HOUSEHOLD CONSUMPTION IN A DEVELOPING COUNTRY AND ITS RESPONSE TO EXTERNAL SHOCKS

Ayushi Singh

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Approved by:

Toan Phan

Simon Alder

Patrick Conway

Lutz Hendricks

Stanislav Rabinovich

ABSTRACT

Ayushi Singh: Household Consumption in a Developing Country and its Response to External Shocks
(Under the direction of Toan Phan)

Using household-level data from Thailand, I document the existence of non-homothetic preferences and consumption smoothing. I find that households consume a higher share of food items at lower budget levels and a higher share of non-food items at higher budget. Households in Thailand can smooth consumption to a large extent, but not perfectly. I then investigate household consumption response to a government spending shock and a negative productivity shock, identified via drought. A significant result is that the marginal propensity to consume (MPC) given a government spending shock is decreasing in the liquidity of a household and financial development of the region. I find that food consumption falls during a drought shock, with no significant change in non-food consumption. I also discuss different margins of adjustment such as labor supply, scale of business, and balance sheet adjustments response that households may employ to ensure consumption smoothing during a drought.

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CHAPTER 1

Consumption Patterns in a developing country

1.1 Introduction

Understanding consumption patterns for households is imperative for formulating macroeconomic models. There is an immense scope of research when studying different consumption characteristics among households. In this paper, using data from Thailand, I focus on two features, namely, non-homothetic preferences and consumption smoothing. I will also briefly discuss regional comparison patterns in Thailand.

Non-homothetic preferences imply that for some goods, with an increase in budget, the share of that good falls. Usually we find that food consumption is a necessity, i.e, when there is an increase in income, households reduce the budget share of food items. Some recent studies have used non-homothetic preferences to reassess how any external event would affect social welfare and, more importantly, the distribution of welfare effects. It is also an important topic when we consider the price effects of an exogenous event. An event that causes a fall in income will harm all households. More households are now at low levels of income, increasing the consumption of the necessity, thereby increasing the relative prices of those goods, leading to a further negative effect on poor households. When we incorporate non-homothetic preferences in our models, we consider the change in the consumption share of necessity and luxury goods with changes in the budget. Without considering these preferences, we will underestimate the damage of a negative wealth shock on poor households.

Many studies have found evidence of consumption smoothing behavior among households. I find the same from the Thailand data. Heterogeneity in this behavior, especially the regional differences, holds relevance for policy implications. Households that smooth their consumption more will respond less to transient income change owing to economic policies. Consumption smoothing is also related directly to households' ability to insure against risk and ensure stable and smooth flow of consumption despite income or wealth shocks, making it an obvious and essential study in development economics.

This paper has the advantage of using monthly household-level data that covers 14 years and 800 households. I will briefly discuss other data sets that can be utilized for a similar study and my rationale for choosing the Thailand Townsend data. Other data sets focused on consumption behavior include the Consumer Expenditure Survey released by the US Bureau of Labor Statistics, and Household Finance and Consumption Survey (HFCS), compiled by the European Central Bank, both surveys contain data for relatively wealthy countries. My focus for this study, however, is to observe household behavior in developing countries. A good source for household-level data from developing countries is the Household Consumption and Expenditure Surveys (HCES), also referred to as Household Income and Expenditure Surveys (HIES), Household Budget Surveys (HBS), or Living Standards Measurement Surveys (LSMS). These surveys have more extended panels starting in the 1980s. The advantage of Thailand's data is it is compiled monthly compared to the surveys mentioned above. Among the freely accessible survey datasets provided by the World Bank, there are only a few years of data per country. Another valuable data set is the Indonesian Family Life Survey collected by the RAND organization. It is a set of 5 longitudinal surveys during the period 1993-2007 containing extensive information at household level.

Section 2 includes literature on non-homotheticity, and consumption smoothing. It also discusses other papers based on the data set used in this paper. Section 3 introduces the data. Section 4 includes different models and specifications for non-homotheticity and consumption smoothing, and their application to Thailand data. Section 5 concludes the chapter.

1.2 Literature

Initial work on non-homothetic preferences started with Geary (1950) and Stone (1954). The resulting Stone-Geary preferences introduced subsistence consumption to the Cobb-Douglas utility function. It is commonly used in the structural transformation literature as well.

Cravino and Levchenko (2017) studied 1994 Mexican peso devaluation and found that it altered relative prices hence having distributional effects as the cost of living increased differently for people in different income brackets. Poor people were seen to consume a larger share of tradeable products and cheaper varieties. By increasing the relative prices for these products, devaluation was found to be anti-poor. Not only the goods predominantly consumed by poor households were more expensive, but because poor households have lower real wealth, they will increase the share of these products in their budgets. Bems and Di Giovanni (2016) studied the welfare costs of external rebalancing due

to the Great Financial Crisis in the European periphery countries and the Baltic countries. They compare the effects of conventional expenditure switching and income-induced expenditure switching (IIES); the latter allows for non-homothetic preferences. They find IIES reduces the welfare costs of the external rebalancing by between 12-17%. This was because the former preferences did not account for the fact that people would substitute domestic products from imported ones when at lower income levels, hence reducing the welfare loss.

Non-homothetic preferences are often studied in the literature on structural transformation, where they study the development of the agricultural, manufacturing, and services sector as a country develops. The literature finds that people prefer agriculture goods more at the low-income level and service sector goods more at high levels of income. I refer to the microeconomic literature on demand estimation which utilizes non-homothetic preferences.

Herrendorf et al. (2013) introduced a multi-sector growth model that can incorporate other structural transformation theories as well. Their benchmark model has four sectors, agriculture(A), manufacturing(M), services(S), and investment(X). Preferences are defined over a sequence of composite good C_t, where C_t is defined as

$$C_t = [\omega_a^{\frac{1}{\epsilon}}(c_{at} - \bar{c_a})^{\frac{\epsilon-1}{\epsilon}} + \omega_m^{\frac{1}{\epsilon}}(c_{mt})^{\frac{\epsilon-1}{\epsilon}} + \omega_s^{\frac{1}{\epsilon}}(c_{st} + \bar{c_s})^{\frac{\epsilon-1}{\epsilon}}]^{\frac{\epsilon}{\epsilon-1}}$$

, where $0<\beta<1, \bar{c_i}$, $\omega_i \geq 0$ and $\epsilon > 0$. This falls under the Stone Geary form of preferences and is the most common way to portray non-homothetic preferences.

Tiezzi (2005) studied the welfare effects and the distributive impacts on Italian households of the Italian Carbon tax. They used the Quadratic Almost Ideal Demand System (QUAIDS), developed by Banks et al. (1997), which is common in Microeconomics literature. The welfare effects have been calculated using True Cost of Living index numbers and the Compensating Variation. They find substantial welfare losses, and the effect becomes bigger as we move up the income distribution.

Demeke and Rashid (2012) used QUAIDS to estimate the welfare impacts of rising food prices in rural Ethiopia. They studied the first and second-order Taylor expansion of the compensated variation.

Consumption smoothing is a relatively more discussed topic in the existing literature on consumption. There are other consumption smoothing-related studies done using the same data set as I

am using. Kinnan (2021) found that informal insurance is an important risk-smoothing mechanism in developing countries. Yet, this risk-sharing is incomplete; household consumption moves with contemporaneous household income. In Kinnan and Townsend (2012), authors emphasized the importance of kinship networks in Thailand villages in facilitating consumption smoothing and investment financing. A contrasting result is shown in Bonhomme et al. (2012). In this paper, authors identify labor supply as an endogenous variable and consider variations in non-labor income and wages; they reject the risk-sharing hypothesis and show that poor households show more significant rejection of the risk-sharing hypothesis.

There are instances of studying consumption smoothing behavior in other developing countries as well. Fafchamps and Lund (2003) found that when faced with income and expenditure shocks, mutual insurance does not appear at villages in the Philippines; rather, households receive help primarily through networks of friends and relatives. They suggest a quasi-credit model where risk is shared within networks through flexible, zero-interest informal loans combined with pure transfers. Janzen and Carter (2018) used data from Kenya to show when faced with a wealth shock, wealthier households primarily cope by selling assets, and poorer households cope primarily by cutting food consumption. They also found that, on average, an innovative microinsurance scheme reduces both forms of costly coping. Islam and Maitra (2012) use data from Bangladesh and find that short-term health shocks experienced by the households do not have a statistically significant effect on changes in consumption. If the household incurs a big expenditure or income loss due to sickness, it reduces its food expenditure in the long run. The instrument households use for insurance is trading their livestock. They also find that microcredit can help insure consumption.

1.3 Data

I have used data from the Townsend Thai project (Townsend, 2017). I have included data collected at the household and financial institutes level from Thailand. This project was initiated in 1998 in four provinces of Thailand, two in the Central region and two in the North-Eastern region. It is an attractive data set because it covers over 700 households over 170 months and because the households are spread across the two fundamentally different regions. Central Thailand is fertile and urbanized, whereas Northeast Thailand is semi-arid and relatively poor. Data were collected from four villages in each province. Figure 1.1 shows the location of the four provinces in Thailand, and Figure 1.2 uses data provided by UNDP to demonstrate the contrasts in the two

regions. Lopburi and Chachoengsao are located in central Thailand, and Buriram and Sisaket are located in north-eastern Thailand. The difference in road connectivity and vehicle registrations in the two regions demonstrates the difference in households' wealth and regional development, respectively. Internet access seems to be homogeneous across the four provinces. There is a regional contrast in the gross provincial product; however, Chachoengsao has decidedly higher GPP among the provinces.

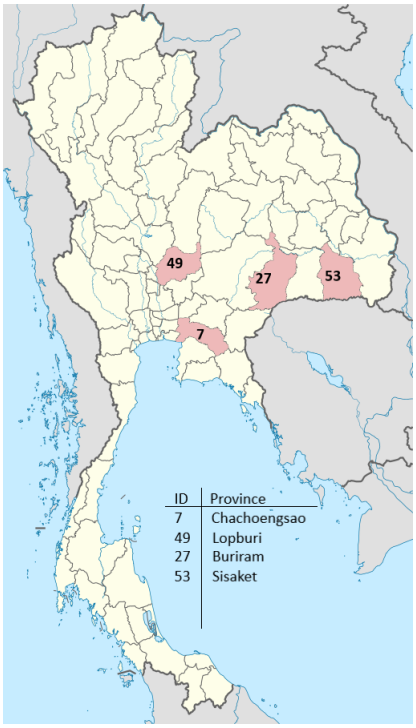


Figure 1.1: Thailand: provinces in the data set

Table 1.1 provides the summary statistics for household consumption in different provinces. The high value of standard deviation is an indicator of high heterogeneity in this data. The top panel of the table gives the summary statistics for the nominal monthly expenditure. The bottom panel converts it to log real per-capita expenditure at the quarterly frequency used in our analysis. Figure 1.3 shows average consumption for the four provinces over time. From the figure, I can infer two points. First, there is high seasonality in this data; this is intuitive for monthly consumption series, especially in rural and semi-urban regions. Second, there is a clear difference in each province's level of consumption, making this data set ideal for any heterogeneity-related study.

