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Consumption Smoothing and Precautionary Savings in Thai Agricultural Households

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Abstract

This paper uses three waves of Thai Socio-Economic Panel Survey at the country level from the period 2005 to 2007 to examine how well agricultural households smooth their consumption in the face of income shock and income uncertainty. The empirical results reveal that Thai agricultural households are quite well in smoothing their consumption in the face of income shock. Additionally, households exhibit clearly the precautionary saving motive behavior as a result of the high positive significance of income uncertainty.

JEL Classification: D12; D91; O16

Keywords: income shocks, permanent income hypothesis, income uncertainty and precautionary savings

บทคัดย่อ

บทความนี้ใช้ประโยชน์จากข้อมูลการสำรวจเพื่อติดตามภาวะเศรษฐกิจและสังคมของครัวเรือนโดยใช้ตัวอย่างซ้ำของไทยในช่วงระหว่างปี 2548-2550 เพื่อศึกษาความสามารถของครัวเรือนเกษตรไทยในการบรรเทาผลกระทบอันเนื่องมาจากความเสี่ยงและความไม่แน่นอนของรายได้ที่มีต่อการบริโภคของครัวเรือน ผลการศึกษาแสดงให้เห็นว่าครัวเรือนไทยมีความสามารถในการบรรเทาผลกระทบอันเนื่องมาจากความเสี่ยงที่เกิดขึ้นกับรายได้ค่อนข้างดี นอกจากนี้ การศึกษา

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ยังชี้ให้เห็นว่าครัวเรือนเกษตรไทยยังแสดงพฤติกรรมการออมเพื่อป้องกันความเสี่ยงอันเกิดขึ้นจากความไม่แน่นอนของรายได้อย่างเห็นได้ชัด

1. Introduction

As with most developing countries, Thai agricultural households especially in rural areas not only have to cope with low income but also with extremely variable income. Agricultural income is inherently uncertain as a result of two main types of risk: idiosyncratic and covariate risk. Both types of risk are beyond the control of agricultural households and this causes serious hardship.

However, according to Milton Friedman's permanent income hypothesis (PIH), which assumes a strict assumption, it is possible that if there is a complete market for credit or if there are some other mechanisms, then transitory income shocks (both idiosyncratic and covariate shocks) should be smoothed away by borrowing and savings and they should not affect the consumption pattern. However, because the credit and insurance markets in most developing countries often do not exist or function only very imperfectly, the agricultural households in those countries need ways to protect themselves against the risk of a bad year. Finding ways to smooth out their consumption between good years and bad can mean the difference life and death (Case, 1995, pp.81).

The study of the impact of shocks on consumption or the specifically testing of the PIH has been proposed in various empirical specifications, both in developed and developing countries, since Milton Friedman's initial formulation of the theory in 1957. The overall conclusion of these studies nonetheless reject the PIH, for example, Hall (1978), Bhalla (1980), Alderman (1996) and Kazianga & Udry (2006). This also includes Paxson (1992) for the case of Thailand. Consequently, among several ideas which try to explain why the PIH has failed[1], researchers frequently appeal to an increase in the precautionary saving motive generated by increases in income uncertainty to explain the discrepancy between theory and behavior, for example, Skinner (1988), Caballero (1990) and Carroll (1994).

[1] Other extensions of the standard version of LC/PIH include the liquidity constraint, departure from full optimization, durability of consumption goods, habit formation, and nonexpected utility.

Similar to the study of Paxson in 1992, the objectives of this paper examines the PIH but gives more weight to the effect of the precautionary saving motive on Thai agricultural household consumption. Furthermore, several different specifications are included. First, this paper chooses the consumption model rather than the saving model to consist with most studies on micro data that choose to model consumption (Browning & Lusardi, 1996, pp.1825). Second, to my knowledge, this is the first paper which implements three wave panel data on Thai household Socio-Economic Panel Survey for the whole country that covers the years 2005 to 2007 to test consumption smoothing in Thai agricultural households. Third, to take advantage of the availability of panel data, our model includes also village (tambon or sub-district)-year dummy variables. The interaction between village and year not only captures the village-specific effect which reflects the difference in economic, social, cultural, and weather factors, as well as other factors that may be influence households of the different villages at the different time, but also captures the aggregate shock which is common across groups of member and cannot be smoothed out by those within the village. Fourth, to predict transitory income shock, this paper not only uses rainfall data but also interacts with farm characteristics, so that the difference in transitory income across households is purely random.

Fifth, this paper also attempts to add specific adverse shocks rather than relying on only income shock to investigate whether these shocks affect well being of the household. However, due to the limit of the data, only illness of the household head is a proxy of our specific adverse shock. Finally, to concern for on the gap between theoretical and actual behavior, this paper combines the PIH with the precautionary saving model by including income uncertainty which is constructed following the technique of Kazianga & Udry. Consequently, this paper examines the impact of both the first moment and the higher moment of income shock.

The empirical results strongly reject the PIH, even if we find the closing zero of the estimated propensity to consume out of transitory income for the whole country, and is insignificant in most regions, but we also find that Thai agricultural households depend less on their permanent income. On the contrary, we find that our constructed income uncertainty variable significantly affected household consumption, supporting the precautionary hypothesis. The remainder of the paper is planned as follows: sections two outlines the theoretical framework

together; section three explains the empirical specification and data description; section four represents the results of the empirical result and discussion; and the final section concludes and proposes the policy implications.

