = 35 Bahts

three fourths of the additional government spending. In other words, an enrollee in the 30 Baht program receives approximately 75 cents per one dollar of government spending. According to table 9, all the welfare effect comes from the pure-insurance component, while the sizes of other components are negligibly small. I may conclude that the only main source of the welfare effect is the decrease in consumption volatility due to the 30 Baht program.

6 Discussion

Decrease in consumption volatility, which is the only main source of the welfare effect of the 30 Baht program, may be explained by the fact that the 30 Baht program reduced out-of-pocket medical spendings at the high percentiles, as shown in table 6 and table 7.

Although this study has no evidence for significant welfare gain from the health improvement from sampled population in this survey, Gruber, Hendren and Townsend (2014) found that the 30 Baht program reduced the infant mortality rate by 13% - 30%. Limitation of health related data in the surveys could be one reason to explain. The other reason is that the 30 Baht program may improve the health outcomes of marginalized

Table 10: Welfare effect comparison with other studies

	Welfare effect per one dollar of government spending		
	This study	FHL (2015)[7]	Limwattananon et al (2015)
Total Welfare effect (γ)	0.75	0.44	n/a
Decomposition of Welfare Effect			
Consumption (γ_C)	0.75	0.31	n/a
—Transfer Component (γ_{CT})	-0.01	0.14	n/a
—Pure-Insurance Component (γ_{CI})	0.76	0.17	0.15
Health (γ_M)	0.00	0.13	n/a

group, eg. infants in a poor province, but not those of average population.

Table 10 compares the estimation of the welfare effect from health insurance in this study with the other two studies. FHL (2015) studies the welfare effect of Medicaid, but use the same framework as the one in this study. On the other hand, Limwattananon et al (2015) studies the welfare effect of the 30 Baht program, but they use different framework to estimate the welfare effect. Note that all three papers use the same CRRA utility function and the same constant coefficients of relative risk aversion ($\sigma = 3$).

According to table 10, the total welfare effect of the 30 Baht program in this study is 75 cents per one dollar of government spending, while FHL(2015) estimate that the welfare effect of Medicaid is only 44 cents per one dollar of government spending. Since Limwattananon et al (2015) use different estimation framework, the total welfare effect is not available. In term of its composition, FHL (2015) estimate that about three fourths of the total welfare effect is contributed from the comsumption component, and the other one fourth is from the health component. The consumption is approximately halved into the transfer component and the pure-insurance component. In contrast, in this study all the total welfare effect is contributed by the consumption pure-insurance component.

Limwattananon et al (2015) define the welfare gain from the 30 Baht program by the

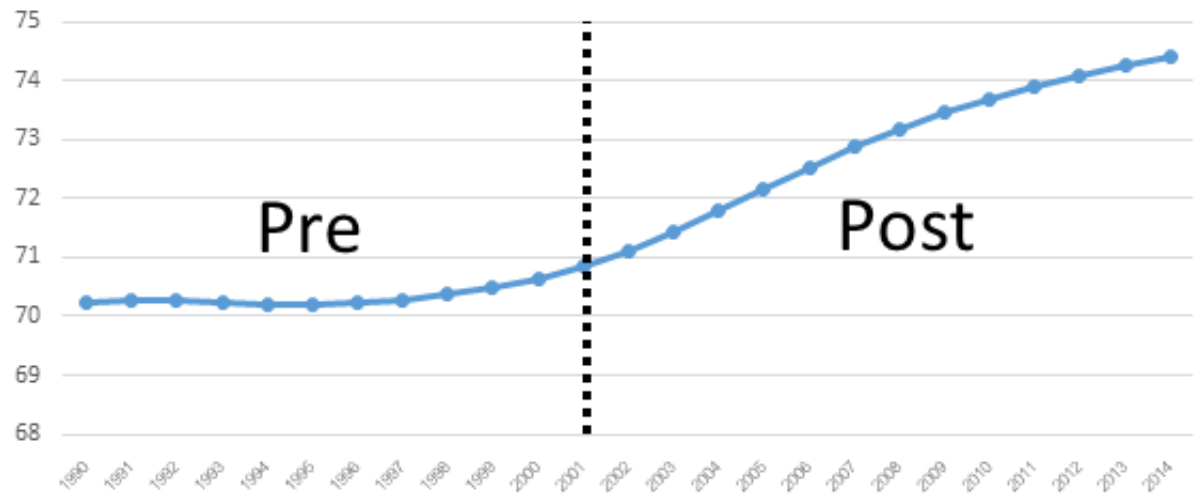
change in risk premium between the pre-30 Baht and the post-30 Baht period[8]. By definition, this is equivelent to the pure-insurance component in my study. They found that the average welfare gain from the 30 Baht program is equal to 13.69 Baht per person per month, or 164.28 Baht per person per year, which can be translated into 15 cents per one dollar of government spending. It is interesting that this number is very close to the one estimated by FHL(2015), although they belonged to different health insurance schemes.