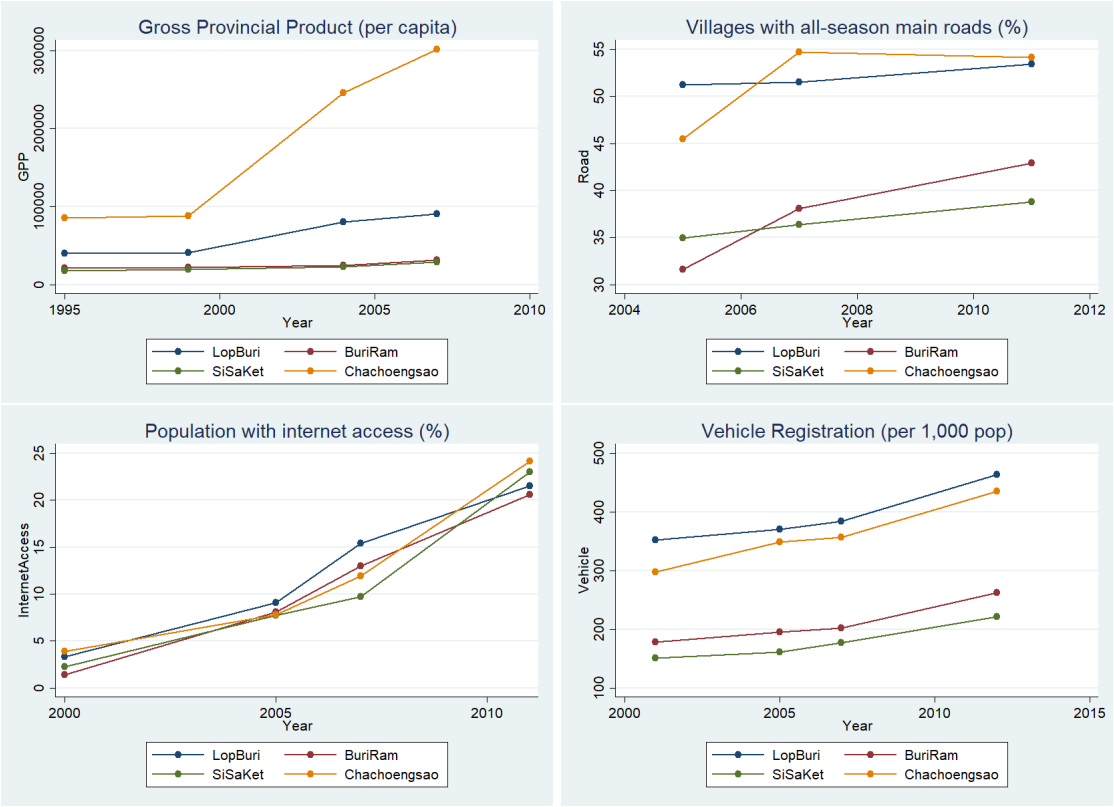


Figure 1.2: Differences among the provinces

Province ID	7	27	49	53
Nominal household consumption expenditure (Monthly)				
Mean	8706.18	5199.92	6684.75	3314.03
SD	15196.58	8638.28	15180.77	8312.88
N	29483	31070	30432	28095
Log real per-capita consumption expenditure (Quarterly)				
Mean	4.25	3.85	4.07	3.39
SD	.57	.59	.66	.56
N	9427	9905	10008	8927

Province ID-7-Chachoengsa (Cen)

Province ID-27-BuriRam (NE)

Province ID-49-LopBuri (Cen)

Province ID-53-SiSaKet (NE)

Table 1.1: Thailand Consumption Data Summary Statistics

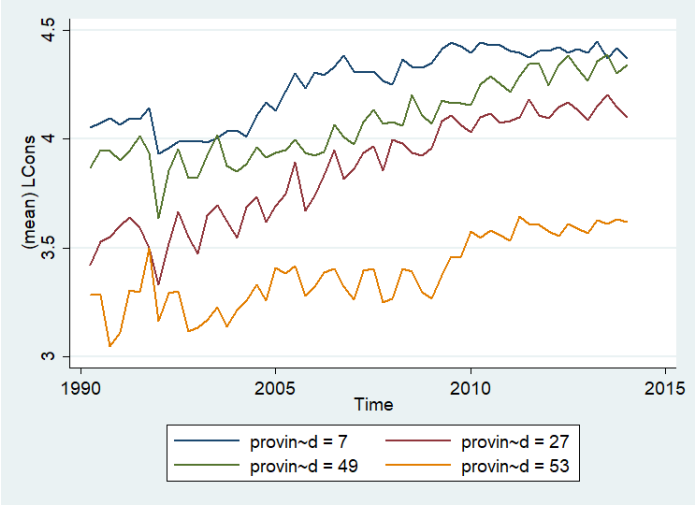


Figure 1.3: Average consumption over time

Province id 7 & 49- Central. Province id 27 & 53- North Eastern

1.4 Non-Homothetic Preferences

We start by plotting budget shares of food and non food goods on log expenditure (the Budget Share Engel Curves).

Figure 1.4: Budget share of Food Goods

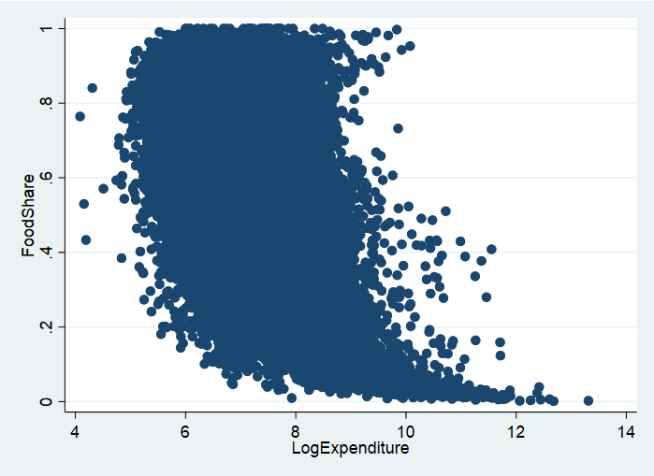
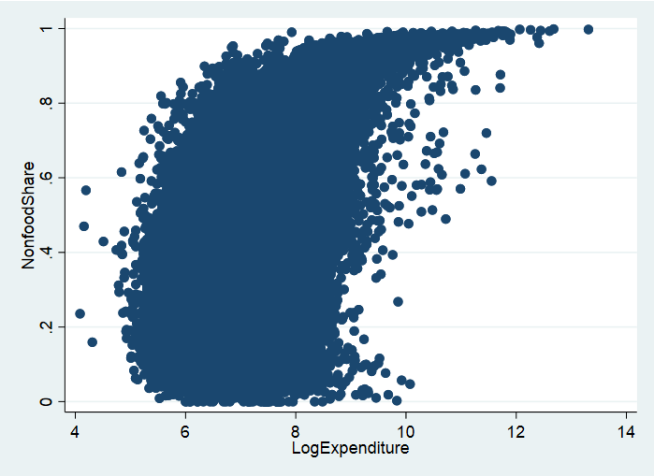


Figure 1.5: Budget Share of Non Food Goods



Homothetic preferences imply that budget share should not change with income but Figures 1.4 and 1.5 show that this is not the case. The budget share of food decreases in log expenditure, and the budget share of non-food is increasing in log expenditure. The consumption data was reported in nominal terms and was divided to real by dividing by regional CPI. I have also estimated AIDS and QUAIDS preferences for Thailand data. These preferences give the budget share of a good as a function of relative prices and total expenditure and fit Thailand data rather well. Deaton and Muellbauer (1980) introduced Almost Ideal Demand System (AIDS), wherein the budget shares of the various commodities are linearly related to the logarithm of real total expenditure and the logarithms of relative prices. The demand functions in the budget shares are given as:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log X/P$$

where w_i is the budget share of good i, p_i is the price of good i and X is total expenditure. In this model budget share of a commodity (and not just the consumption of that commodity) depends on total income.

Banks et al. (1997) introduced the Quadratic Almost Ideal Demand System (QUAIDS) which includes a quadratic in the logarithm of total expenditure. This permits goods to be luxuries at

some income levels and necessities at others. The demand system is given by:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{i,j} \log p_j + \beta_i \log \left(\frac{X}{a(p)} \right) + \frac{\lambda_i}{b(p)} \left[\{ \log \left(\frac{X}{a(p)} \right) \} \right]^2$$

w_i is the budget share of good i, p_i is the price of good i and X is total expenditure.

Details of the two systems, including definition of a(p) and b(p), are provided in the appendix.

Table 1.2: AIDS-QUAIDS Model

	AIDS	QUAIDS
α_{food}	0.467^{***}	0.466^{***}
	(0.0012)	(0.00119)
$\alpha_{nonfood}$	0.533^{***}	0.533^{***}
	(0.0012)	(0.00119)
β_{food}	-0.154^{***}	-0.161^{***}
	(0.0005)	(0.000893)
$\beta_{nonfood}$	0.154^{***}	0.161^{***}
	(0.0005)	(0.000893)
$\gamma_{F,F}$	0.108^{***}	0.107^{***}
	(0.0027)	(0.00276)
$\gamma_{F,N}$	-0.108^{***}	-0.107^{***}
	(0.0027)	(0.00276)
$\gamma_{N,F}$	-0.108^{***}	-0.107^{***}
	(0.0027)	(0.00276)
$\gamma_{N,N}$	0.108^{***}	0.107^{***}
	(0.0027)	(0.00276)
λ_{food}	-	-0.004^{***}
		(0.000426)
$\lambda_{nonfood}$	-	0.004^{***}
		(0.000426)

t standard errors in parentheses

*** $p < 0.10$, ** $p < 0.05$, * $p < 0.01$,

Table 1.2 provides the estimates of the system using Thailand household data. The symmetry in the results in $\beta's$ and $\gamma's$ are due to restriction used to identify the demand system. A negative β_{food} classifies food goods as a necessity, and a positive $\beta_{non-food}$ classifies non-food goods as a luxury in both the models. This implies with an increase in budget, the share of food goods should

decrease, and the share of non-food goods should increase. Interpretation of γ's is as expected. An increase in food price decreases the budget share of food goods and increases the budget shares of non-food goods and vice versa. Poor households have a higher share of food items in their basket of goods, whereas rich households have a higher share of non-food goods. Despite the obvious nature of the result, theoretical models often do not account for this consumption characteristic, leading to biased results, especially when studying external economic shocks' welfare effects. For instance, whenever there is a negative income shock, all households are poorer, but households will now consume more food items (since they are at lower income levels), thereby pushing up the relative prices of food goods. As a result, households at the lower end of income have lower-incomes, and the good dominating their goods baskets is costlier due to the shock, Cravino and Levchenko (2017) shows this result in their study about the effect of devaluation in Mexico.