2. Theoretical Framework

In this section, we explain the theoretical model that underlines our empirical work. Consequently, we first consider the household utility function, which takes the form:

$$U = E\left[\sum_{j=0}^{\infty}\left(\frac{1}{1+\delta}\right)^{j} U\left(C_{it+j}\right)\right] \qquad (1)$$

where $U(\cdot)$ is the concave instantaneous utility function which is assumed to be additively separable with identical sub-utility functions for each period. C_{it+j} is the consumption of household i in period $t+j$, and δ is the rate of the subjective time preference or the discount rate.

Assets evolve according to the interest rate and the proportion of income which is consumed or saved:

$$A_{it+j} = (1+r_{t+j})(A_{it} + Y_{it} - C_{it}) \qquad (2)$$

Given a specification of preferences, the intertemporal budget constraint, we can in principle solve for the consumption function by assuming that the utility function is quadratic; $U(c_t) = C - \frac{a}{2}C^2 \quad , a > 0$ as follows:

$$C_t = \left(\frac{r}{1+r}\right)\left[A_t + E\sum_{j=0}^{\infty}\frac{1}{1+r_{t+j}}Y_{t+j}\right] \qquad (3)$$

Equation (3) indicates that the standard version of the LC/PIH which represents current consumption, is the annuity value of current assets plus the present value of the expected stream of future income.

The standard version of the LC/PIH is generally accepted as the primary theoretical framework for modeling the determinants of consumption and saving decisions of households.

Yet the simple model of the standard version of the LC/PIH overlooks some crucial real-world characteristics and seriously deteriorates its theoretical and empirical validity. With a poor description of behavior under the uncertainty of the quadratic utility function, two main utility functions, which are more attractive, are implemented; that is, the exponential utility function which exhibits constant absolute risk aversion (CARA), and the isoelastic utility function, which exhibits constant relative risk aversion (CRRA). Both utility functions are nonincreasing absolute risk aversion, and there is a positive third derivation of the utility function and convexity in the marginal utility.

Since it has tractability, the CARA utility has been chosen by several authors. This includes Caballero (1990), Kimball & Mankiw (1989), Dardanoni (1991) and Wang (2004). Thus, if we apply the CARA utility in the form $U(C_t) = -\frac{1}{\alpha}\exp(\alpha C_t) \quad , \alpha > 0$ and base it on Caballero's approach (1990), the consumption function becomes:

$$C_t = \frac{1}{(T-t+1)} A_t + Y_t - \frac{1}{4}(T-t)\alpha\sigma^2 \qquad (4)$$

which implies that current consumption depends on the certainty equivalent plus a precautionary element which depends on income uncertainty (σ^2) and prudence (α)[2].

3. Model Specifications and Data Description

3.1 Model Specifications

In order to implement the empirical test for the LC/PIH and precautionary saving hypothesis, we need to develop an empirical consumption model. According to the standard version of the LC/PIH, household consumption is determined by two main factors: permanent income and life cycle factors. Additionally, one of the main objectives of this paper is the study of how farm households smooth their consumption in response to transitory income shock. The model thus is first specified as:

[2] Note that if $\alpha = 0$ in equation (4), the optimal consumption follows the standard version of the LC/PIH

$$C_{irt} = \beta_0 + \beta_1 Y_{irt}^{p} + \beta_2 Y_{irt}^{T} + \beta_3 L_{irt} + \beta_4 IS_{irt} + \lambda_i + \varepsilon_{irt} \qquad (5)$$

where C_{irt} is consumption of farm household i in region r at time t, Y_{irt}^{p} is permanent income, Y_{irt}^{T} s transitory income , L_{irt} is the life-cycle factors which are presented in the form of the number of household members in each of five age categories that follow Paxson's paper (Paxson, 1992, pp.17), IS_{irt} is the idiosyncratic shock, (λ_i) is household fixed effect which captures the unobservable household characteristics other than the set of household characteristics, and ε_{irt} is an error term.

To measure permanent and transitory income, we modifies the study of Fafchamps *et al.* (1998), Kazianga & Udry (2006) and Jacoby & Skoufias (1997) which exhibited a similar approach but a little different in detail. All of these begin with setting the income equation of the form:

$$Y_{irt} = \alpha_1 X_{irt} + \alpha_2 R_{rt} \otimes Q_{irt} + \gamma_{rt} + \lambda_i + u_{irt} \qquad (6)$$

if we nevertheless define $\gamma_{rt} = \alpha_r R_{rt} + \tilde{\gamma}_{rt}$, and assume that $\tilde{\gamma}_{rt}$ is uncorrelated with X_{irt} and Q_{irt}. We then can rewrite equation (6) as[3]:

$$Y_{irt} = \alpha_1 X_{irt} + \alpha_2 R_{rt} \otimes Q_{irt} + \alpha_3 R_{rt} + \lambda_i + (\tilde{\gamma}_{rt} + u_{irt}) \qquad (7)$$

where Y_{irt} is household income, R_{rt} is the deviation of rainfall from the long-run regional mean and this deviation squared, Q_{irt} is the farm characteristics that are determinants of income, such as the demographic structure of the household and detailed information on its landholdings and their quality (Fafchamps *et al.* 1998, pp.288), γ_{rt} is a village-year fixed effect, and u_{irt} is a random component. The Kronecker product $(\otimes)$ generates the interaction terms.

