

Credit/Gifts versus Buffers as Means for Consumption Smoothing in Thailand

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Abstract

This paper presents evidence on the role of Credit/Gifts and Buffer Stocks in consumption smoothing for rural households in Thailand. An advantage of the dataset employed is that it reports household financial transactions every year for the period 1997-2001. Buffers (savings and asset sales) are more intensively used relative to Credit/Gifts (borrowing/lending and gifts). However, using two alternative tests of consumption smoothing - Zeldes (1989) permanent income and Townsend (1994) full insurance - we find that Credit/Gifts is effectively used to smooth consumption. Surprisingly, we find no effect of Buffers on consumption smoothing. However, when we stratify our sample by household's land holdings we find a very surprising pattern on the use of Buffers: it substantially reduces consumption changes for relatively rich households but it amplifies consumption variations for households with small land holdings.

1 Introduction

Empirical literature on consumption smoothing has stressed the analysis of the impact of idiosyncratic (income) shocks on consumption. Using Arrow-Debreu theory of risk allocations, Mace (1991), Cochrane (1991), Townsend (1994), Altonji-Hayashi-Kotlikoff (1996), among others, have tested for full insurance in various economies. Although full insurance is generally rejected, a large degree of risk sharing is found in the data. However, there exist few empirical studies on what kind of opportunities to smooth consumption are observed in actual economies. Using the permanent income model as a benchmark, some of these studies focused on individual opportunities to bear risk such as the use of Buffers (See Zeldes (1989), Deaton (1990), Rosenzweig-Wolpin (1993), Paxson (1994), etc). Less work has been done to study more collective opportunities such as the role of credit and gifts

(Eswaran-Kotwal (1989), Udry (1994) and Lim-Townsend (1998) are examples). The contribution of this work is to assess empirically the role of Credit/Gifts versus Buffer Stocks on consumption smoothing by employing both Arrow-Debreu and permanent income approaches.

An advantage of this study is the use of household financial transactions data. We measure household "deficit" as consumption minus income and study the role of Savings, Borrowing, Lending, Remittances/Gifts and Assets trade at deficit financing. We employ a panel of 960 households in rural and semi-urban regions extracted from the Townsend's Survey in Thailand. First we report on the intensity of use of the alternatives financing devices. We then stratify households in the sample by their use of the financing devices to study which of them help consumption smoothing. Our estimated impacts do not take into account the "endogenous" household selection of a particular financing device¹ (or set of devices: Credit/Gifts versus Buffers). Our results do control, however, for the effect of household size and age, gender, education and wealth of the head of the household.

Our main findings are the followings. First, we note that although we have detailed information on household financial transactions we are not able to succeed in quantitatively account for a significant part of the deficit². This may be due to the sensibility of quantitative financial information (?). Nevertheless, we observe that households are intensive users of financing devices. More than 90% of the households report saving/assets transactions in the panel. Borrowing and Gifts transactions are also very common - more than 80% of the households report changes in borrowing and gifts. Lending transactions are neither that common nor frequent. Second, we find that landless households (and those with small plots of land) are intensive users of borrowing, gifts and assets sales relative to households with larger land holdings. Relatively poor households, however, are clearly not users of savings. We find less a pattern for the case of households with large land holdings, but surprisingly, their savings seem to amplify the deficit. Third, using two alternative tests of consumption smoothing - Zeldes (1989) permanent income and Townsend (1994) full insurance - we find that Credit/Gifts is effectively used to smooth consumption. Surprisingly, we find no effect of Buffers on consumption smoothing. However, when we stratify our sample by household's land holdings we find a very surprising pattern on the use of Buffers: it substantially reduces consumption changes for relatively rich households but it amplifies consumption variations for households with relatively smaller land holdings. Finally, we find that household borrowings alone do not reduce consumption

¹Even if we counted with a theory of the use of financing devices, the correction of selection bias will be complicated (if not impossible) by the requirement of an instrument to identify the selection equation, that is, we would need a household characteristic correlated to the use of a financing device but uncorrelated to the household ability to smooth consumption.

²The inclusion of real assets purchases and livestock into the deficit does not affect our success as it does in Lim-Townsend (1998).

variations, but it is the combination of borrowing with household lending and gifts that substantially lowers the impact of income shocks on consumption.

Section II describes the data. We then introduce our empirical strategy in Section III. Section IV presents sample summary statistics and discusses measurement problems. Section V introduces our main results. Finally, Section VI concludes.

2 Data

The panel data used in this paper come from a project funded by the National Institute of Health, the National Science Foundation, and the Ford Foundation. See Townsend et al (1997). An initial cross sectional survey of 2880 households was fielded in May 1997, and a resurvey of one third of the original sample was carried out every year during 1998-2001. Two regions were chosen deliberately, namely the more developed Central region and the relatively poor, semi-arid Northeast.

Resurvey information covered two provinces in each region, and 4 tambons or subcounties from each province were chosen in a stratified random sample designed to pick up ecological variation. See Binford, Lee, and Townsend (2001). Within each tambon 4 villages were chosen at random from an enumeration of villages available from the Community Development Department, and within each village 15 households were chosen at random from a listing held by the headman. Thus the target number of household is 960, with an even number in each province. Replacement households were added so as to be able to continue to compute village averages. In 1999, there were successful re-interviews of 96.3% of the 1998 original replacements household. The re-interview rates for 1999-2000 and 2000-2001 are 97.1% and 96.6%. The total numbers of households re-interviewed across pairs of years varies from 909 to 925. The number with usable consumption data over all years is 828, for example.

In the appendix we are precise on our measures for consumption, income, and financing devices: Savings, Borrowing, etc. The Survey's questionnaires can be found and downloaded from the Townsend Thai Project website at <http://www...>

3 Empirical Strategy

To study the impact of the use of Credit/Gift versus Buffers on consumption smoothing we use two alternative benchmark economies: a permanent income world and a complete markets optimal allocation of risk-bearing. In this section we discuss both the theoretical foundations for each benchmark and the actual implementation of the tests.