Table 1.3: Budget Elasticity

	All	North East	Central
Food Share	0.554	0.663	0.069
Non Food Share	1.616	1.613	1.998

Table 1.4: Cross Price Elasticity

	All		North East		Central	
	P_{Food}	$P_{Nonfood}$	P_{Food}	$P_{Nonfood}$	P_{Food}	$P_{Nonfood}$
Food Share	-0.787	0.232	-0.766	0.102	-1.290	1.220
Non Food Share	-0.294	-1.321	-0.425	-1.187	0.311	-2.309

Table 1.3 provides the budget elasticity in the QUAIDS model. One percent increase in income or budget will lead to a 0.554 percent increase in the budget share of food items, whereas it will lead to a 1.616 percent increase in the budget share of non-food items. With an increase in income or budget, households demand more non-food goods relative to food goods. This shows that households will not increase their consumption in the same ratio given an increased income. I further compare these elasticities for different regions. Food share responds approximately 10 times more in the North-Eastern region than in the Central region. Non-food share responds more in the Central

region relatively. There is non-homotheticity for food consumption in both regions; QUAIDS results for different regions are included in the appendix. Table 4 shows own and cross price elasticities. Two observations are lower price elasticities for food share and negative cross price elasticity for non-food share originating from North-East. This would mean that higher price of food goods in this region will make households significantly poor, they will be reduce their non-food consumption as well.

Figure 1.6 show that average household wealth is significantly higher in the Central region and that Non-Food share is consistently higher in the Central region. In the North-Eastern region, food share mostly overshadows non-food share with few instances of overlap. This is consistent with the non-homothetic argument of wealthier households having a higher non-food share in their expenditure. Since the food share is usually greater than non-food share in the North-East region, a rise in price in there will have more severe effects than a similar increase in Central region.

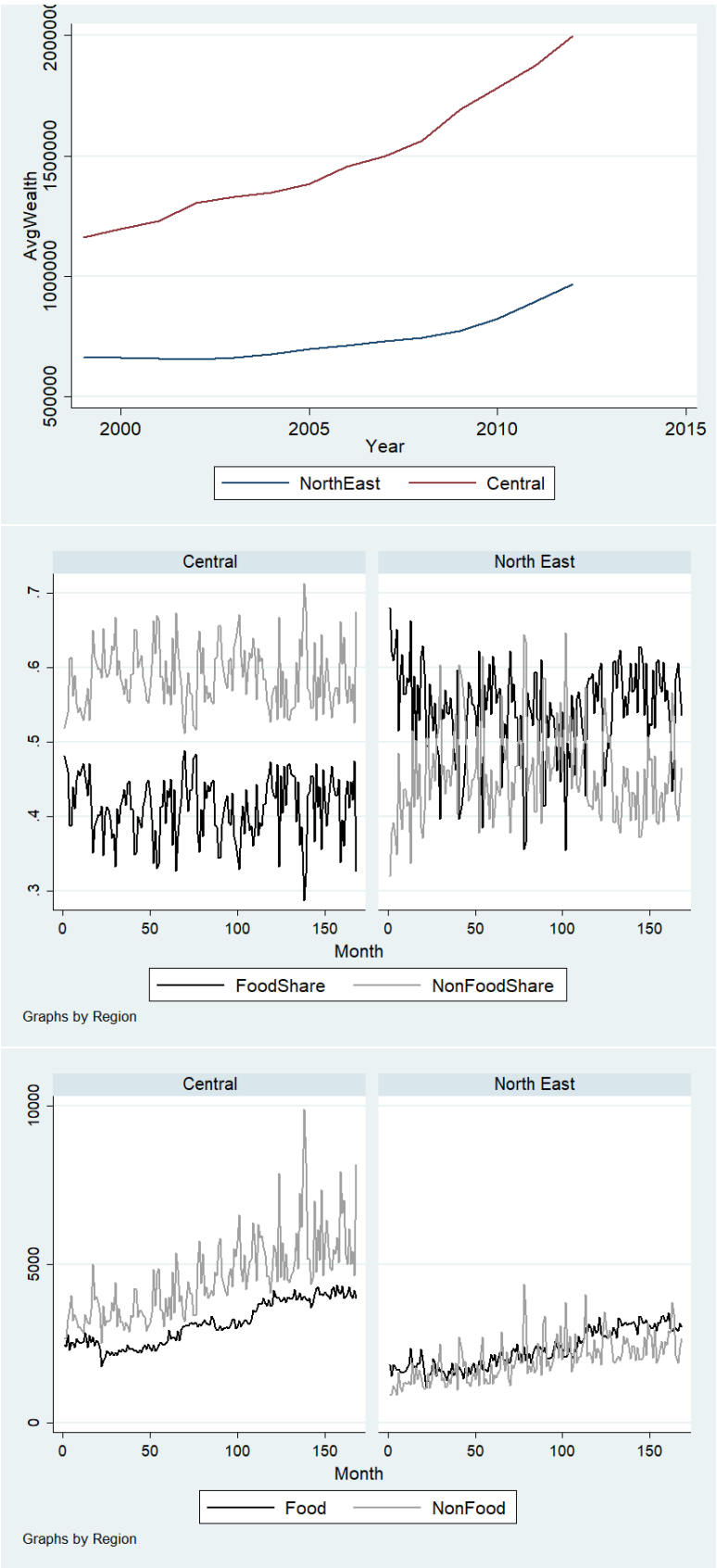


Figure 1.6: Regional Wealth and Consumption

1.5 Consumption Smoothing

I start this section by estimating the equation used by Townsend (1995). I compare my results from the results in the original paper, also based on data from Thailand. The following consumption smoothing equation was used in the paper.

$$\frac{\ln c_t^i - \ln c_\tau^i}{t-\tau} = \beta \frac{\ln \bar{c}_t^g - \ln \bar{c}_\tau^g}{t-\tau} + \phi \frac{\ln y_t^i - \ln y_\tau^i}{t-\tau} + \epsilon_{t,\tau}^{i,g}$$

c is household consumption, y is household income and c^g is average group consumption. We consider village to be a risk sharing group in this paper, this is in accordance to other related studies using Thailand data that found kinship networks at village levels that aid in risk-sharing. If risk sharing is complete, the coefficient on group consumption will be one, and the coefficient on household income will be zero. ϕ can be interpreted as marginal propensity to consume income. In another specification for consumption smoothing in the same paper, the author regressed the difference in household consumption on just the difference in household income. Townsend (1995) uses district level data in the regressions. The difference between two time points ranges from two to five years. The samples were collected in 1975, 1981, 1988 and 1990. All these reasons lead to much higher results as compared to my results. As I aggregate my data, the resulting MPC increases, however, I do not have enough districts and year to replicate their results.

Table 1.5: Consumption Smoothing: Version 1

	(1)	(2)	(3)	(4)	(5)
	LConsMonthD	LConsMonthD	LConsYearD	LConsYearD	LConsYearVilD
LConsAvgMonth	0.00160***				
	(0.000203)				
LIncMonthD	0.00716***	0.00737***			
	(0.00122)	(0.00122)			
LConsAvgYearD			0.718***		
			(0.0448)		
LIncYearD			0.0576***	0.0601***	
			(0.00744)	(0.00758)	
LIncYearVilD					0.0762**
					(0.0249)
Unit	Household	Household	Household	Household	Village
Time	Month	Month	Year	Year	Year
N	57146	57146	7209	7209	203
adj. R^2	0.002	0.001	0.065	0.023	0.058

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.5 estimates the two specifications for consumption smoothing from Townsend (1995) on Townsend Thailand data. Column 1 and 2 corresponds to household level monthly data. Column 3 and 4 corresponds to household level annual data. Column 5 data corresponds to village level annual data. As I aggregate the data, moving from column 1 to column 5, the coefficient for log change in income keeps increasing reaching a maximum of 0.076 in the fifth column. It is still significantly lower than the .35 at an average found by the original paper, but due to data limitations I can not reach that stage of aggregation.

Full insurance model should have $\beta = 1$ and $\phi = 0$. Our results suggest rejection of full insurance. However, the coefficient is very low at approximately 2%, implying that households can still insure (though not perfectly) against income changes. This shows that there is imperfect consumption smoothing in Thailand, demonstrated by the positive and significant coefficient on log difference of income. This shows that log change in consumption moves with log change in income, but this change is not one-to-one. Log change in consumption also depends on average consumption in the village the household is located in. Household consumption moves along with average village consumption given the risk-sharing mechanism at the village level; these include informal borrowing and lending and gifts and transfers.

Kinnan and Townsend (2012) studies the importance of kinship networks in facilitating consumption smoothing, using the same data set as used in this paper, another variation of consumption smoothing equation was used.

$$\Delta c_{ivt} = \alpha_1 \Delta y_{ivt} + \alpha_2 \Delta y_{ivt} \times r_{i,B} + \beta_1 \Delta y_{ivt} \times k_i$$

$$+\beta_2 \Delta y_{ivt} \times \bar{w_i} + +\beta_3 \Delta y_{ivt} \times a_i + \delta_{BB,t} + \epsilon_{it}$$

where c_{ivt} and y_{ivt} are, respectively the per capita consumption and income of household i in month t , r_{iB} indicates connection to the financial system, k_i is an indicator for presence of kin in the village, $\bar{w_i}$ is household i âs average net worth over the sample period, a_i is the number of transaction partners a household is ever observed to have, and δ_{Bt} is a common time effect for all households connected to the financial system.

They explain the difference from the old equation as "We use levels, rather than logs, because some households have zero or negative net income in a given month, and we do not want to discard those observations."

Table 1.6: Consumption Smoothing: Version 2

	(1)	(2)	(3)
	ConsD	ConsD	ConsD
IncD	0.0109***	0.0111***	0.0375*
	(0.00397)	(0.00399)	(0.0192)
Central Region×IncD			-0.0323*
			(0.0195)
_cons	29.30	-187.4**	-166.2**
	(47.07)	(80.47)	(80.96)
Time Fixed Effects		Yes	Yes
Adjusted R2	0.00167	0.00219	0.00432
N	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

ConsD is the first difference of consumption

IncD is the first difference of Income

I have included the consumption smoothing results from this paper for comparison purpose. The slight difference in the baseline regression is because this paper used an older version of the data. My baseline result mimics Kinnan and Townsend (2012) baseline results well, they found that a one baht income change associated with a 0.0078 baht consumption change. In my results- a one baht income change associated with a 0.0111 baht consumption change. The effect of household located in Central region is to decrease consumption sensitivity by 0.0323 baht per one baht income change.