From equation (7) we may divide total income into three types following Kazianga & Udry (2006) and Fafchamps *et al.* (1998). Permanent income is defined as $Y_{irt} = \hat{\alpha}_1 X_{irt}$,

[3] Equation (7) is less general than (6), but it permits us to examine the impact of aggregate (village level) rainfall shocks on consumption and saving choices. (Kazianga & Udry, 2006, pp.426).

transitory income is defined as $Y_{irt}^{T} = \hat{\alpha}_2 R_{rt} \otimes Q_{irt} + \hat{\alpha}_3 R_{rt}$ and unexplained income is $Y_{irt}^{u} = Y_{irt} - Y_{irt}^{p} - Y_{irt}^{T}$

After the three income components are estimated, we then may estimate the standard version of the LC/PIH by substituting these estimated incomes into (5):

$$C_{irt} = \beta_0 + \beta_1 \hat{Y}_{irt}^{p} + \beta_2 \hat{Y}_{irt}^{T} + \beta_3 \hat{Y}_{irt}^{u} + \beta_4 L_{irt} + \beta_5 IS_{irt} + \lambda_i + \varepsilon_{irt} \qquad (8)$$

If our objective is the study of how farm households smooth their consumption in response to transitory income shock, we then can check whether $\beta_1 = 1$ and $\beta_2 = 0$ from equation (8). Nevertheless, as we known in the theoretical section, the standard version of the LC/PIH overlooks some crucial real-world characteristics, in filling this gap; thus, we may extend the standard version of the LC/PIH by considering the effect of the precautionary saving motive in our consumption model also.

There are several candidate measurements for income risk that have been implemented by several authors. For example, Skinner (1988) used the occupation of the head of the household as a proxy for risk. Guiso, *et al.* (1992) constructed income variance from direct survey questions. Carroll & Samwick (1997) used the variance of income and the variance of log income from the observed income processes to proxy for income risk. Jalan & Ravallion (2001) constructed a measure of household-specific income uncertainty as the variance of the estimated innovation error, or the variance of the residual in the income regression. However, there were mixed results concerning the relationship between the different measurements of income risk and saving (consumption); thus it is difficult to assess which is a good measure of risk.

Additionally, a measure of income uncertainty also depends on data type. This paper studies the impact of transitory income and income uncertainty due to rainfall variation using three-wave Thai household panel data. Unfortunately, this is short panel data, and constructing income uncertainty with short panel data may not be an appropriate approach. Nonetheless, by applying Kazianga & Udry's approach (Kazianga & Udry, 2006, pp.434) we can construct income uncertainty for short panel data by estimating income variance with the time series of rainfall variation, interacted with household land characteristics weighted by the estimates from equation (7). This formulas is presented as follows:

$$\hat{\sigma}^2\left(y_{irt+1}^T\right)=\frac{1}{16}\sum_{t=1988}^{2004}\left[\hat{\alpha}_2\tilde{R}_{rt}\otimes\overline{Q}_{ir}+\hat{\alpha}_3\tilde{R}_{rt}\quad-\left(\hat{\alpha}_2\overline{R}_{rt}\otimes\overline{Q}_{ir}+\hat{\alpha}_3\overline{R}_{rt}\right)\right]^2 \quad (9)$$

where $\hat{\sigma}^2\left(y_{irt+1}^T\right)$ is the estimated income variance, $\tilde{R}_{rt}$ is historical rainfall data $\overline{Q}_{ir} = \frac{1}{3}\sum_{t=2005}^{2007} Q_{irt}$. Assuming that households have rational expectations concerning the distribution of income shocks due to the rainfall that they can expect, we can estimate income variance by combining our estimate $\hat{\alpha}_2$ and $\hat{\alpha}_3$ from equation (7) with historical rainfall and the land characteristics data in the above explanation.

Using this measurement of income risk, equation (8) is rewritten as:

$$C_{irt} = \beta_0 + \beta_1\hat{Y}_{irt}^p + \beta_2\hat{Y}_{irt}^T + \beta_3\hat{Y}_{irt}^u + \beta_4\hat{\alpha}_{iy}^2 + \beta_5 L_{irt} \quad + \beta_6 IS_{irt} + \lambda_i + \varepsilon_{irt} \quad (10)$$

where $\hat{\alpha}_{iy}^2$ is income risk, and according to the theory of precautionary saving, β_4 should be negative, indicating that households that face higher income risk should consume less and save more.

3.2 Data Description

There are two sources of the data that is used for this paper. First, the Thai Household Socio-Economic Panel Survey collected by the National Statistical Office (NSO) provides the socioeconomic data on Thai households, just as Thai Socio-Economic Surveys (SES) did, but with fewer details. Second, the Meteorological department in the Ministry of Information and Technology provide regional rainfall data from 1988 to 2007 from 115 weather stations in Thailand. Only 83 weather stations however are utilized due to the matching-up process; that is, households were matched to only the nearest weather stations.