The permanent income model is based on the idea that insurance markets are exogenously "shut down" and we are left with pure credit - borrowing and lending - as the main financing device. Alternatively, in a buffer stock world, households keep positive amounts of currency, savings, crop inventories and capital assets to buffer the impact of income/demographic shocks. The first-order conditions for the choice of currency, storage and lending are

$$\mu_c^v(h_t)P_{Mt} \geq \sum_{h_{t+1}} \mu_c^v(h_{t+1})P_{M,t+1} \quad (1)$$

$$\mu_c^v(h_t) \geq \sum_{h_{t+1}} \mu_c^v(h_{t+1})(1 - \delta) \quad (2)$$

$$\mu_c^v(h_t)P_{Mt} \geq \sum_{h_{t+1}} \mu_c^v(h_{t+1})(1 + r_t^l)P_{M,t+1} \quad (3)$$

where r_t^l is the lending rate of interest, P_{Mt} is the price of currency in terms of goods, δ accounts for a depreciation rate on accumulated assets and the Lagrange multipliers $\mu_c^v(h_t)$ where defined above. If we imagine a permanent income world with perfect credit markets, common real borrowing and lending rates r_t and equality in rates of return, we get an specialized version of (1-3):

$$U_c^j(c_t^j) \geq E\beta(1 + r_t)U_c^j(c_{t+1}^j) \quad (4)$$

with equality in the permanent income world and inequality when buffers stocks hit zero and the household is not able to borrow. Zeldes (1989) proposes a generalized, empirical version of (4) of the form:

$$U_c^j(c_t^{vj}, \theta_{jt}) \geq E_t \frac{U_c^j(c_{t+1}^{vj}, \theta_{j,t+1})(1 + r_{jt})}{1 + \delta} \quad (5)$$

where θ is a demographic household-specific shock, δ is the discount rate, r is the interest rate faced by the household and E_t is an expectation operator relative to all variables known at date t by household j . Equation (5) leads to a similar equation with the expectation operator replaced by the inclusion of an error term uncorrelated with information known by the household at date t . The household shock θ consists of an orthogonal component k^1 , an aggregate time group effect k_t^{2v} , and a fixed family effect k_j^3 as well as systematic change due to *age* and a measure of family size, *AFN*. With CRRA preferences to the coefficient $(1 - \alpha)$ and the shock entering exponentially, this delivers the following regression equation:

$$\ln \left(\frac{c_{t+1}^{vj}}{c_t^{vj}} \right) = k^1 + k_t^{2v} + k_j^3 + \frac{1}{\alpha} \left[\ln(1 + r_{jt}) + b_1 \text{age}_{jt} + b_2 \ln \left(\frac{AFN_{j,t+1}}{AFN_{j,t}} \right) \right] + v_{j,t+1} \quad (6)$$

One can include date t income of household j , X_t^j , with a coefficient β , into the regression equation (6) assuming that it is uncorrelated to the error term $v_{j,t+1}$. If the permanent income model is a good approximation, the income term should not be significant.

The "complete markets" approach is based on the idea that households should be immune from idiosyncratic shocks, once we control for aggregate shocks. Suppose we consider individual k in some group v (a village here) with utility function separable in consumption and leisure. Then the first-order conditions for the choice of consumption for individual k from the program delivering full insurance is

$$\lambda^k W_c^k [c_t^{vk}, A_t^{vk}] = \mu_c^v(h_t), \nabla k \quad (7)$$

where W_c is the derivative of the utility function with respect to consumption c_t ; A_t^k is an age-sex index for individual k ; λ^k is a weight reflecting the status or wealth of individual k ; and μ_c is a common Lagrange multiplier for group v . All choices variables are indexed by the history h_t of shocks. Suppose the following functional form for the utility function

$$U^k(c_t^{vk}, A_t^{vk}) = -\frac{1}{\sigma_k} \exp \left[-\sigma_k \frac{c_t^{vk}}{A_t^{vk}} \right] \quad (8)$$

Then assuming identical λ^k and common coefficient of risk aversion σ in the household j , and taking time differences to eliminate household fixed effects, we get the following regression equation:

$$c_{t+1}^{vj} - c_t^{vj} = \alpha(\bar{c}_{t+1}^v - \bar{c}_t^v) + \gamma(\tilde{A}_{t+1}^j - \tilde{A}_t^j) + \beta(X_{t+1}^j - X_t^j) + u_t^j \quad (9)$$

In equation (9) time differences of consumption in household j in group v is related to the time differences of group v consumption; a time difference in a relative demographic term³; changes in other variables X_t^j measuring shocks to income, demographics, etc; and some measurement error u_t^j in household consumption. The theory of risk allocation with complete markets suggests that no variable in X_t^j will enter significantly in the regression equation; and also implies that $\alpha = 1$ picking up the effect of aggregate, group-level risk. In practice, we follow previous studies and run the regression equation where X_t^j is household income. Also, we include controls - both as an additive term and interactive with income changes - for household size and age, gender, education and wealth of the head of the household.

Our main interest in our study is to evaluate if those households who are intensive users of Credit/Gifts or Buffers succeed in reducing the impact of income shocks into consumption. In terms of our regression equation, we aim to measure how β is affected by the use of a particular financing device.

With minor differences in the specifications of the demographic terms, equation (9) turns out to be very similar to equation (6). Both theories predict that idiosyncratic (income) shocks should not have an effect on consumption changes. The main difference is that the *level* of household income in

³This index \tilde{A}_t^j measures the log weighted household j age/sex composition relative to that of the group.

the permanent income test is replaced by household *changes* in income for the case of the complete market test.