1.6 Conclusion

This paper has shown non-homothetic preferences in Thailand household consumption using AIDS and QUAIDS. We often assume that household's preferences over food and non-food items remain constant at different income levels. However, this paper shows that household's preferences change as their income changes; they relatively demand more food items at low-income levels and

more non-food items at high-income levels. Though not uncommon in Micro literature, these kinds of demand structures are rarely used in macroeconomic literature, except when studying an economy's structural transformation. There is scope to study how household consumption of food and non-food goods respond to temporary and permanent shocks and how the response would differ in the short-run and long run. Secondly, I discussed consumption smoothing in Thailand with the existence of partial risk-sharing at the village level. Since consumption smoothing is imperfect, household consumption will respond to exogenous shocks, also the ability to smooth consumption differs from household to household leading to heterogeneity in consumption response to a given shock.

CHAPTER 2

Heterogeneous Consumption Responses to Fiscal Spending Shocks in a Developing Country

2.1 Introduction

Fiscal policy has always been a highly debated topic among economists. Depending on the theoretical model, fiscal policy can have no, temporary or permanent effects on output. The empirical evidence is also mixed, and the the effects of fiscal policy remain an important research area, especially for developing countries. Furthermore, the effects could be heterogeneous across households. I study the effect of fiscal spending on household consumption in Thailand and disaggregate the consumption response by household characteristics and by consumption categories.

The analysis of government policies in developing countries is crucial for several reasons. First, there is a lack of such empirical studies on developing countries which usually have more limited government resources due to a narrow tax base. Governments in developing countries are also known to engage more in discretionary policies instead of automatic stabilizers (Jansen (2004)). These discretionary policies mainly aim to meet short term objectives, which makes it important to study how a developing country's economy responds to a fiscal policy change in the short run. Second, the heterogeneous effects of fiscal policy shocks on different types of households could be especially relevant in developing countries for example due to the large inequality of access to financial services that affects how households can smooth their consumption in the presence of shocks. Detailed microeconomic data makes it possible to study the effects of government policies at different margins. It gives us vital information regarding household and region-specific responses to the policy, enabling valuable policy suggestions. For instances some households or regions might have a higher marginal propensity to consume in response to government spending. This is valuable information if the government aims to use discretionary spending to boost the economy.

This paper first identifies government spending shocks in Thailand using the Structural Vector Auto-Regressive methodology described in Blanchard and Perotti (2002). I will then regress these shocks on household-level consumption using rich monthly microdata from Thailand that contains

observations on household balance sheets, regional measures of financial development, and detailed consumption information. The household data I employ comes from four provinces in Thailand. Two of the provinces belong to the less developed and rural North-East region and two in the relatively more developed, semi-urban Central region. The two origins are significantly different in average wealth and scale of development, allowing me to study fiscal policies' effects in different economic contexts. To analyze the role of household liquidity, regional financial development, and household composition for the consumption response to a fiscal policy shock, I interact these variables with the fiscal spending shock to compare how households respond along these two margins. I also run separate regressions of food and non-food consumption.

I find that positive government spending shocks increase private consumption. When allowing for heterogeneity in the effect of the fiscal shock on household's consumption, I find that it is precisely the households likely to be liquidity and credit constrained whose consumption reacts more strongly to fiscal shocks. This finding confirms the predictions of standard theory, as well as existing empirical results from developed countries. Households that do not face these constraints are better able to smooth their consumption, as a results their consumption's response to fiscal shocks would be less as compared to households that face liquidity and credit constraints and are less likely to smooth consumption.

The existing literature found similar results for how consumption responds to policy shock and household liquidity in the context of developed countries. Mankiw (2000) emphasizes the need to account for heterogeneity when studying the fiscal policy effect by identifying two types of agents: the low-wealth households who are unable to smooth consumption (spenders), and the high wealth households who can successfully smooth consumption (savers). Similar empirical results include Kaplan and Violante (2014), who suggest a large part of heterogeneity in the consumption response to the US stimulus payments depends on households' hand-to-mouth status, and Jappelli and Pistaferri (2014), who use the 2010 Italian Survey of Household Income and Wealth to show that given a fiscal stimulus check, households with low cash-on-hand exhibit much higher marginal propensity to consume (MPC). Concerning consumption categories, the paper finds that food consumption reacts more strongly to fiscal shocks. This result is interesting because using a model with non-homothetic preferences; I can classify food as a necessity and non-food as a luxury good, making food consumption relatively inelastic. Given the non-homothetic preferences, we would expect non-food

consumption to increase more in response to fiscal shocks compared to food consumption. One possible way to explain this result is that other consumption categories are costly to adjust due to indivisibilities in large items, like housing or consumer durables.

The rest of the paper is structured as follows. Section 2 discusses the related literature, section 3 analyzes how different components of government budget affects household income, section 4 contains the fiscal shock identification, section 5 analyses household and region-specific effects of the fiscal policy, section 6 differentiates policy responses by consumption categories of food and non-food consumption, section 7 briefly analyzes consumption elasticities for various components of the government budget and section 8 concludes the paper.

2.2 Related Literature

Fiscal policy can support short-run goals such as stimulating the economy or long-run objectives such as growth. Expansionary fiscal policy is not without costs, including crowding out of private investment, rising public debt ratios, and inflation. Ricardian equivalence claims that households are forward-looking, implying that consumers will not increase consumption with an increase in government spending since they expect the government to raise taxes in the future to make up for the current rise in its expenditure. This idea was advocated by Barro (1974). Aschauer (1985) uses the Citibank economic database to provide empirical evidence for the Ricardian equivalence. They use full information maximum likelihood method to estimate a two equation system of consumption and government spending while restricting the way in which past government expenditure and deficits influence consumption.

There have been many arguments against the existence of Ricardian equivalence. Feldstein (1986) showed that when an individual's future income is uncertain, then his future endowments will also be uncertain; thus, consumption rises more in response to an increase in current income than a present value increase in income of his heirs. Fatás and Mihov (2001) use US data to show that an increase in government expenditure increases output by more than one-to-one, mainly driven by consumption. Ravn et al. (2007) employ a panel VAR analysis using data from four developed countries, the US, the UK, Canada, and Australia, to show that an increase in government purchases leads to a rise in private consumption.

Apart from studying the total change in consumption, it is also imperative to investigate any heterogeneity in the consumption response. These studies aid in better aiming the fiscal policy

for the desired result. Anderson et al. (2016) combine the two schools of thought and found that wealthy households behave according to standard RBC models' predictions. In contrast, poor households act according to standard IS-LM models. They use CEX data and a three-variable VAR motivated by Ramey (2011). Their empirical analysis divides the data according to income quintiles to show that the wealthiest experience a high cumulative decrease in consumption, whereas the most impoverished experience a significant increase in consumption in response to unexpected changes in aggregate macroeconomic fiscal policies. Jappelli and Pistaferri (2014) uses the 2010 Italian Survey of Household Income and Wealth to show that households with low cash-on-hand exhibit much higher MPC given a fiscal stimulus. They also find a flat age profile of MPC until retirement, a positive correlation between MPC and unemployment, and a negative relation between being turned down for credit and MPC. Misra and Surico (2014) uses the Consumer Expenditure Survey data and quantile regressions to show that given a rebate, 40 percent to 50 percent of households had insignificant MPCs, 20 percent of households had MPC above one-half and the rest somewhere in between. They also showed that the most considerable propensity to consume out of tax rebate is found for households with high levels of mortgage debt and high level of income.

We can explain the heterogeneity in consumption response through consumption smoothing mechanism. Households aim to smooth consumption over time. Using village data from India, Townsend (1994) concluded that the full insurance model, with risk-sharing at the village level, is surprisingly a good benchmark model. Subsequent work has rejected the full insurance model, but it can not reject imperfect consumption smoothing in developing countries. Kinnan et al. (2014) use the Thailand data to show the presence of imperfect insurance in Thai villages that aids in partial consumption smoothing. Even though all households aim to smooth consumption, their ability to do so is not uniform. If a household can efficiently smooth consumption, any gain or loss from an unexpected fiscal policy change should not significantly affect household consumption. Households that cannot smooth consumption efficiently will change their consumption more in response to a fiscal policy shock.

Chang et al. (2002) studied the relationship between fiscal policy variables and output using cointegration and VAR techniques using data from 1950 to 1995. They concluded that given the long run independence of the variables, fiscal policy is ineffective in Thailand. They argued that Thailand's economy relies heavily on natural resources, which leads to a lack of long-run relationships between

output and fiscal policy. Jansen (2004) disagrees with the ineffectiveness of fiscal policy. Using data from 1970 to 2002, they find that fiscal policy instruments have been actively used as a stabilization policy in Thailand. They mentioned that the role of automatic stabilizers is limited compared to industrialized countries. This is due to many reasons such as the small share of government revenue and expenditure in GDP, low-income elasticity of taxes, and a small percentage of income-elastic taxes in total tax revenue, and the absence of automatic stabilizers such as unemployment benefits. Thailand has, however, consistently and actively employed discretionary fiscal policy as required. Son (2006) used the 1998 Socio-Economic Survey of Thailand to analyze the impact of fiscal policy on poverty. They conclude that the inability to tax personal and corporate income and wealth effectively leads the government to rely on indirect taxes such as VAT and excise tax, which are anti-poor in general.

As discussed in Perotti (2007), fiscal policy in developed and developing countries are distinct. Government budgets in developed countries are a more significant share of GDP. Transfers are a substantial portion of the expenditure side of the budget and personal and social security taxes of the revenues side. In comparison, the consumption of goods and services dominates the government budget's expenditure side in developing countries, and indirect taxes dominate the revenue side. However, he mentioned that "there is no reason to believe that the methodologies applied to OECD countries should not apply to other countries."

2.3 Income and Government Spending

Government spending affects consumption via household income. In this section, I study how government spending impacts household income. I regress household income on total and different components of government budget, economic indicators (X), household time varying factors (Z), quarterly, yearly and household fixed effects. The following equation depicts this relationship.

$$Income_{i,t} = a_1 + a_2 GovernmentSpending_t + a_3^x X_{t-1} + a_3^z Z_{i,t} + \delta_Q + \delta_Y + \delta_i + \epsilon_{i,t}$$

X_{t-1} includes one lag of agricultural production index, manufacturing production growth and retail sales growth. $Z_{i,t}$ includes household mean education, mean age and number of members in a household. The standard errors are robust.