The Thai Households Socio-Economic Panel Survey is the first panel dataset conducted by a Thai government organization. Under this survey, the households were interviewed repeatedly every year during 2005-2007. In each survey round, sample households from 76 provinces all over the country, both inside and outside municipal areas were selected using two-stage stratified sampling. Approximately 6,000 households were chosen in the first round but then these households contribute response rate was about 96.2 and 93.1 percentages in 2006 and 2007, respectively. However, because this paper involved with the study of the impact of transitory

income shock and income variance as a result of rainfall variability on household consumption, only crop farmers were chosen[4].

Table 1 presents the summary statistics of the main variables used in the empirical analysis. Annual total income and expenditure consumption are derived from asking households in the year before the survey. Total income is the summation of farm profit and nonfarm income in terms of wage, salary and benefits, while total expenditure includes expenditure on all goods and services.[5] Both total income and expenditure are adjusted using Provincial Consumer Price Index (PCPI) provided by the Internal Commercial Department in the Ministry of Commercial in each year of the panel data to obtain real values from the nominal figures derived from the survey rounds. Owned land and unowned land are the main determinants of the permanent income of farm households. Most households have generally own land; however, a large number of households nevertheless do not have own land and thus they used unowned land in terms of rented land, public land, and conserved forest and others to cultivate their crops. Additionally, many households also use both owned land and unowned land for their cultivation.

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[4]Since Thai Household Socio-Economic Panel Survey report occupation's detail less than SES, sample households in this paper thus are different from Paxson's study (Paxson, 1992) which used rice farmers as a sample households. This is thus another key difference with Paxson's study.

[5] Total expenditures include housing expenditure (e.g. house/land rent, housing utility bills, house renovation cost, etc.), expenditure on food, drinks, and tobacco, expenditure on healthcare, expenditure on education, expenditure on transport (e.g. travelling fare, petrol cost, vehicle buying), recreational expenditure (e.g. newspaper, movie), personal expenditure (e.g. clothes, shoes), social expenditure (e.g. charity, transferring money to other people outside household), other (e.g. tax). Since some of durable goods expenditure (i.e. vehicle buying) are included aggregately with other non-durable goods in transport expenditure, so we cannot separate them from each other. Thus, our expenditure variable includes both non-durable and durable goods. However, this is similar with many papers. Example are Paxon (1992), Miles (1997), Ersado, Alwang, and Alderman (2003), and Meng (2003). Miles (1997, p.17) indicate that "including durable goods is problematic because of the infrequency of large purchase and the mis-match between the timing of expenditure and the flow of service from the ownership of the goods. But excluding durables is not an attractive option since the propensity to consume durables out of gains in wealth may be both significant and larger than the propensity to consume other goods and service".

Table 1

Mean and standard deviations of main variables for the entire samples

Variables	Variable description	Mean	Std. Dev.
Income	Farm profit plus nonfarm profit	133383.800	168439.600
Consumption	Total expenditure	94651.400	81884.530
Owned_land	Land of household which is not rented land, public land or conserved forest	16.396	48.790
Unowned_land	Rented land and public land including conserved forest	4.550	42.231
Soil_fertility	Dummy variable for soil's quality (equal to 1 if households locate in Central ,East ,West or North regions where have a good quality of soil)	0.368	0.482
Head_illness	Illness of household head	0.018	0.136
Dev_rain	The deviation of rainfall	45.570	226.972
Dev_rain_squared	Squared of the deviation of rainfall	53583.950	108914.200
Ownedland_xi_dev	The interaction term between owned land and the deviation of rainfall	629.158	10795.650
Unownedland_xi_dev	The interaction term between unowned land and the deviation of rainfall	238.847	3925.317
Soil fertility_xi_dev	The interaction term between soil's fertility and the deviation of rainfall	32.687	144.012
Head_age_xi_dev	The interaction term between age of household's head and the deviation of rainfall	2445.239	12268.300

Due to concerning for the differences in the soil quality in each region, this paper controls soil quality by including a soil-type variable in the model. These soil quality data were studied by Kanchanakul *et al.* (2000). In their study, they concluded that the northeastern and southern region of Thailand had low-quality soil, while other regions had high-quality soil. The illness and experience of the household head were other factors which determine household income, especially farm households. They thus are also included. The age of the household head is used as a proxy variable for the household head's experience. The number of household numbers, which was classified by gender, age, and education level, represented the final set of the household demographics variable included in the model of this paper. This paper adapts slightly Paxson's classification because it has been a good classification for controlling for farm household demographics (see the classification in Paxson, 1992).

The deviation of rainfall from its long-term average and its squared are included in the model in conjunction with panel data on household income to construct the estimates of transitory income due to rainfall shock. These rainfall variables are constructed using annual regional rainfall data obtained by summing the monthly regional rainfall data that were reported by each regional weather station. The weather stations that are selected for this paper locate all over the country, in all regions and provinces. Figure 1 displays the mean annual rainfall in each region. This figures shows that the mean annual rainfall of all regions are quite similar, except for the southern region which is located in a different geographic from other regions in Thailand. Therefore the rainfall in the south clearly shows a large deviation from other regions.