While different contexts and different estimation frameworks may explain the discrepancy, I argue that the main reason why my estimation is different from the others is measurement. The framework used by FHL(2015) and Limwattananon et al (2015) require consumption data, and both of them state that they proxy consumption by subtracting income by out-of-pocket medical spending. I have shown that the 30 Baht program affects consumption and income differently. While the treatment group's average income significantly increases after the 30 Baht program, its average consumption actually slightly decreases due to increased saving. Note that the positive effect of the 30 Baht program on income is similar to FHL(2015)'s estimation, in which the consumption transfer component, which is define the change in the difference between average income and out-of-pocket medical spending, is positive.

On the other hand, the positive effect of the 30 Baht program on saving is opposite to the study of Chou, Liu and Hammitt (2003). They found that the National Health Insurance in Taiwan reduced saving of the treatment group. They explain that health insurance decreases the variance of future medical spending, therefore households decide to reduce precautionary saving.

[8] Although their framework is different from mine, both of our frameworks use CRRA utility function with the same constant coefficients of relative risk aversion.

Figure 1: Thailand's Life Expectancy before and after the reform



source: World Bank

One possible reason why the sampled households in this survey increase saving is possibly because of increased life expectancy. Given a fixed amonth of income and strictly concave utility function, an unexpected additional period of life causes a decrease in current consumption and an increase saving, which increases future consumption. Figure 1 shows that life expectancy in Thailand had changed less than 1 year during the decade of 1990's. After 2001, when the 30 Baht program is initiated, it had increased more than 3 years within 13 years.

I do not have any strong evidence to explain why consumption decreases and saving increases after the 30 Baht program. No matter what is the cause of this phonomenon, the bottom line is that it is necessary to take intertemporal consumption into account, in order to estimate more accurate welfare effect. Additional saving turns to be consumption in the future period, and the welfare effect from this source is excluded in the static framework of welfare effect estimation.

References

[1] Chou, S. Y., Liu, J. T., & Hammitt, J. K. (2003). National Health Insurance and precautionary saving: evidence from Taiwan. Journal of Public Economics, 87(9), 1873-1894.

[2] Finkelstein, A., Hendren, N., & Luttmer, E. F. (2015). The value of medicaid: Interpreting results from the oregon health insurance experiment (No. w21308). National Bureau of Economic Research.

[3] Gruber, J., Hendren, N., & Townsend, R. M. (2014). The great equalizer: Health care access and infant mortality in Thailand. American economic journal. Applied economics, 6(1), 91.

[4] Gruber, J., & Madrian, B. C. (2002). Health insurance, labor supply, and job mobility: a critical review of the literature (No. w8817). National Bureau of Economic Research.

[5] Gruber, J., & Yelowitz, A. (1997). Public health insurance and private savings (No. w6041). National Bureau of Economic Research.

[6] Limwattananon, S., Neelsen, S., O'Donnell, O., Prakongsai, P., Tangcharoensathien, V., van Doorslaer, E., & Vongmongkol, V. (2015). Universal coverage with supply-side reform: The impact on medical expenditure risk and utilization in Thailand. Journal of Public Economics, 121, 79-94.

[7] Samphantharak, K., & Townsend, R. M. (2010). Households as corporate firms: an analysis of household finance using integrated household surveys and corporate financial accounting (No. 46). Cambridge University Press.

[8] Starr-McCluer, M. (1996). Health insurance and precautionary savings. The American Economic Review, 86(1), 285-295.

[9] Thanmanthong, S. (2010). Thailand's Universal Health Coverage Scheme (The 30 Baht program): 2002 - 2009. Bangkok: Faculty of Economics, Thammasat University

[10] Thavorncharoensap, M., Teerawattananon, Y., Natanant, S., Kulpeng, W., Yothasamut, J., & Werayingyong, P. (2013). Estimating the willingness to pay for a quality-adjusted life year in Thailand: does the context of health gain matter?. ClinicoEconomics and outcomes research: CEOR, 5, 29.