Figure 2.1 shows different components of government budget and its distribution in 2005 and

20012.

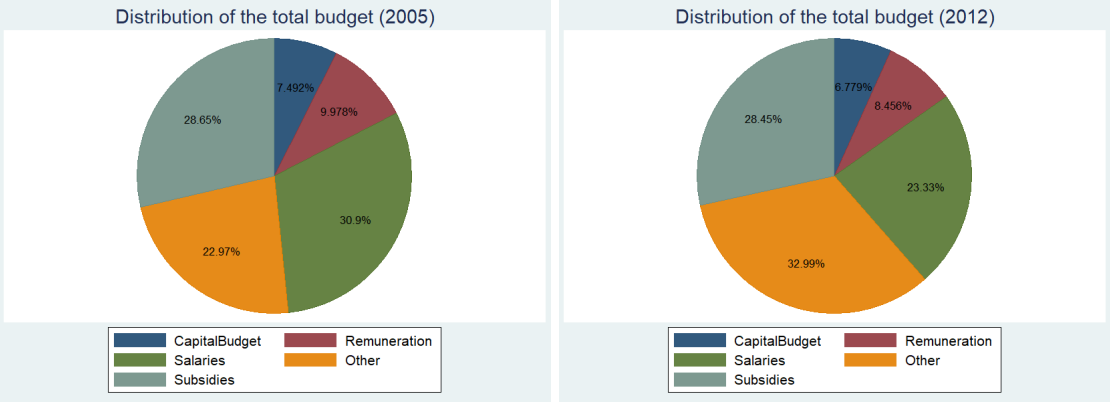


Figure 2.1: Government Budget Components

Table 2.1 shows the summary statistic for income, total government budget and different government budget components. All the values are transformed to real and per-capita terms. Table 2.2 gives the result for this section. According to the estimation, one unit increase in total real per-capita government budget is associated with 1.115 unit increase in real per-capita household income. This result is significant at 1%. Other significant increase was noted for other and subsidies components. One unit increase in other and subsidies component of real per-capita government budget is associated with 1.335 and 1.919 unit increase in real per-capita household income respectively. Capital budget and Remuneration had a negative coefficient, whereas Salaries had a positive coefficient, however these results were not statistically significant.

Table 2.1: Real Per Capita Budget and Income

	mean	sd	min	max
Income	94.12238	330.683	-7087.75	22559.14
TotalBudget	77.01833	18.11063	47.29492	121.6226
CapitalBudget	5.321462	3.357021	.7606798	14.07728
Remuneration	7.843459	2.37596	3.868864	15.67473
Salaries	21.43334	4.997411	17.87441	38.0064
Other	21.06568	7.815074	10.7492	42.83435
Subsidies	21.35439	7.689803	11.44781	38.78669

Table 2.2: Income and Government Budget

	Income	Income	Income	Income	Income	Income
Total	1.115***					
	(0.364)					
CapitalBudget		-1.920				
		(1.601)				
Remuneration			-1.597			
			(5.248)			
Salaries				1.627		
				(6.229)		
Other					1.335**	
					(0.566)	
Subsidies						1.919***
						(0.682)
L.Agricultural_Production_Index1	0.815**	0.375	0.298	0.342	0.674*	0.676**
	(0.359)	(0.328)	(0.318)	(0.374)	(0.368)	(0.321)
L.ManuProdGrowth1	1.105	0.855	0.826	0.858	0.959	1.120
	(0.868)	(0.830)	(0.899)	(1.032)	(0.861)	(0.826)
L.RetailSalesGrowth1	-2.150*	-2.577**	-2.678**	-2.669*	-2.215*	-2.360*
	(1.233)	(1.288)	(1.360)	(1.389)	(1.211)	(1.302)
MeanAge	0.698	0.702	0.703	0.704	0.694	0.704
	(0.643)	(0.643)	(0.643)	(0.643)	(0.643)	(0.643)
MeanEdu	12.95***	12.92***	12.95***	12.95***	12.85***	13.06***
	(4.737)	(4.737)	(4.741)	(4.737)	(4.744)	(4.736)
Members	-10.64***	-10.62***	-10.62***	-10.62***	-10.54***	-10.77***
	(3.770)	(3.770)	(3.769)	(3.770)	(3.767)	(3.776)
N	19632	19632	19632	19632	19632	19632
adj. R^2	0.016	0.016	0.016	0.016	0.016	0.016

Includes Quarterly and Yearly fixed effects

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

2.4 Fiscal Shock Identification

There are several standard methods in the literature to identify fiscal shocks. These can broadly be divided into SVAR, the narrative approach, or deduction from DGSE models. I chose the SVAR route due to relatively straightforward, and direct identification and given the data restriction for Thailand. I followed the Blanchard and Perotti (2002) procedure.

The steps are as follows. First, run a basic VAR

$$Y_t = A(L, q)Y_{t-1} + U_t,$$

with $Y_t \equiv [T_t, G_t, X_t]'$. T, G and X are government revenue (net taxes), government spending and GDP respectively. All variables are in log, real and per capita terms. $U_t \equiv [t_t, g_t, x_t]'$are the reduced form residuals and $A(L, q)$ is a four-quarter distributed lag polynomial.

Second, they assume that there is a linear relationship between reduced-form residuals and uncorrelated structural shocks. The relationship is as follows:

$$t_t = a_1 x_t + a_2 e_t^g + e_t^t$$

$$g_t = b_1 x_t + b_2 e_t^t + e_t^g$$

$$x_t = c_1 t_t + c_2 g_t + e_t^x$$

The first equation above implies that any unexpected movement in taxes is due to unexpected movement in GDP, structural shock to spending, or structural shock to taxes. Perotti (2007) explains the first component in the equation as the automatic response of government spending to innovations in GDP, the second component is the systematic discretionary response to innovations in taxation, and the third component is the random discretionary shocks to the fiscal policies. The second equation implies that any unexpected movement in government spending is due to unexpected movement in GDP, structural shock to taxes, or structural shock to spending. The third equation implies that any unexpected movement in GDP is due to unexpected movement in taxes, unexpected movement in spending, or structural shock to GDP. In this step, they impose several restrictions to identify these structural shocks (e_t^t, e_t^g, e_t^x).

The first step for their identification strategy is taking $b_1 = 0$, which means that the government does not make spending decisions by observing unexpected movements in GDP within the same quarter. a_1 is the elasticity to the output of net taxes. This calculation requires data regarding different categories of taxes and their bases, among other things. Since this information was not easily available for Thailand, I use the value 2, which was computed for the US by the authors. Restrepo (2020) follows the same approach and used this value for Latin American countries. He mentioned that the identification of shocks is not sensitive to this value. As a robustness check, I have repeated the analysis of this paper with $\alpha_1 = 1$. The main tables for $\alpha_1 = 1$ are included in the appendix. This assumption is common for papers on developing countries that follow this paper's methodology.

Next, they construct cyclically adjusted reduced form tax and spending residuals, $t'_t \equiv t_t - a_1 x_t$ and $g'_t \equiv g_t - b_1 x_t = g_t$, this is no longer correlated with e^x_t and can be used as instruments to estimate c_1 and c_2. To estimate a_2 and b_2, they follow two alternative assumptions. Under the first assumption, tax decisions come first, $a_2 = 0$ and b_2 can be estimated. Under the second assumption, spending decisions come first, $b_2 = 0$ and a_2 can be estimated. They find that shocks arising from both the assumptions are almost identical.

There were two primary considerations when I chose to adopt the Blanchard and Perotti (2002) framework for Thailand. First was a lack of data to estimate the tax elasticity of output for Thailand. I used the value calculated for the US for this paper, but I also do a robustness check with a much more conservative value. Second, this approach was created for the US, so I have to be careful when adopting it for a developing country like Thailand. There is a precedence of using this approach for other emerging countries (Restrepo (2020)). Perotti (2007) surveys fiscal policy in developing countries and comments that all the methodologies for identifying fiscal shocks in developed countries were developed to deal with the obstacle of reverse causality in estimating the effects of fiscal policy. There is no reason to believe that they will not work for developing countries as well. He also emphasized that the issue of fiscal shock identification in developing countries is not a lack of developing countries' specific identification strategy but a lack of data.

While using this methodology for my paper,I tested for units roots in all three macro series using augmented dickey-fuller test. I could not reject the null hypothesis of existence of unit root. The unit was removed by using the first difference of all the series. I also checked for cointegration among the

series. There was no cointegration, therefore I do not have to use error correction method, however I transform the variables by using first difference. This methodology of using first difference of SVAR in this identification was also employed for various Latin American countries by Restrepo (2020).

Figure 2.2 shows the estimated government spending shock with both the above assumptions. Since the two are almost identical, which assumption I use does not matter for my analysis. I will call this, e_t^g, GShock from here on. These shocks are structural fiscal shocks and are uncorrelated with all other structural shocks.

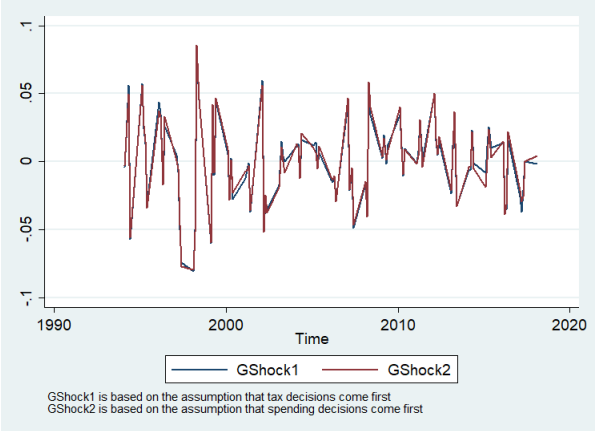


Figure 2.2: Government Spending Shock

2.5 Consumption and Government Spending Shock

Using the consumption smoothing equation from the first chapter, I use the following baseline regression in this section

$$\Delta \ln C_{ivt} = a_1 \Delta \ln C_{vt} + a_2 \Delta \ln I_{ivt} + a_3 GShock_t + \epsilon_{i,t}$$

In the above equation, $\Delta \ln C_{ivt}$ is the first difference of real per-capita consumption, $\Delta \ln C_{vt}$ is first difference in the average consumption for the village household is located in, $\Delta \ln I_{ivt}$ is the first difference of real per-capita income, and GShock is the unanticipated change in government spending as identified using SVAR in the last section. The standard errors are robust.

Since government spending is also correlated with household income, estimated the above will underestimate the coefficient a_3. An alternative will be to remove Income from the equation. I have included the results for latter in the appendix, wherein I remove Income from the baseline and add

quarterly and yearly fixed effects.

Liquidity and financial institute variables will be introduced along with an interaction with Fiscal Shock Variable.