4. Results and Discussion

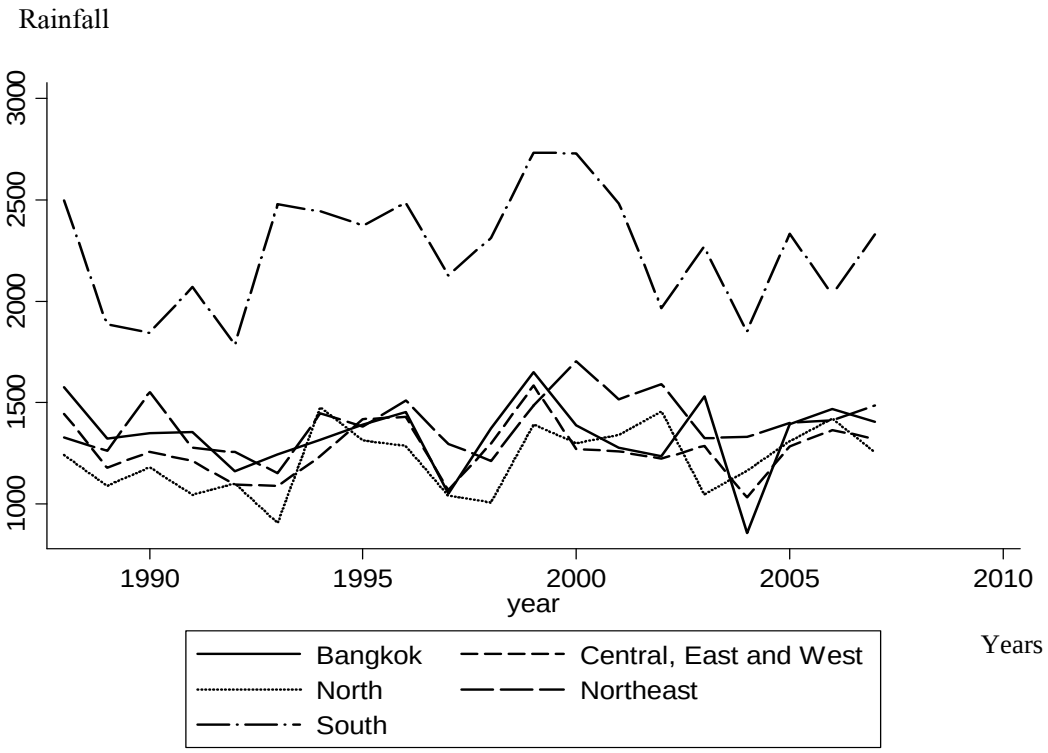
4.1 Income equation

Table 2 reports the estimates of the reduced-form fixed effect income regressions from equation (7). The table shows separately the results among three groups of regions, since there is a highly-different rainfall quantity in some regions and there is also a difference in the main crops that are cultivated in some regions which may respond differently to rainfall. We thus investigate the first group by summing all of the regions in order to obtain overview results. We then exclude the southern region due to a large difference both in the mean and standard deviation and the

main crop cultivation in this region. Finally, we group households in northern and northeastern regions to be the third group as a result of the similarity of rainfall data and several types of cultivated crops[6].

Figure 1

Annual average rainfall



[6]Rice is the main crop cultivated by households in the northern and northeastern regions, while households in the southern region cultivate mostly rubber.

Table 2

Fixed effect income regressions (group of region)

Dependent variable: Income

Regions	All regions	All regions except southern region	Northern and Northeastern regions
Variables			
Owned_land	204.656	179.957	128.301
	(74.979)***	(60.563)***	(35.704)***
Unowned_land	-20.984	24.559	52.611
	(65.944)	(58.379)	(51.923)
Dev_rain	485.024	244.215	225.902
	(159.392)***	(71.111)***	(73.760)***
Squared_dev_rain	-0.345	-0.242	0.199
	(0.106)***	(0.105)***	(0.112)**
Ownedland_xi_dev	-1.007	-0.880	-0.647
	(0.334)***	(0.262)***	(0.152)***
Unownedland_xi_dev	-0.191	-0.944	-1.430
	(0.983)	(0.831)	(0.761)**
Soil fertility_xi_dev	-458.516	-233.727	-342.398
	(177.354)***	(91.067)***	(84.966)***
Head_age_xi_dev	-0.576	-0.003	-0.611
	(0.674)	(0.762)	(0.808)
Cons	12996.530	11761.370	5609.110
	(68567.570)	(68938.570)	(69870.630)
Number of observations	5648	4903	4144
R-squared	0.053	0.090	0.085
Sargent-Hansen test	2.9e+07***	9.9e+06***	1.0e+06***
F-tests			
Test 1	5.460***	11.530***	6.340***
Test 2	10602.580***	1394.840***	46835.290***

Notes: 1.) Robust standard errors in brackets under coefficients
2.) * significant at 10% ; ** significant at 5% ; ***significant at 1%
3.) Test 1: rainfall variables jointly insignificant. Test 2: village-years dummies jointly insignificant.
4.) Regressions also include demographic variables (head illness, age of household head, age of household head square, boys, girl, adult males with different of education level, adult females with different of education level, and elders) but coefficients are not report.