4 Household Financial Accounting

A salient feature of the dataset employed in this study is that it documents household financial transactions every year, which allows us to measure quantitatively the flow of funds financing the deficit defined as *expenditures* minus *revenues*. Based on our measures for consumption and income, we can attempt to quantify each component of household i budget equation:

$$\begin{aligned} & P_{qt}c_t(i) + P_{bt}b_t(i) + P_{at}a_t(i) - P_{qt}q_t(i) - P_{at}[T(i) - l(i)] \leq \\ & + [B_{t+1}(i) - (1 + r_t^B)B_t(i)] + [(1 + r_t^L)L_t(i) - L_{t+1}(i)] + G_t(i) \\ & + [S_t(i) - S_{t+1}(i)] + P_{kt}[K_t(i) - K_{t+1}(i)] + [M_t(i) - M_{t+1}(i)]. \end{aligned}$$

The left hand side of the budget equation measures the deficit. Current expenditures are composed by consumption, $c_t(i)$, noncapital inputs used in farming or other activities, $b_t(i)$ and labor inputs hired by the household, $a_t(i)$, all of these value terms at prices P_q , P_b and P_a . Revenues are composed by output quantities $q_t(i)$ at market prices P_q and salaries earned from the sale of labor $T(i) - l(i)$ at wage rate P_a . The financing of the deficit is reflected on the right hand side of the budget equation, which is composed by net borrowing $[B_{t+1}(i) - (1 + r_t^B)B_t(i)]$; net loan repayments received $[(1 + r_t^L)L_t(i) - L_{t+1}(i)]$; remittances and gifts $G_t(i)$; decreases in savings $[S_t(i) - S_{t+1}(i)]$; capital assets sales $P_{kt}[K_{t+1}(i) - K_t(i)]$ and, finally, decreases in cash holdings $[M_t(i) - M_{t+1}(i)]$.

Households report on the amount of borrowing, lending, gifts received, savings and the value of capital assets every year. Unfortunately, household do not report on cash holdings, which undermined our original plan of quantifying every aspect of the household budget equation. In the following subsections we analyze the data in detail. First we describe the financial accounting of three households to stress some important issues on the data. Then we present summary statistics for our sample. Finally, we study different metrics that allow us to quantify how much of the deficit can be accounted and explained by observed financial transactions.

4.1 Some Examples

In order to provide some sense of the data we selected three households and report details on their financial accounting. The purpose is to make some points to guide our analysis. For each household we present a table that summarizes household's *balance of payments*.

Household deficit is the result of subtracting net total income from consumption expenditures. After adding investment - measured as the change in productive physical assets, which include agricultural assets (tractors, etc), fish ponds, livestock, land and business assets (including start up investment) - we obtain household's total financial needs. We grouped financing devices in 5 groups: 1) Remittances/gifts is the amount sent by relatives/friends living in other villages, 2) Savings include financial savings and crop inventories, 3) Borrowing is calculated net of repayments made, 4) Lending to relatives/friends and business partners is also computed as net of repayments received and 5) Household assets is the change in durable consumption goods, such as TV, VCR, bikes, etc.

4.1.1 Household 27071308013

Household obtained its income mainly from rice farming. Despite its investment in livestock (buffalo, pigs, ducks or chicken), no significant income from raising livestock was reported. Indeed, surprisingly, the highest investment was carried out in the worst year in terms of income. Even though the table does not show a prominent role of borrowing, funds from the Bank for Agriculture and Agriculture Cooperatives (BAAC) were the most important source to finance the deficit. However, income deteriorated every year, making necessary to supplement borrowing with remittances and accumulated savings.

	1998	1999	2000	2001
Consumption	24330	18437	20081	28408
Net Income	5350	-1500	-19400	8245
Deficit	18980	19938	39481	20163
Investment	-4000	13000	24000	10000
Total Financial Needs	14980	32938	63481	30163
Remittances/Gifts	0	23000	8800	18700
Net Use of Savings	-11440	14698	2342	-500
Net Increase of Borrowing	25000	-2500	42500	0
Net Decrease of Lending	0	0	0	0
Net Assets sales	0	0	0	-1500
Residual Deficit	1420	-2260	9839	13463

In 1998, financial need was presumably financed entirely by borrowing 25000 Bahts from the BAAC⁴. The apparent weird pattern of savings (increased by 11440 Bahts) may be explained by the

⁴The purpose of the loan was to buy/build house and consumption, although house repairs expenses were 1500

”over-sized” loan obtained from the BAAC. In 1999, with income still depressed, borrowing from the BAAC (25000 Bahts again) was supplemented with remittances and the selling of rice in storage. The year 2000 was the worst year in terms of income and, at the same time, household invested an amount of 24000 Bahts in livestock. This year the household borrowed an amount of 70000 Bahts from the BAAC⁵ to finance a deficit of 90981 Bahts⁶, received 8800 Bahts in remittances and used savings by 2342 Bahts. Finally, income recovered in 2001 decreasing the deficit to 1998-99 levels. However, when we take into account repayment obligations from last-year loan (78400 Bahts), total financial needs amounted to 108563! In 2001 the BAAC rescheduled the loan repayment date, extending it for 5 years. This seems to be in line with the BAAC risk-contingency system discussed in Townsend-Yaron (2001). Remittances were seemingly used to repay BAAC loans, which may suggest a role for transfers among relative and friends as insurance indemnities.

4.1.2 Household 53050613001

	1998	1999	2000	2001
Consumption	150923	208590	60320	33298
Net Income	33080	27500	78386	26734
Deficit	117843	181090	-18066	6564
Investment	-59000	30000	24200	17950
Total Financial Needs	58843	211090	6134	24514
Remittances/Gifts	0	100000	0	0
Net Use of Savings	14800	32200	-19200	18180
Net Increase of Borrowing	57000	-1800	203200	-24000
Net Decrease of Lending	0	0	0	0
Net Assets sales	0	0	-5050	0
Residual Deficit	-12957	80690	-182816	30334

In addition of income earned farming rice, household report revenues from an owned store⁷. Household consumption was large in 1998 and 1999, which drove the deficit to its highest levels⁸. Here, again, income was never enough to finance expenditures, although the situation is quite dif-

Bahts that year.

⁵The purpose of the loan was to buy livestock, although actually buying 24000 Bahts.

⁶Including repayment of last-year loan from the BAAC for 27500 Bahts.

⁷In fact, net income peaked in the year 2000 due to the store revenues.

⁸Household reported educational expenses of 65000 and 105000 Bahts in 1998 and 1999, respectively, compared to 14000 and 11000 Bahts during 2000 and 2001. A daughter attending to the University seems to be the reason for the increase.

ferent to our first example: net income does not deteriorate every year⁹. Again, borrowing from the BAAC was originally used to finance the deficit, but rice in storage, remittances, funds from a moneylender, and income from the store were very much used to smooth consumption.