2.5.1 Liquidity

Prior research has shown that liquidity or borrowing constraints invalidate the permanent income hypothesis. Zeldes (1989) used Panel Study of Income Dynamics (PSID), a representative panel of U.S. families, to show that liquidity constraints violate the Euler equation. Essentially, the marginal utility of consumption today and tomorrow is equal only if households can transfer resources between periods. If the ability to share resources is constrained, then the marginal utility of consumption today must be higher than the marginal utility tomorrow. By the same logic, households with more liquid assets can conveniently transfer resources across periods; their consumption should respond less to a fiscal shock than households with less liquid assets in their portfolio.

In this subsection, I check the hypothesis that the more liquidity constrained a household is, the more responsive consumption should be to a fiscal shock. Similar results are found by Kaplan and Violante (2014), who demonstrate that hand-to-mouth households have a higher MPC out of transitory income changes such as fiscal stimulus payments, and Jappelli and Pistaferri (2014), who use Italian data to show that individuals with low cash-on-hand exhibit a much higher MPC during unexpected fiscal shocks.

I use the average over past quarters of household's cash-in-hand, deposits at financial institutions, and inventories to measure their liquid assets. Table 2.3 provides summary statistics for the three variables. Figure 2.3 shows the average of these variables over time for the four provinces in the data set. In general, I observe an increase in the average of these variables, with cash-in-hand in Buriram as an exception. I also observe that there is a convergence in deposits in financial institutions. The above must be due to development in Thailand's financial market in this period, with less financially developed regions catching up with more developed ones. Inventory is the stock of items that the household holds for their business or farm. For instance, if the household has rice fields, then inventory would mean rice stored at home. The use of inventory is not as obvious a liquid asset as the other two. However, given the rural nature of the area, most of the stock of inventories comprises agricultural or livestock products that can be directly used in bad times and stored in good ones.

Table 2.3: Liquidity variable summary statistics (levels)

	mean	sd	min	max
RealCashL	1670.394	3605.307	2.400492	150066.9
RealInventoriesL	1208.216	2934.568	0	74346.36
RealDepositsL	342.1675	2119.726	0	63070.62
Observations	43146			

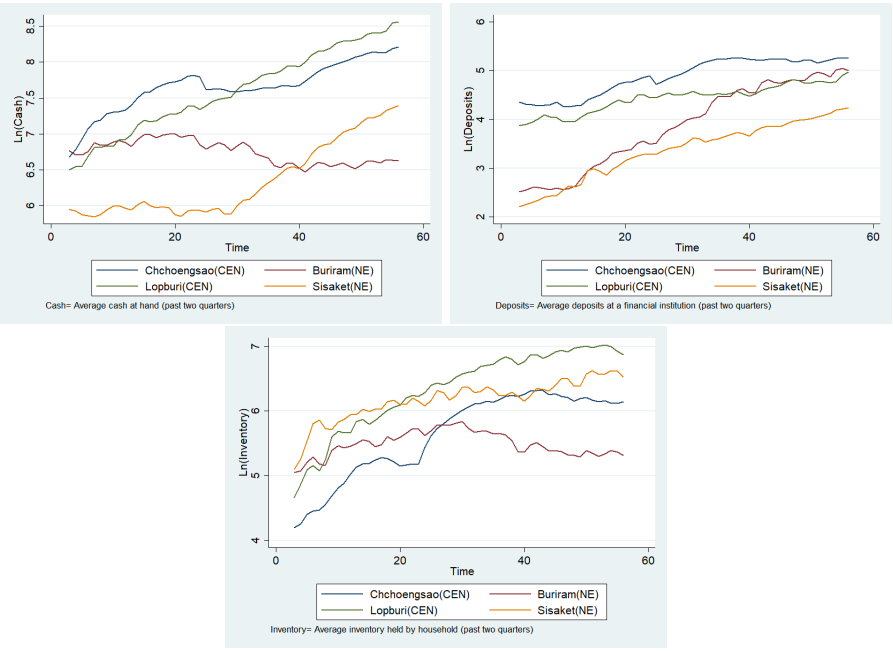


Figure 2.3: Liquidity variables at province level

In Table 2.4, Column 1 is the baseline equation for this section, column 2, 3, and 4 introduces cash, inventory, and deposits respectively as liquidity measures. According to column 1, 1% increase in unanticipated change in government spending corresponds to 0.392% increase in household consumption. According to the consumption smoothing motive, I expect the interaction between the fiscal shock and liquidity measure to have a negative coefficient. It is the case for my results, however, only the interaction with inventory is statistically significant. According to column 3, 1% unanticipated increase in government spending is associated with 1.203% increase in household consumption if there is no inventory. With 1 unit increase in log of average inventory over past two quarters, increase in household consumption decreases by 0.123%. This implies that the marginal propensity to consume (MPC) given government spending is decreasing in household inventory.

Table 2.4: Fiscal Shock: Liquidity

	(1)	(2)	(3)	(4)
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.293***	0.286***	0.293***	0.286***
	(0.0142)	(0.0140)	(0.0142)	(0.0140)
$\Delta \ln I_{ivt}$	0.0105***	0.00871***	0.0100***	0.00875***
	(0.00192)	(0.00190)	(0.00194)	(0.00190)
GShock	0.392***	0.997**	1.203***	0.645***
	(0.0980)	(0.445)	(0.437)	(0.203)
LCashL		0.000721*		
		(0.000385)		
GShock×LCashL		-0.0885		
		(0.0636)		
LInvL			0.000799**	
			(0.000395)	
GShock×LInvL			-0.123*	
			(0.0630)	
LDepL				0.000746
				(0.000598)
GShock×LDepL				-0.0643
				(0.0437)
N	27642	27133	27240	27133
adj. R^2	0.027	0.026	0.027	0.026

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Since the results are not statistically significant for cash, I have extended the analysis to regress the baseline separately for household below and above the median cash in hand holding (based on average over past two quarters) in Table 2.5. Column 2 only includes the households that have less than median cash holding and column 3 includes only the households with more than median cash holding. For households with less than median cash holding, 1% unanticipated increase in government spending corresponds to 0.487% increase in household consumption. For households with more than median cash holding, 1% unanticipated increase in government spending corresponds to 0.304% increase in household consumption.

Table 2.5: Fiscal Shock: Cash

	All	Less than median cash	More than median cash
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.293***	0.260***	0.314***
	(0.0142)	(0.0173)	(0.0223)
$\Delta \ln I_{ivt}$	0.0105***	0.00631***	0.0114***
	(0.00192)	(0.00235)	(0.00304)
GShock	0.392***	0.487***	0.304**
	(0.0980)	(0.135)	(0.144)
N	27642	12876	14257
adj. R^2	0.027	0.027	0.025

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

2.5.2 Financial Development

A lack of financial development is akin to borrowing constraints. As discussed in the last subsection, borrowing constraints will create an environment where the Euler equation would not hold, and marginal utility of consumption today will be higher than tomorrow. Following this reasoning, I check the hypothesis that households belonging to regions with less financial development will have higher marginal propensity to consume due to a government spending shock.

I look into regional financial development to create a proxy for the credit constraints faced by households. To this aim, I use the institutional data set under the Townsend Thai Project. It is a financial institution-level data that I aggregate at the Province level. I have also divided the resulting data by province population to correct for size differences in different provinces.

I construct three variables to depict the financial development of a province over time, utilizing available information. The first variable expresses the number of financial institutes; NumInst; it is the sum of the province's number of institutes. The second variable describes the quality of these institutes. It is called InstScore1, where $InstScore1 = \frac{Lending+Saving}{NumInst}$. Lending and Saving are indicators of whether the institute provided that particular activity. Another alternative variable is InstScore2, where $InstScore2 = Lending + Saving$. Figure 2.4 shows the variables for different provinces over time. I can see the stark differences in financial development in the two regions clearly from the figures. One province was removed from this subsection due to a very steep rise in the number of institutes in province Chachoengsao (id=7) in early 2000. Remaining three provinces also had a increase in indicators around 2001, this corresponds to a change in government policy around this period to encourage financial institutions in rural and semi-urban regions.

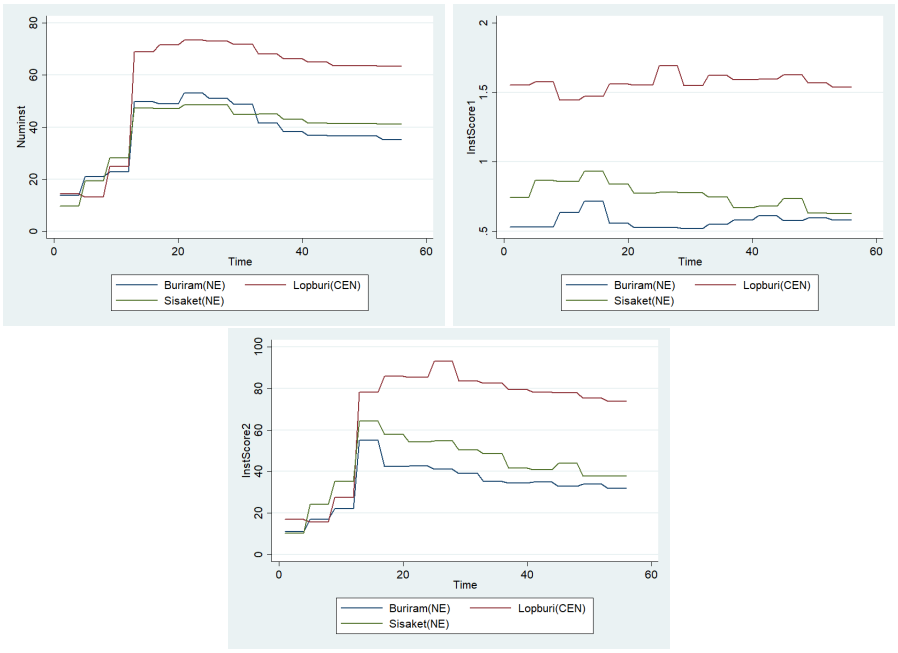


Figure 2.4: Financial development variables at province level

Table 2.6: Liquidity variable summary statistics (levels)

	mean	sd	min	max
NumInst	44.97109	17.85715	9.686135	73.38382
InstScore1	.9709926	.4431149	.5205886	1.692567
InstScore2	48.34497	23.2603	10.378	93.09117
Observations	33600			

Table 2.7 present the results for this subsection using NumInst, InstScore1 and InstScore2 as financial development indicators. The corresponding value of interaction coefficient is negative for all three variables; this implies that with an increase in financial development (or decrease in credit constraints), MPC with respect to government spending shock decreases. Consumption of households belonging to regions with low financial development will respond more to these shocks. For instance, if the number of financial institutes is 0, then 1% unanticipated increase in government spending corresponds to 1.076% increase in household consumption. With every additional financial institute, the increase in household consumption falls by 0.0145%.