When we look at the impact of the explanatory variables on household income, we find that owned land has a large, positive and significant effect on household income at the 1% level, while unowened land is not significant in any of the region groups. The land ownership variables are nevertheless jointly significant at the 1% level for the F-statistic test in all of the region groups. Regarding the set of the individual rainfall variables, we find most individual rainfall variables are highly significant. Rainfall deviation has a positive significant impact on household income in all region groups, while its square has a negative, significant relationship in most of the region groups. Furthermore, we find that most of the interaction terms between rainfall deviation and household characteristics, that is owned land, unowned land, soil fertility and household experience, show a negative significant relationship with household income also. This means that rainfall may not only affects income directly but also through household characteristics. More specifically, the income of household with household characteristic shows a negative sensitivity to rainfall variations. The negative significant impact of this relation has been supported by many previous studies which used the same technique, for example, Fafchamps *et al.* (1998) and Kazianga & Udry (2006). As a result of the significance of most of the rainfall variables, the null hypothesis, that these rainfall variables are jointly insignificant is rejected at the 1% level across all region groups. This should support our claim that regional rainfall variation may explain transitory income and income variance.

4.2 Consumption equation estimation

Table 3 reports the fixed effect consumption regression due to the Sargent-Hansen test report of a 1% level of significance in all region groups[7]. We find some evidence of a statistically-significant relationship between household consumption and transitory, permanent, and unexplained income, respectively only in a group of all regions. For the group of all regions and group of all regions except the southern region, the estimated propensity to consume out of transitory income is quite consistent with the PIH where the coefficient of transitory income should be close to zero, and several studies also support this result. These include Jacoby and

[7] By following our model, and try to avoid model specification errors, we include all involving variables in our empirical test all at once. This kind of specification can be found in several papers. These include Paxon (1992), Guiso, Jappelli and Terlizzese (1992), Carroll and Samwick (1997), Miles (1997), Pistaferri (2001), Ersado, Awang, and Alderman (2003), Meng (2003), and Cheikhna and Mishra (2009).

Skoufias (1998), Pistaferri (2001) and Meng (2003). Consequently, finding the estimated propensity to consume out of transitory income more than zero may significantly imply that some Thai agricultural households are still unable to smooth consumption in the face of income shock due to rainfall variation.

Contrary to the effect of transitory income, although we find a significant relationship between household consumption and permanent income in all region groups, the consumption propensity out of permanent income is not consistent with the PIH. The coefficient of permanent income closes to zero rather than close to one as explained by the PIH. This implies that the consumption of Thai agricultural household depends less on permanent income. This evidence nevertheless may be not surprising for an empirical study. Meng (2003) found the consumption propensity out of permanent income at about 0.5 for total consumption and about 0.13 for food consumption, while Carroll (1994) and Zhou (2003) found that the coefficient was always small and was sometimes negative and insignificant Moreover, an updated study of Ruangthamasak (2008) about Thai household consumption which used the Thai Household Socio-Economic Survey (SES) in 2006 has shown also a closing zero in her estimated permanent income coefficient.

The behavior of Thai agricultural households appears to be consistent evidently with the buffer stock model, with a negative statistical significance at the 1% level in all region groups. The results are consistent with several studies, such as those of Dardanoni (1991), Carroll (1944), Chen *et al.* (1999), Meng (2003) and Ruangthammasak (2008). Appearing to be a precautionary saving behavior among Thai agricultural households indicates that households will consume less if they expect higher future income variability due to rainfall variation. More specifically, households will not fully smooth transitory shocks, but may permit consumption to drop, in the face of transitory shocks in order to preserve their buffer stocks against the possibility of future shock (Kazianga & Udry, 2006, pp.433).

Table 3

Fixed effect consumption regression (groups of region)

Dependent variable: Consumption

Regions	All regions	All regions except southern region	Northern and Northeastern regions
Variables			
Transitory income	0.302	0.185	0.052
	(0.107)***	(0.081)***	(0.101)
Permanent income	0.209	0.101	-0.019
	(0.097)***	(0.087)	(0.101)
Unexplained income	0.087	0.083	0.083
	(0.016)***	(0.019)***	(0.022)***
Variance of income	-3.88e-13	-1.32e-12	-5.75e-13
	(1.65e-13)***	(5.27e-13)***	(2.34e-13)***
Head_illness	2246.160	2358.814	4628.051
	(6476.290)	(6504.451)	(6854.272)
Members 0_5	6068.467	5803.776	6949.286
	(3727.770)	(3964.023)	(4257.505)
Members 6_11	9836.365	11674.780	12907.160
	(3693.142)***	(3817.259)***	(4050.327)***
Members 12_17	15746.600	19759.990	21366.370
	(3703.723)***	(3733.735)***	(4294.037)***
Members 18_60	19899.080	22746.770	25888.910
	(3251.749)***	(3159.610)***	(3867.528)***
Members 61_up	10642.960	14640.300	16111.050
	(5117.994)***	(5154.851)***	(5767.064)***
Cons	307.920	1265.015	839.409
	(12179.730)	(11139.920)	(10652.050)
Number of observations	5648	4903	4144
R-squared	0.207	0.227	0.215
Sargent-Hansen test	1.5e+11***	5.0e+09***	3.8e+10***
F-tests**:**			
Test 1 :	66.630***	107.220***	101.580***
Test 2 :	0.790	0.950	0.470
Test 3 :	3.2e+06***	33076.960***	94346.500***