In 1998, household sold business assets, borrowed from the BAAC¹⁰ and sold stored rice to finance increased expenditures. Financial needs peaked at 211090 Bahts in 1999, half of which was covered by received remittances. Also, household continued selling rice in storage. Still, a residual deficit of 80690 Bahts resulted, which may suggest that only part of the educational expenditures was actually paid. In 2000 household obtained 180000 Bahts from a moneylender, presumably to finance last year residual deficit. Income from business and funds borrowed from the BAAC were enough to pay back to the moneylender. Finally, in 2001, the deficit decreased to 6564 Bahts, and livestock investment seemed to be financed selling rice in storage¹¹.

4.1.3 Household 7060209008

Household earned the bulk of her income from business¹². Household also obtained additional income from farming and salaries. Income from business dropped substantially in 2000. Also, consumption peaked in 2000 and 2001 due to house repairs of 150000 and 200000 Bahts respectively.

	1998	1999	2000	2001
Consumption	127213	123837	259220	353215
Net Income	266900	325580	159080	537500
Deficit	-139687	-201743	100140	-184285
Investment	0	0	30000	0
Total Financial Needs	-139687	-201743	130140	-184285
Remittances/Gifts	0	0	1440	2100
Net Use of Savings	-500500	151500	203000	119500
Net Increase of Borrowing	0	0	0	0
Net Decrease of Lending	0	20000	20000	0
Net Assets sales	0	-39000	1000	-17500
Residual Deficit	360813	-69243	-95300	-80185

⁹In fact, income from rice farming is pretty stable, around 32000 Bahts every year.

¹⁰With a purpose of financing educational expenses household borrowed 60000 Bahts to pay back in 5 years. Also, household repaid 18000 Bahts and took a new loan for 15000 Bahts (both 1-year loans and to buy fertilizers).

¹¹Household claimed (advanced?) repayment of 84000 Bahts from loan disbursed in 1998 (due in 2002) to finance educational expenditures, and at the same time borrowing 60000 Bahts for consumption and fertilizers to repay next year. Still, last year loan of 40000 Bahts remained unpaid, or probably rescheduled together with other pending loans.

¹²Main source of income was classified as "Other Income" in the survey. When asked to specify, household claimed to provide machinery and equipment (tractors, etc) for ploughing the fields.

Household earned enough income to finance expenditures, except in 2000, when accumulated savings were used to finance the deficit. In fact, accumulated savings was the main financing device used by the household. No borrowing/lending nor remittances seemed to play an important role in financing the deficit. Note that the household claimed to increase savings by 500500 Bahts in 1998, even though that year surplus was around 140000 Bahts.

4.1.4 What do we learn from these examples?

A main lesson from these examples is that, even if we count with household financial transactions, we are not able to match each individual expenditure with its corresponding financing. For example, we may observe that savings decreased at the same time that the deficit increases, but this does not imply that the decrease in savings is used to finance the deficit. In this sense our dataset is much more limited than the ICRISAT transaction files used by Lim-Townsend (1998), where each transaction of the household showed its corresponding financing¹³. Consequently, we do not expect to do well in "tracking" the deficit as Lim-Townsend (1998). Indeed, this is not the purpose of this paper. Our goal here is to compare the role of Credit/Gift to Buffer Stocks at consumption smoothing. Nevertheless, we attempt to replicate Lim-Townsend metric on "tracking" the deficit in our sample but we end up concentrating our attention on partial correlation of financing devices to the deficit.

Second, we observe that it is not clear that trades in productive assets should be considered a financing device and not an expenditure that needs to be financed¹⁴. However, since in this paper we focus our attention on consumption smoothing, assets trades are considered as a financing device.

Finally, there exist apparent interactions among financing devices. It is possible, for example, to find that savings does not seem to "track" the deficit well when considered separately, but we often can rationalize its behavior observing borrowing and gifts changes. Our first example illustrates this point. In 1998, we observe that savings increased when the household needed to finance the deficit. However, the reason why savings increased is because borrowed amount exceeded financial needs. In this sense, partial correlation among financing devices can be informative on this point.

4.2 Summary Statistics

In this section we report summary statistics to provide a sense of how often and in what amounts each of the deficit financing devices is used by the households in our sample. We distinguish be-

¹³Our approach here estimates household consumption based on a basket of 10 goods and take the revenues and financing devices as reported by the household in the survey.

¹⁴Lim-Townsend (1998) showed that the inclusion of real capital assets as part of expenditures improved their success at "tracking" the deficit.

tween formal and informal sources of borrowings and savings; and also between trades of durable consumption (household assets), land/ponds and productive assets (investment). Results are reported in the following table where a positive number implies an a inflow of funds (decreases in savings, for example) to the household.

	% HH	years ¹⁵	25% ¹⁶	50%	75%	sdev ¹⁷
Deficit	100	4.0	-13400	2900	18700	43000
Borrowing	84	3.0	-4200	-100	5700	31700
Lending	38	2.2	-22500	-7600	-2500	61300
Gifts	82	2.7	1200	4300	10900	18600
Savings	90	3.5	-1600	-100	1800	43500
Assets Trade	94	3.0	-14700	-3700	250	120000
- HH assets	86	1.9	-6100	-1600	-250	19200
- Land/Ponds	21	1.3	-17500	-4000	15000	300000
- Productive	71	2.8	1500	-2300	-9100	36400

Both Buffer Stocks (savings and assets) and Credit/Gifts (borrowing, lending and gifts) are intensively used by the households in our sample. More than 90% of the households report saving/assets transactions in the panel. Borrowing and gifts transactions are also very common - more than 80% of the households report changes in borrowing and gifts. Lending transactions are neither that common nor frequent.

On average, borrowings, savings and assets trades seem small relative to the deficit when we compare 25 and 75 percentiles of their distributions, which may suggest the need to use more than one of these devices to finance the deficit. This is also true when we consider one-sided devices such as gifts (inflow) and lending (outflow). Only land/ponds sales appear to match 25 and 75 percentiles of the deficit, but these trades are infrequent (1.3 years out of 4, on average) and are carried out by only 21% of the households.