Table 2.7: Financial Institutions

	(1)	(2)	(3)	(4)
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.292***	0.291***	0.291***	0.291***
	(0.0159)	(0.0159)	(0.0159)	(0.0159)
$\Delta \ln I_{ivt}$	0.0103***	0.0101***	0.0102***	0.0101***
	(0.00202)	(0.00203)	(0.00202)	(0.00203)
GShock	0.468***	1.076***	1.030***	0.976***
	(0.114)	(0.285)	(0.280)	(0.246)
NumInst		0.000182***		
		(0.0000667)		
GShock×NumInst		-0.0145**		
		(0.00590)		
InstScore1			0.00572*	
			(0.00295)	
GShock×InstScore1			-0.576**	
			(0.251)	
InstScore2				0.000154***
				(0.0000594)
GShock×InstScore2				-0.0111**
				(0.00452)
N	19540	19540	19540	19540
adj. R^2	0.032	0.032	0.032	0.032

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

2.5.3 Food and Non-Food

The fiscal policy literature often focuses on non-durable consumption. The data used here enables me to divide consumption into food and non food expenditure. Figure 2.5 shows the division of food and non food consumption expenditure in the four provinces. The ratio of food consumption ranges from 37.4% to 54.04%, with households in the central region spending the majority if their consumption on non-food and vice-versa for households in the north eastern region. According to the existing literature, fiscal shock should affect food (non-durable) consumption more. This is contradictory to what models based on non-homothetic preferences suggest. In this section, I regress government spending shock on food and non food consumption separately.

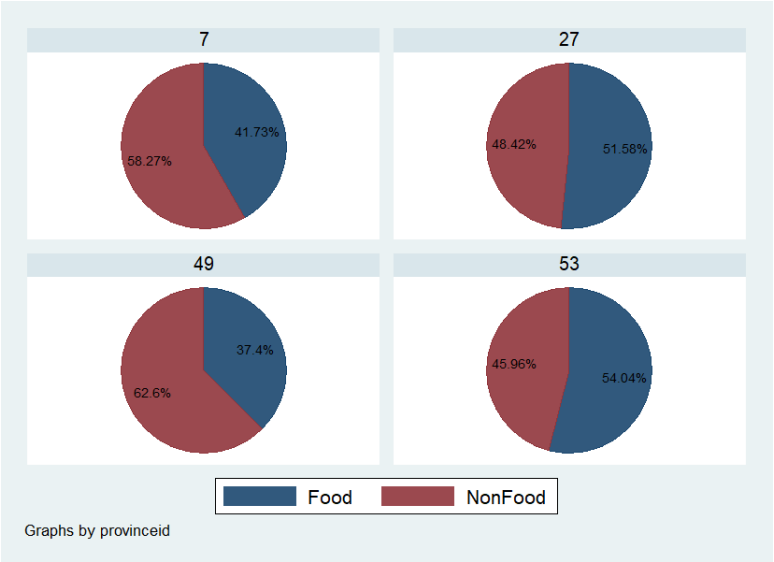


Figure 2.5: Food and Non-Food Consumption

Table 2.8 shows a 1% unanticipated increase in government spending corresponds to 0.068% increase in household food consumption. The government spending shock coefficient in non-food consumption is not statistically significant. This result is consistent with the existing literature.

Table 2.8: Fiscal Shock: Food and Non-Food

	(All)	(Food)	(Non-Food)
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.293***	0.131***	0.367***
	(0.0142)	(0.00917)	(0.0192)
$\Delta \ln I_{ivt}$	0.0105***	0.0111***	0.00914***
	(0.00192)	(0.00132)	(0.00278)
GShock	0.392***	0.608***	0.116
	(0.0980)	(0.0666)	(0.144)
N	27642	27642	27636
adj. R^2	0.027	0.017	0.020

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

2.6 Conclusion

I find that, at least in the short run, a positive government spending shock leads to an increase in private consumption. Most of the existing macroeconomic theories suggest the same outcome. My current results are based on the short run as I study the effects of consumption in the quarter of the government spending shock. I also mainly focus on an unanticipated shock. Both these features would lead to at least temporary effects in both New Keynesian and New Classical models, wherein a surprise change in policy will lead to a change in output and consumption in the short run. I plan to extend this analysis to the medium-run, which will give us more perspective on the macroeconomic side.

The focus of this paper lies in the heterogeneity in the consumption response to a fiscal spending shock. I recognize that households generally aim to smooth consumption inter-temporally. However, their ability to do so differs. If a household can easily transfer resources between periods, it is more likely to either not increase consumption or increase it minimally with a fiscal spending shock. This rationale is in line with the Neo-Ricardian Hypothesis, where the households are anticipating future

tax obligations with increased government expenditure. Developing countries, like Thailand, have many households that face liquidity and borrowing constraints, which will make the transfer of resources over different periods difficult or costly. These households will have a higher marginal utility of consumption today than tomorrow and change their consumption more in response to a fiscal shock. As a result, the effects of fiscal policy will vary with household-specific liability and credit constraints.

Another result of the paper is that food consumption responds to a fiscal shock, whereas non-food consumption does not. This result is counter-intuitive given the relatively inelastic demand for food as compared to non-food goods. The current study is limited to short-run effects; it will be interesting to include the medium-run effects. Another extension can be to differentiate between transient and permanent shocks.

CHAPTER 3

Household Response to Productivity Shock in a Rural Economy

3.1 Introduction

This paper studies how households in rural and semi-urban regions of developing countries respond to aggregate productivity shocks. Since the households surveyed in this paper are predominantly involved in agriculture-related jobs, the productivity shock is estimated in terms of an extreme rainfall event. I analyze the effect of productivity shock on household employment, consumption, income, assets, and liabilities.

This paper focuses on aggregate shocks instead of idiosyncratic shocks. Coping strategies used and their effect varies greatly depending on whether the shock is aggregate or idiosyncratic. Households in the data are found to self-insure using informal methods against idiosyncratic shocks. When faced with shocks like a health shock, villages act like insurance units as they have a strong network of informal borrowing and lending. This system, however, collapses when there is a negative wealth shock affecting the entire village.

One of the main results of this paper is that days employed in cultivation activity increase with a negative productivity shock. It is interesting because a negative productivity shock is usually expected to decrease employment as marginal return to labor falls. With the fall in marginal return to labor, people may substitute labor hours with leisure or move across industries and geographical locations. This simple reasoning may hold in developed countries but fails in developing countries where people are constrained to maintain a minimum subsistence level of consumption, can not easily migrate, and lack financial services to smooth consumption across periods. Given the conditions mentioned above, when a household faces a negative productivity shock, it will respond by increasing its labor supply, contrary to the common belief. Kaur (2014) found similar results using Indian data.

Another significant result is that a negative productivity shock reduces food consumption and food consumption share in total household expenditure. Using various demand systems, I found that food consumption in Thailand is non-homothetic. This implies that a negative wealth shock

should increase the food share of total household consumption. A possible way to explain this result is that most non-food consumption is often costly to adjust due to indivisibilities in large items, like housing or consumer durables.

When looking at income variables, I find that households face a fall in revenue from their occupational activities, but they also reduce operation costs. Overall, there is a decrease in cultivation-related income and labor income, this is despite increase labor supply in cultivation activity. Among balance sheet items, there is no change in total assets and total liabilities. Among the subcategories, there is an increase in cash in hand and deposits. One possible reason can be reduced costs of household employment activities. This, however, needs further inspection. There is also a decrease in inventories, which can be due to increased consumption of household production of agricultural items.

Instances of using rainfall to estimate productivity shock are often found in developing country related literature. To further justify my use, I have regressed agricultural production index, manufacturing production growth, and retail sales growth on my productivity shock variable (Drought) along with calendar month and year fixed effects. I find that drought reduces the agricultural productivity index, driven by crop productivity, but has no impact on other indicators.

Table 3.1: Agricultural Product and Prices

	(1)	(2)	(3)	(4)	(5)
	API	APICrop	APILivestock	ManuProdGrowth	RetailSalesGrowth
Drought	-13.36***	-15.82***	-0.457	-0.621	-0.137
	(4.467)	(5.368)	(1.034)	(1.412)	(1.090)
Calendar Month Fixed Effects	✓	✓	✓	✓	✓
Year Fixed Effects	✓	✓	✓	✓	✓
Adjusted R2	0.950	0.950	0.849	0.339	0.514

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

3.2 Literature

Productivity shocks are often estimated using rainfall data in papers based on developing countries. Kaur (2014) used rainfall to show that nominal wages rise with positive shocks, but do not fall

with negative shocks in village labor markets in India. This nominal wage rigidity causes labor misallocation. Households with small landholdings increase labor supply to their own farms when they are rationed out of the external labor market. Jayachandran (2006) also used rainfall to identify negative transitory productivity shocks. She found that the closer the workers are to subsistence, the more inelastically they supply labor and the more the wage moves in response to productivity shocks.

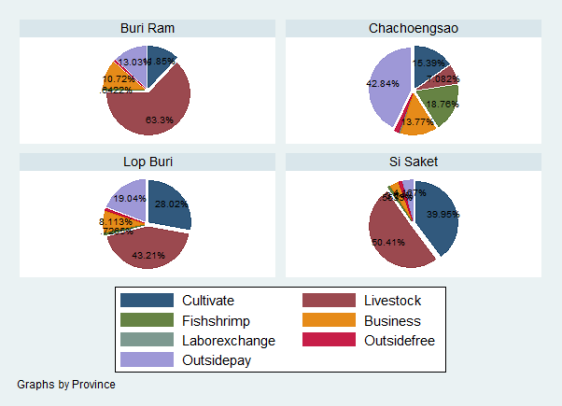
Studying how consumption responses to different shocks is connected to consumption smoothing literature. If the household can smooth consumption more, they are less likely to change consumption in response to transient shocks. Townsend (1995) used data from Thailand to show that households in Thailand have partial insurance and can imperfectly smooth their consumption. Another paper on Thailand, Kinnan and Townsend (2012) found that households rely on their kinship networks to deal with exogenous shocks. However, this mechanism largely fails when dealing with aggregate shocks as compared to idiosyncratic shocks. Chiappori et al. (2014) also found villages to work like a risk-sharing group. These results are not shared in these papers wherein I check if a negative productivity shock, measured through a drought shock, effects informal borrowing or lending. In case of an aggregate shock, households can not insure each other and have to reduce their consumption.