Notes: 1.) Robust standard errors in brackets under coefficients. 2.) * significant at 10% ; ** significant at 5% ; ***significant at 1%. and 3.) Test 1: coefficient of YP = 1 , Test 2: coefficient YT = coefficient of YP and Test 3: village-years dummies jointly insignificant

There are several plausible explanations for these evidence. First, there has been high financial development in the Thai economy since 1986. Both formal institutions such as commercial banks, noncommercial banks, finance and insurance companies, savings and agricultural cooperatives, credit unions and quasi-formal institutions such as savings groups, production credit groups, rice banks, women's groups and the buffalo bank have highly increase either in setting up new institutions or creating new branches[8]. An increase in these financial intermediations, especially for those quasi-formal institutions, will help to increase the accessibility of financial sources for agricultural households. This explanation is also supported by a study of Kaboski & Townsend (2005), in which they find that quasi-formal institutions can help Thai rural households to smooth consumption in the face of income shocks. Second, Thai agricultural households may implement several informal insurance mechanisms, such as drawing savings, selling assets, increasing work hours, off-farm working, diversifying crops, reciprocal gifts and loans and risk-sharing in the community. These mechanisms are important tools for the poor in managing shocks since they can provide protection from shocks in some ways. Among several mechanisms, many studies have found the implementation in some mechanisms on Thai households. These include Paxson (1992), Townsend (1995), Paulson (2000), Tongruksawattana *et al.* (2010), Rungruxsirivorn (2007) and Rigg & Salamanca (2009).

Third, there has been a high increase in government welfare support program (*"Grass Roots program*s") over the past decade, such as debt moratoria for farmers, people's bank project, village-urban community fund, free education policy, universal health care and a variety of "*Ua-athorn*" policies, for example, loans for cheap housing, scholarships for students from poor households, etc. Although it is generally accepted that these policies have implicitly political goals, these policies can increase household income and then household consumption, especially for poor households, even if it is just a short period of a rise in welfare. Menkhoff & Rungruxsirivorn (2010) found that village funds reached the target group of lower income households better than formal financial institutions and helped to reduce credit constraints. This

[8] Quasi-formal institution is the institutions that keeps records and often have bank accounts, but do not in general have their own office (Kaboski & Townsend, 2005, pp.6).

evidence is also consistent with a study of Rungruxsirivorn (2007), which examines the nature of risk faced by households in Thailand and their strategies to mitigate income shock. In this study, she found that borrowing from the village fund was the most common risk-mitigating strategy implemented by households. Finally, apart from the empirical evidence of Ruangthammasak (2008), which found a closing zero of the propensity to consume out of permanent income of Thai households as well as studies of Carroll (1994) and Zhou (2003), which found that the consumption propensity out of permanent income was always small and was sometimes negative and insignificant. Naga and Bolzani (2006) indicated that there are several reasons why the marginal propensity to consume out of permanent income (MPCPI) is less than unity.[9] First, if there exits a bequest motive, and such a good is a luxury, then the MPCPI will typically be smaller than one. Second, credit market imperfections in various forms may result in the MPCPI being different from one by forcing the consumer to depart from the optimal allocation rule. Third, the existence of a precautionary saving motive may also result in the MPCPI being smaller than one. Buffer stock saving behavior, for instance, induces consumers to maintain a constant permanent income to wealth ratio. Unexpected rises in permanent income induce the consumer to save (rather than to consume more) in order to maintain a constant permanent income to wealth ratio. Under the standard PIH, only the expected value of lifetime wealth affects consumption, so that consumption is in sensitive to a perceived changes in future income risk, and thus the 1% change in permanent income causes the 1% change in consumption. However, the existence of a precautionary saving motive which permits in sensitivity of consumption to uninsurable income risk may cause the MPCPI to be less than one since consumption may drop to serve as a buffer stock against uncertainty. The extent to which consumption can be reduced depends on the degree of uncertainty of future income (i.e. consumers with greater income uncertainty, ceteris paribus, have lower current consumption (Carroll, 1994, pp.111).