We also find, but not report in the table, that the relatively poor Northeast region is related to smaller borrowing amounts but a larger number of households borrowing. We find that 89% of the households in the Northeast report access to credit, while this percentage decreases to 78% in the Central region. However, borrowing amounts seems smaller in the Northeast. Interestingly, we

¹⁵Mean "across households" of the mean number of years that the financing device is actually used by each individual household - out of the 4-year panel.

¹⁶We first calculate the mean "across time" for each household. Then we report 25%, 50% and 75% values "across households".

¹⁷Similarly, we compute first the standard deviation "across time" for each household. Then we calculate the mean standard deviation"across households".

find that households in the Northeast, on average, accumulated debt for 6200 Bahts, while those in the Central region showed a net repayment of 11600 Bahts. This may in part explain why we observe larger gifts transfers in the Northeast. We also find that households in the Northeast save substantially more in crop inventories relative to formal institutions. Also, their assets trades are much lower in amounts relative to the Central region.

Landless households (and those with small plots of land) are intensive users of borrowing, gifts and assets sales relative to households with larger land holdings. Poor households, however, are clearly not users of savings. We find less a pattern for the case of households with large land holdings. Relatively rich households borrowing amounts are, on average, 5 times larger than landless households. However, we find that indebtedness of poor households is huge: mean accumulated debt of landless households was 17000 Bahts during the 4 years. This is surprising when we compare this number to those of households at the top quartile in terms of landholdings, which account a net borrowing (repayment) of -3200 Bahts respectively. We observe that gifts transfers increase with the landholdings of the household. Landless households mean gift transfer is 7000, while this is increased to 11300 for the case of rich households. Household lending transactions consist of funds that households lend to relatives, friends or business partners. We find that household lending inside the village is more frequent and involve smaller amount relative to lending outside the village. Also, as expected, richer households lend larger amounts, receive larger gifts, have larger savings and are involved in the largest assets trades.

4.3 Metrics

We employ three different metrics to assess how well each of the financing devices "track" the deficit: 1) Relative Mean Squared Errors, 2) Variance Decomposition and 3) Partial Correlations.

4.3.1 Relative Mean Squared Error (RMSE)

Let d_t denote the deficit at year t and let Δf_t denote the corresponding change in a particular financing device. We define the RMSE as in Lim-Townsend (1998):

$$\frac{\sum_{t=1}^T (d_t - \Delta f_t)^2 / T}{\sum_{t=1}^T (d_t)^2 / T},$$

where T is the number of pairs of years in our panel, 4. The denominator scales the mean squared error by the total variation in the deficit. A RMSE of 0 means "perfect tracking", and 1 implies that the financing device is essentially not used. When the RMSE is greater than 1, the financing device amplifies the deficit. This is a very strict measure of "tracking" since it analyzes financing devices separately and requires them to "track" the deficit every year. We have seen in the examples and

the summary statistics table that devices are generally used in combination with others, and that the "timing" of expenditures and revenues is not always captured by annual changes.

We find that none of the financial devices does a good job at "tracking" the deficit. Results are not much affected by including real assets purchases and livestock into the deficit as in Lim-Townsend (1998). At best, only 10% (about 80 in number) of the households are able to finance a substantial part of the deficit by using a given financing device. We then discuss the relative performance of alternative financing devices and concentrate on those households with relative success at "tracking" the deficit with a particular device (lower tail of RMSE distribution).

Percents	Brgs	Lend	Gifts	Svgs	Assets	Cred/gifts	Buffers
10%	0.73	0.98	0.66	0.80	0.76	0.57	0.73
20%	0.89	0.99	0.88	0.92	0.96	0.79	0.93
30%	0.99	1.00	0.98	0.98	1.00	0.95	1.04
40%	1.00	1.00	0.99	1.00	1.07	1.04	1.20
median	1.04	1.00	1.00	1.02	1.22	1.20	1.43
60%	1.18	1.00	1.00	1.07	1.49	1.43	1.92
70%	1.46	1.00	1.05	1.20	2.20	1.89	2.68
80%	1.97	1.09	1.14	1.43	3.31	2.65	4.56
90%	3.81	1.70	1.49	2.29	9.69	5.34	14.05

We find that Credit/Gifts dominates Buffer Stocks in RMSE. Moreover, gifts and borrowing show the lowest RMSE measures, followed by capital assets and savings. Lending does poorly since few households in the sample actually lend to others. Credit/gifts track better the deficit in the relative poor Northeast region, and Buffer Stocks do better in the Central region. In terms of household occupation, we find that both Credit/gifts and Buffer Stocks track best the deficit for farmer households, who represent 70% of the households in the sample.

Borrowing, surprisingly, appear "tracking" the deficit best for those relatively poor households. This is also the case of gifts and household assets (durable consumption) trades. Savings, however, are not used by poor and they appear to "track" the deficit best for richer households.

4.3.2 Deficit Variance Decomposition

Consider now a variance decomposition of the deficit. To illustrate, imagine a household using only savings, S , and borrowing, B , to finance the deficit. We start from the following identity,

$$DEF = S + B$$

We multiply both sides by the deficit, DEF , and take expectations to obtain

$$\begin{aligned} E[(DEF)^2] &= Cov\{S, DEF\} + Cov\{B, DEF\} \\ 1 &= \frac{Cov\{S, DEF\}}{E[(DEF)^2]} + \frac{Cov\{B, DEF\}}{E[(DEF)^2]} \\ 1 &= \beta_{S,DEF} + \beta_{B,DEF} \end{aligned}$$

If a group of households only uses decreases in savings, S , to finance the deficit, then $\beta_{S,DEF} = 1$ and $\beta_{B,DEF} = 0$. As a result, regression coefficients close to 1 will imply that the device finances a large proportion of the deficit. However, as reported in the following table, we find relatively small covariances between the deficit and the financing devices. Again, we concentrate our attention on the relative success of alternative devices.