There is a little evidence of following the LCH among Thai agricultural households. Even though household members aged 6 to 11 and 12 to 17 appear to have a large, positive

[9]There is another possible explanation of the cause of departing from PIH as a result of including both non-durable and durable goods. There are many paper try to develop model in order to explain why including durable goods may be cause of departing from PIH. These include Mankiw (1982), Blinder and Bar-Ilan (1988) and Caballero (1994).

significant impact on household consumption in most region groups, and this result is quite consistent with the LCH in which the higher there are children (including elders), the higher there is household consumption, there is also the result which highly contradicts the LCH due to the largest positive significant impact of household members aged 18 to 60. These households should consume less and save more as per the LCH prediction. This evidence may nevertheless be explained by the consumption boom hypothesis in Thailand during the period of this study. Moreover, there are several empirical studies shown that the age profile of consumption is *humps-shaped* rather than *bumps-shaped* as predicted by of the life cycle model. The life cycle model states that a smooth consumption profile is independent of the shape of the income profile. A large amount of the literature indicates nevertheless that consumption and income have a similar humps-shape, with peaks of both paths occurring around age 50 (Hansen & Imrohoroglu, 2008, pp.566). These studies include those of Thurow (1969), Carroll & Summers (1991), Attanasio *et al.* (1999) and Gourinchas & Parker (2002). In the case of Thailand, Paxson (1996) indicated that income and consumption profile appear to track each other as in the U.S, Britain, and Taiwan, which she also studied. However, she showed additionally that the peaks in income and consumption occurred later in Taiwan and Thailand than in the U.S and Britain (Paxson, 1996, pp.270). This leaves work for the future.

For idiosyncratic and aggregate shock, we find only the impact of aggregate shock on household consumption. Village (tambon or subdistrict)-years dummy variables are statistically joint significant at the 1% level in all region groups. This implies that aggregate shocks were significant determinants of household consumption while this was not true for household head illness.

5. Conclusion

By combining the PIH with the precautionary saving hypothesis, for the first time, we examine the relationships among transitory income, permanent income, as well as variance income and consumption in agricultural households in Thailand using three-wave Thai Socio-Economic Panel Survey from 2005 to 2007. Our results reveal that the consumption behavior of Thai agricultural households is less consistent with the PIH. Although we find a significant

impact of transitory income shocks due to rainfall variation, which is close to zero of households in the entire country ,and especially in group of all regions except southern region, we find that the consumption propensity out of permanent income is not consistent with the PIH even if there are a significant relationship between household consumption and permanent income in all region groups. The coefficient of permanent income closes to zero rather than close to one as explained by the PIH. This implies that the consumption of Thai agricultural household depends less on permanent income. Four plausible explanations are implemented to sort out these evidence. First, there has been higher in financial development in Thailand since 1986. Second, Thai agricultural households may utilize several informal insurance mechanisms. Third, there is a high increase in the government welfare support programs (the "Grass Roots programs") over the past decade. An increase in these three channels may enhance consumption smoothing mechanisms and then protect households from transitory income shock. Finally, we presume also that the high degree of uncertainty in future income may be a cause of a small and insignificant in the coefficient of permanent income of Thai agricultural households.

In contrast with the evidence of the PIH, Thai agricultural households exhibit clearly the precautionary saving motive behavior in each region group. This implies that households drop their consumption to preserve their buffer stocks against future income shock due to rainfall variation. We find also a little evidence of the impact of family composition on household consumption, which is consistent with the life-cycle hypothesis. In addition to the results above, we find no a negative impact of an idiosyncratic shock proxied by illness of household head on household consumption in all region groups, while the aggregate shock proxied by the village (tambon or subdistrict)-years dummy variables has a significant impact on all region groups.

There are some important policy implications which may be implemented as a result of this evidence. *First*, since consumption is one of the basic indicators of household welfare, and this study's results show some evidence of the impact of income shocks due to rainfall variation, at least some levels and in some region groups, therefore, to protect household welfare from income shocks, as well as other adverse shocks, such as pest attacks, disease of crops and price risks, the government should provide and promote either consumption or income smoothing mechanisms, especially for agricultural households in the group of the central, eastern and

western regions, which has faced significant income shock due to rainfall variation, for example, increasing accessibility to formal institutions especially for poor households, promoting and setting up microfinance institutions such as saving groups, production credit groups, rice banks, etc., as well as providing and promoting the use of risk insurance for agricultural products and promoting the diversification of economic activities. *Second*, finding a little evidence of the impact of income shock due to rainfall variation on most agricultural households may imply that most households can smooth their consumption due to income shock from rainfall variation, nevertheless, it should be noted that rainfall variation, which effect the household income in this study is just a small or transitory income shock, but not a big or persistent shock. If a shock persists for many periods, this hardly rejects its worse impact[10]. Therefore in order to ensure that household welfare does not deteriorate from this shock, the government should not only provide or promote either consumption smoothing mechanisms which can protect households from transitory shocks but also improve effectively both management and infrastructure related to irrigation systems to bear the changes in the global climate. In addition, since climate change is an inevitable phenomenon, and it affects clearly and directly agricultural households, providing a knowledge through education, training and essential information (e.g. climate trends, weather forecasts, existing strategies including introducing new technologies and production methods) should be also one of the government's policies for protecting household welfare, especially agricultural households. *Finally*, although transitory income shock has a little impact on household consumption, household consumption can be reduced by the effect of future income uncertainty as a result of precautionary saving motive of households. To protect against a shortfall in household consumption in this manner, the government should also promotes savings seriously and systematically since savings not only protect against a decline in household consumption but also shield households from the impact of adverse shocks.

[10] Even with global emission of greenhouse gases drastically reduced in the coming year, the global annual average temperature is expected by 2°C above preindustrial level by 2050. A 2°C warmer world will experience more intense rainfall and more frequent and more intense droughts, floods, heat waves, and other extreme weather events" (World bank, 2010).

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