	Brgs	Lend	Gifts	Svgs	Assets	Cred/Gifts	Buffers
All	.065 (.001)	.021 (.162)	.028 (.000)	-.033 (.238)	.102 (.255)	.114 (.000)	.070 (.460)
NE	.032 (.096)	.023 (.319)	.041 (.001)	.048 (.033)	.009 (.833)	.096 (.002)	.057 (.216)
Central	.082 (.010)	.021 (.329)	.018 (.001)	-.058 (.227)	.172 (.298)	.121 (.002)	.114 (.512)

Again, we find that Credit/gifts dominates Buffer Stocks. Borrowing and gifts show positive and significant covariances with the deficit. Except for savings in the NE, buffers stocks do not covariate with the deficit. We find that borrowing explain .265 of the variation in the deficit for wage earners. Surprisingly, savings significantly amplify the deficit for business owners. We also find interesting patterns with respect to household land holdings. Credit/gifts covariate with the deficit for all households except the richest quartile. Buffers stocks pick large point estimates but they are never significant. Savings are correlated to the deficit for richer households, but this correlation is negative (amplifying the deficit) for the richest ones.

4.3.3 Partial Correlations

As evidenced in the last two subsections, we have not succeed in accounting for a significant proportion of the deficit. This leads us to concentrate our attention on correlations between the deficit and the alternative financial devices. Indeed, our purpose here is not to account the deficit in "levels", but rather to measure the relative importance of Credit/gifts and Buffers on consumption smoothing.

This section reports conditional correlations between the deficit and financing devices. The advantage of these measures is that, when evaluating a particular device, potential correlations with other devices are taken into account.

	Brgs	Lend	Gifts	Svgs	Assets	Cr/Gifts	Buffers
Deficit	.074 (.000)	.034 (.051)	.081 (.000)	-.019 (.284)	.042 (.017)	.091 (.000)	.037 (.037)
Brgs		-.022 (.222)	-.033 (.062)	.004 (.820)	-.180 (.000)		
Lend			-.024 (.172)	.028 (.117)	-.222 (.000)		
Gifts				-.024 (.174)	-.038 (.032)		
Svgs					.020 (.253)		

Credit/gifts appear again dominating Buffer Stocks at deficit financing. Borrowing and gifts still pick the highest correlations to the deficit after controlling for potential correlations among financing devices. Surprisingly, savings do not appear correlated to the deficit nor even correlated to any other device. Although aggregate assets sales correlation to the deficit is small, we observe (but not report) that household assets sales and land/ponds sales are significantly correlated to the deficit, both with a correlation coefficient of .062. Household assets sales are more important in the relatively poor Northeast region, while land/ponds are more common in the Central region.

When we stratify our sample by land holdings, we find that Credit/gifts dominates Buffer Stock for all households except the richest ones, who seem not to use any of the devices studied in this paper. Indeed, borrowing seems very much used by landless households and those with relative small plots of land, while richest ones do not use borrowing at all. Also, household assets are more intensively used by relative poor households. Land/ponds sales are used by all except landless.

Correlations among Financing Devices We find substantial correlations among alternative financing devices. This fact may in part explain the poor performance of the RMSE and Variance Decomposition in accounting for the deficit. Also, correlations among devices would help us to understand if two devices are used as complements or substitutes to one another. In this section we report our main findings with respect to partial correlations among devices.

Assets sales (household assets in particular) and gifts appear negative correlated to borrowings, which may suggest that both devices are used as substitutes for borrowings. That is, households would sale assets either because they cannot borrow or just to repay a loan. This is also the case for gifts received from family members living in other villages. Gifts seem to work as "insurance indemnities" when they are received to repay loans. Moreover, we find that assets sales are negative

correlated to gifts transfers, which actually suggests that either assets sales or gifts substitute borrowing, but not both at the same time. Moreover, we find gifts negative correlated to borrowings only in the Central region, and negative correlated to all other devices but borrowing in the relatively poor Northeast. Indeed, we find that gifts are negative correlated to borrowing for landless households.

5 Test Results

In this section we present our main results on the role of Credit/gifts versus Buffer Stocks as means of consumption smoothing. Section IV was intended to understand the main patterns in the use of financing devices, but no attempt was made to measure their benefits at reducing consumption variations. This is the purpose of this section, which start out discussing the results for the permanent income/buffer stocks model of Zeldes (1989). Then we turn to Townsend (1994) complete markets test.

5.1 Permanent Income/Buffer Stocks Tests

Following Zeldes (1989) we run a very similar version of his permanent income regression. Results for the whole sample, by region and by household's land holdings are presented in the next table.

	All	Central	Northeast	Poor	Rich
α	(.000)	(.000)	(.000)	(.000)	(.000)
γ	65428 (.043)	157019 (.018)	-987 (.968)	113000 (.044)	8213 (.819)
β	-.076 (.024)	-.076 (.187)	-.074 (.056)	-.293 (.002)	-.040 (.210)
No. obs.	2992	1308	1684	1360	1632
Adj. R ²	.0588	.0596	.0481	.0779	.0712
Prob > F	.0000	.0000	.0000	.0000	.0000

Household in our sample fail to pass the permanent income test. The estimated impact of current income level to consumption changes is -.076. This coefficient is similar accross regions, although only significant in the Northeast. Consistent with Zeldes (1989) results, we find that households with accumulated assets (large land holdings) are able to pass the test. Much to the contrary, relative poor households face a very large impact of current income on consumption changes, estimated in the order of .293. We run similar results for quartiles of land holdings and we observe that the

coefficient on current income decreases monotonically (-.432, -.329, -.113 and -.000) as land holding increases.

We now concentrate on the estimated impact of income on consumption, β , stratifying the sample by use of a particular financing device. We consider a household a frequent *user* of a device if the household reports changes in that device at least 3 out of the 4 years of the panel. Results are reported in the following table.

	All	Central	Northeast	Poor	Rich
Credit/Gifts	-.05 (.065)	-.05 (.263)	-.06 (.147)	-.15 (.061)	-.03 (.294)
Buffers	-.07 (.061)	-.06 (.346)	-.07 (.080)	-.33 (.003)	-.03 (.418)
Borrowing	-.12 (.015)	-.16 (.106)	-.04 (.528)	-.19 (.066)	-.09 (.105)
Gifts	-.10 (.104)	-.16 (.198)	-.06 (.488)	-.43 (.007)	-.04 (.513)
Lending	-.00 (.934)	.07 (.740)	-.16 (.050)	-.69 (.030)	-.01 (.901)
Savings	-.07 (.053)	-.07 (.338)	-.09 (.037)	-.37 (.003)	-.02 (.496)
Asset Trade	-.09 (.039)	-.06 (.511)	-.07 (.144)	-.32 (.014)	-.03 (.390)

We find a similar impact of income on consumption changes for both Credit/gift and Buffer Stocks users. We find no significant results by region, but, again, when we classify households by their land holdings we observe that poor households are unable to eliminate consumption changes by using Credit/gifts or Buffers as rich household do. Surprisingly, we find borrowing users associated with a large impact of income on consumption. The estimated coefficient is -.12. Indeed, rich households still seem unable to eliminate the effect on consumption of current income by borrowing.

We now discuss the effect of the use of alternative financing devices on the impact of current income on consumption changes¹⁸. Results are presented in the following table.

¹⁸A positive measure in the coefficients above implies that the impact of current income on consumption is reduced, and viceversa.

	Cr/Gft	Buffer	Brgs	Gifts	Lend	Svgs	Asset
All	-.26 (.000)	-.15 (.053)	-.06 (.080)	-.12 (.002)	-.11 (.002)	-.13 (.017)	-.03 (.495)
Impact	.20 (.000)	.07 (.299)	-.02 (.496)	.07 (.024)	.11 (.000)	.06 (.208)	-.07 (.040)
Cen	-.30 (.000)	-.14 (.191)	-.07 (.273)	-.14 (.032)	-.12 (.045)	-.13 (.111)	-.02 (.800)
Impact	.26 (.000)	.07 (.470)	-.03 (.564)	.11 (.034)	.14 (.004)	.07 (.346)	-.08 (.091)
NE	-.06 (.420)	-.15 (.484)	-.08 (.107)	-.04 (.358)	-.07 (.080)	-.05 (.590)	-.06 (.327)
Impact	-.02 (.738)	.07 (.718)	.01 (.841)	-.05 (.239)	.00 (.970)	-.03 (.755)	-.01 (.868)
Poor	-.54 (.000)	-.16 (.236)	-.34 (.002)	-.33 (.001)	-.28 (.003)	-.21 (.067)	-.15 (.183)
Impact	.29 (.003)	-.16 (.129)	.07 (.387)	.09 (.227)	.21 (.076)	-.11 (.227)	-.19 (.034)
Rich	-.17 (.001)	-.61 (.000)	-.02 (.493)	-.06 (.100)	-.08 (.024)	-.26 (.000)	-.02 (.575)
Impact	.15 (.001)	.57 (.000)	-.04 (.157)	.03 (.268)	.09 (.002)	.24 (.000)	-.03 (.366)

We find that Credit/gifts reduce substantially the sensitivity of consumption to income. Buffer Stocks, however, do not affect significantly the effect of current income on consumption.

However, it is not borrowing (as we may expect) but gifts and lending what seems to explain the beneficial effect of Credit/gifts. Although buffers have no significant effects, we do find that assets sales increase consumption sensibility to income significantly. These results are especially true in the Central region.

It is interesting to note that when we stratify by household's land holding we still find a beneficial role of Credit/gifts for poor households. However, assets sales appear to indicate stress instead of being used to smooth consumption. On the other hand, as expected, we observe that rich households reduce consumption sensibility by means of Buffers, particularly by the use of accumulated savings. Those rich households users of Credit/gifts also reduce the impact of income on consumption.

5.2 Full Insurance Tests

We now open the possibility for insurance and gifts at household level and run the test for full insurance on the whole sample, on each region and stratifying households by land holdings. Results are presented in the following table¹⁹:

	All	Central	Northeast	Poor	Rich
α	(.000)	(.000)	(.000)	(.000)	(.000)
γ	64243 (.045)	159754 (.015)	-3286 (.894)	120270 (.032)	-2163 (.951)
β	.110 (.011)	.137 (.075)	.012 (.777)	.361 (.005)	.047 (.226)
No. obs.	2992	1308	1684	1360	1632
Adj. R ²	.0785	.0839	.0688	.0791	.1126
Prob > F	.0000	.0000	.0000	.0000	.0000

As expected from our permanent income test results, households fail to pass the test for full insurance. This is consistent with results obtained in Townsend (2002) using the same dataset. Income changes do affect consumption variation with an estimated coefficient of .110. However, we can not reject full insurance for households in the relative poor Northeast region. Nor is full insurance rejected for the case of relative rich households²⁰, while those landless or with small plots of lands face a significant effect of idiosyncratic income shocks into consumption, with an estimated coefficient of .361.

We now report the estimated impact of income on consumption, β , stratifying households by the use of alternative financing devices. The following table reports the results.

The impact of income shocks on consumption is similar for those users of Credit/gifts and Buffers, with estimated coefficients of .08 and .09 respectively. However, when we consider those households intensive users of borrowing alone, we find that their estimated impact is .20. The point estimate for those who receive gifts is .24. Surprisingly, estimated coefficient for lending households is negative, although this is only the case of rich households, who may sacrifice consumption to lend funds or increase consumption when income is low and they claim repayments (?). The point to stress here is that borrowing, lending and gifts considered separately are not associated to a low impact of income on consumption, but it seems that the combination of the three (Credit/gifts) appears beneficial for

¹⁹We do not report results for controls used in the estimation, such as age, education, wealth, etc. The F-test for the jointly significance of the time-village fixed effects α is reported.

²⁰Defined as those with land holdings larger than the median of the sample.

consumption smoothing. However, for the case of Buffers users, we observe that both savings and assets sales separately have similar coefficients (both .10) to the joint category of Buffers (.09).

	All	Central	NE	Poor	Rich
Credit/Gifts	.08 (.024)	.11 (.103)	-.01 (.765)	.46 (.000)	.02 (.539)
Buffers	.09 (.051)	.11 (.200)	.00 (.939)	.34 (.021)	.02 (.617)
Borrowing	.20 (.000)	.30 (.005)	.01 (.924)	.46 (.001)	.11 (.047)
Gifts	.24 (.000)	.22 (.031)	.22 (.003)	.49 (.001)	.17 (.005)
Lending	-.13 (.067)	-.14 (.581)	.00 (.968)	.70 (.001)	-.14 (.097)
Savings	.10 (.031)	.12 (.174)	.01 (.740)	.35 (.034)	.03 (.453)
Asset Trade	.10 (.043)	.14 (.186)	-.01 (.906)	.40 (.028)	.04 (.385)

When we stratify by region and land holdings, we find that those households in the Central region and those relatively poor face a larger impact of income shock to consumption variations. This result seems independent of the device used to finance the deficit.

We now present our results on the impact of the alternative financing devices on consumption smoothing in the following table²¹.

We find that those intensive users of Credit/gifts are able to substantially reduce the impact of income on consumption. This result holds in both regions but it is only significant for relative rich households. Buffers, on the other hand, seem to have no significant effect on consumption smoothing in the whole sample and in each particular region. However, we find a perverse effect of buffers for the case of poor households and a substantial beneficial impact on relatively richer households.

²¹A positive measure in the coefficients above implies that the impact of income change on consumption is amplified, and viceversa.

	Cr/Gft	Buffer	Brgs	Gifts	Lend	Svgs	Asset
All	.35	.11	.09	.18	.17	.04	.07
	(.000)	(.239)	(.052)	(.000)	(.000)	(.565)	(.163)
Impact	-.29	-.01	.05	-.13	-.22	.08	.05
	(.000)	(.954)	(.229)	(.005)	(.000)	(.293)	(.256)
Cen	.36	.07	.11	.23	.25	.02	.07
	(.001)	(.641)	(.146)	(.007)	(.003)	(.900)	(.414)
Impact	-.29	.08	.15	-.18	-.25	.15	.11
	(.006)	(.579)	(.025)	(.011)	(.000)	(.184)	(.118)
NE	.21	.19	.16	.02	.04	-.04	.09
	(.033)	(.402)	(.005)	(.648)	(.348)	(.713)	(.299)
Impact	-.22	-.18	-.21	-.02	-.13	.06	-.09
	(.027)	(.424)	(.000)	(.706)	(.013)	(.619)	(.302)
Poor	.44	.15	.38	.40	.37	.19	.28
	(.007)	(.410)	(.006)	(.004)	(.004)	(.219)	(.057)
Impact	-.11	.25	-.04	-.08	-.33	.24	.12
	(.451)	(.085)	(.712)	(.477)	(.005)	(.055)	(.312)
Rich	.37	.43	.03	.11	.12	.09	.03
	(.000)	(.003)	(.475)	(.012)	(.003)	(.353)	(.604)
Impact	-.37	-.40	.06	-.11	-.18	-.05	.03
	(.000)	(.007)	(.126)	(.006)	(.000)	(.636)	(.438)

We find that it is not borrowing but gifts and lending what seems to explain the result on Credit/gifts. This pattern is more clear when we stratify by region. While in the relatively poor Northeast borrowing and lending considered separately seem helpful, in the Central region borrowing alone amplifies consumption variations, but this effect seemed more than compensated by the role of gifts and lending. This is also true for the case of richer households, where the apparent (not significant) perverse effect of borrowing is more than compensated by gifts and lending. Both cases evidence that it is the combination of borrowing, gifts and lending (Credit/gifts) which seems to be important for consumption smoothing.

It is also interesting to note that while buffers help to reduce the impact of income on consumption for rich households, when we consider savings and assets trades separately we find no significant effects. This fact may suggest that both savings and assets sales used together are necessary to reduce the impact of income on consumption.

6 Final Remarks

In this paper we employed data on financial transactions to study the role of Credit/gifts and Buffer Stocks in consumption smoothing for rural households in Thailand. Much of the empirical literature has focused on the effect of "buffers" - cash holdings, savings, crop inventories and capital assets - on consumption smoothing (See Zeldes (1989), Deaton (1990), Rosenzweig-Wolpin (1993), Paxson (1994), etc). These studies "shut down" insurance markets by assumption and employ the permanent income model as the benchmark. However, we find that Credit/gifts (borrowing/lending and gifts) transactions abound in the data. Although "buffers" (savings and asset sales) are more intensively used relative to Credit/Gifts (borrowing/lending and gifts), still more than 80% of the households claimed to have borrowed and received gifts transfers. We also find that it is particularly the case of landless households (and those with small plots of land) where borrowing, gifts and assets sales are more common.

Surprisingly, using two alternative tests of consumption smoothing, we find that those relatively intensive users of Buffer Stocks are not able to do better on consumption smoothing. Indeed, relatively poor households seem to do worse on consumption smoothing when they use buffers. However, a caveat applies. If poor households are intensive users of currency (as Deaton (1990) and Lim-Townsend (1998) documented) to buffer shocks, we are definitely understimating the effect of Buffers on consumption smoothing since currency is not observed in our dataset. Consistent with previous studies, we find that Buffers do substantially reduce the impact of income on consumption changes for relatively rich households.

Our main conclusion from our findings is that there seem to exist a prominent role of informal borrowing/lending and gifts transfers in consumption smoothing for relatively poor households. Two main findings support this statement. First, the relatively poor Northeast region does better in terms of consumption smoothing²². What is it "special" about the Northeast relative to the Central region? More access to (informal) credit, larger gifts transfers and assets trades in much lower amounts seemed important for the relative success of the Northeast. Moreover, in the Central region, the role of gifts and household lending seemed essential to revert the perverse result of borrowing on consumption smoothing. Second, even though relatively poor households had more limited access to credit, we found that Credit/gifts succeeded to reduce the impact of current income shocks on consumption. This result was especially significant in the permanent income test. When we employed the complete markets benchmark, we loose the statistical significance of this finding, probably explained in part by the inability of poor households to compensate for the increasing indebtedness with gift transfers.

²²The Northeast actually pass the test for full insurance.

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