Among consumption, I find that households reduce food consumption, and no change in non-food consumption. This result varies in literature. For instance, Janzen and Carter (2018) used data from Kenya to show when faced with a wealth shock, wealthier households primarily cope by selling assets, and poorer households cope primarily by cutting food consumption. Islam and Maitra (2012) use data from Bangladesh and find that short-term health shocks experienced by the households do not have a statistically significant effect on changes in consumption. If the household incurs a big expenditure or income loss due to sickness, it reduces its food expenditure in the long run. However, Skoufias (2003) found that consumption is only partially protected from idiosyncratic shocks to income with food consumption being better protected than non-food consumption expenditures.

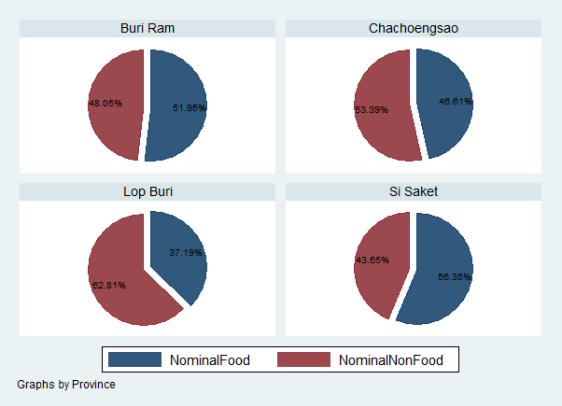
3.3 Data

Looking at household level data summarized at province level as depicted in Figure 3.1 gives us further insight into the households studied in this paper. Apart from one province (Chachoengsao), households in the remaining three provinces spend their time mostly in livestock and cultivation related activities. This further goes on to show that our data is from predominantly rural and

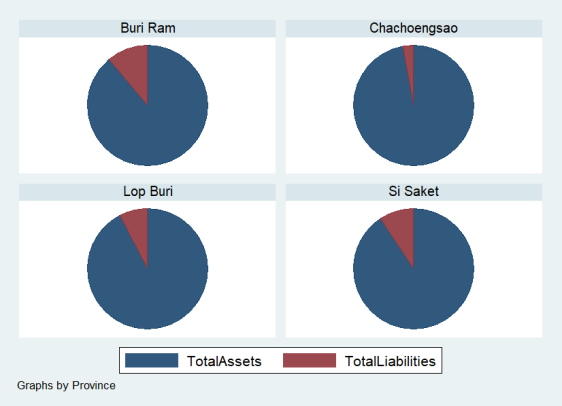
agrarian areas. The two relatively richer provinces have a higher proportion of non-food items in their budget, and the poorer provinces have a higher share of food items in their budget. Within assets, land is the main component, followed by cash in hand and then inventories. Among liabilities, other borrowing is dominant followed by accounts payables, and credit from ROSCA forms a small portion if liabilities. Lastly, households gain revenues from household business and cultivation related activities. For two provinces, fish and shrimp industry form a significant part of their revenue, livestock related revenue is also significant for all the provinces. Detailed summary statistics of all the variables used in this chapter can be found in the appendix.



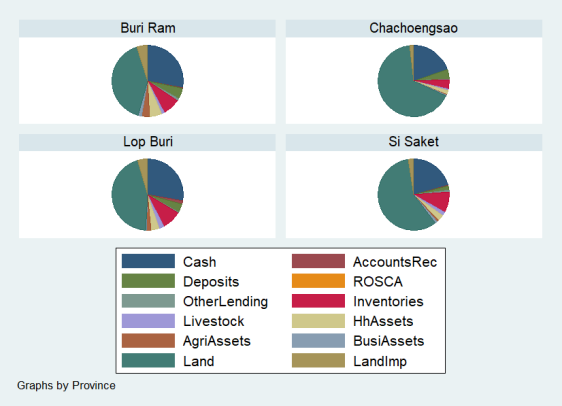
(a) Employment



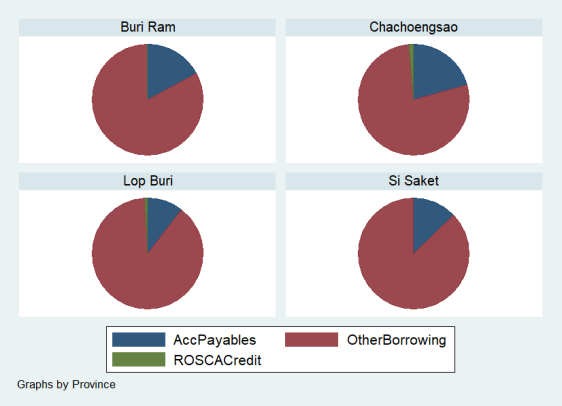
(b) Consumption



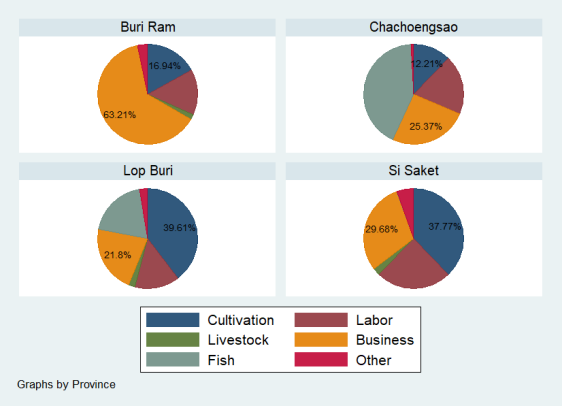
(c) Balance Sheet



(d) Assets



(e) Liabilities



(f) Revenue

Figure 3.1: Thailand Household Data

3.3.1 Rainfall Shocks

Rainfall is estimated using the Global Terrestrial Air Temperature and Precipitation data set. This data provides grid estimates of rainfall for a long monthly a panel of 1900-2017. I employ two methods for estimating provincial rainfall using the grid rainfall data. In the first method, I use

ArcGIS and find the grid points lying within a province and its mean. In the second method, I use STATA, where I find the centroid of each province and the rainfall at the centroid is given the weight 1 and rain within 50km, and 100km distance from the centroid is given the weight equal to the inverse square of the grid point to the centroid of the province. Both methods estimate the roughly similar amount of rainfall in each province.

Next, I calculate percentiles of rainfall for given calendar month and province from 1960-2017. If rainfall in a given month in our sample is less than 10th percentile for that calendar month and province, it is called a P10Shock. If a province faced P10Shock in the current or previous month, then we have a Drought shock.

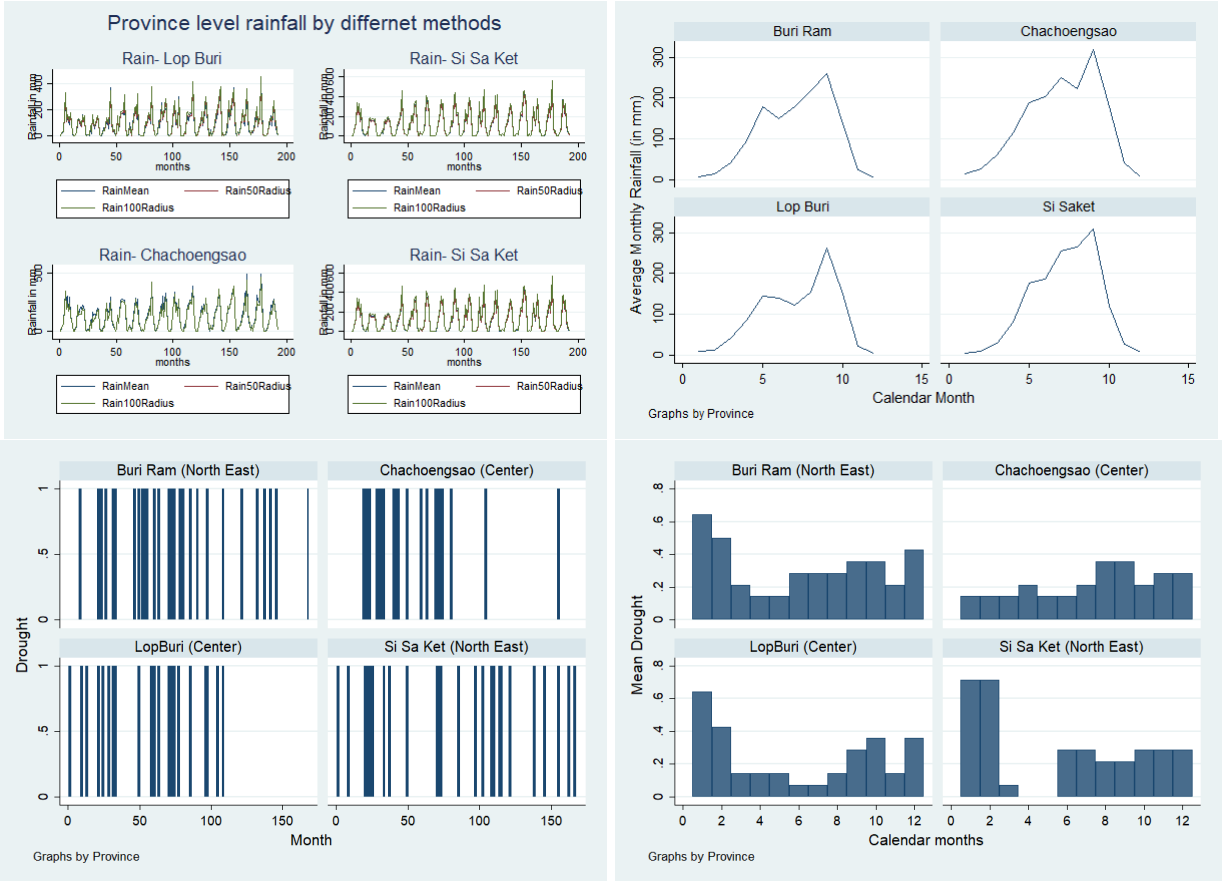


Figure 3.2: Rainfall and Drought in the provinces

3.4 Empirical Strategy

Using the consumption smoothing equation from the first chapter, I use the following baseline regression in this section

$$\Delta \ln C_{ivt} = a_1 \Delta \ln C_{vt} + a_2 \Delta \ln I_{ivt} + a_3 Drought_t + \epsilon_{i,t}$$

In the above equation, $\Delta \ln C_{ivt}$ is the first difference of real per-capita household consumption, $\Delta \ln C_{vt}$ is first difference in the average consumption for the village household is located in, $\Delta \ln I_{ivt}$ is the first difference of real per-capita income, and Drought is as defined in the last subsection. The standard errors are robust. There is an issue of drought coefficient being under-reported if change in income is correlated with drought shock. Not including change in income in the equation will lead to an over-reporting of the drought coefficient. This equation is used for total consumption and total food and non-food consumption. The above can not be used when studying different subcategories of food and non food consumption. This is because change in village average is often led by change in few household's consumption when we look into these subcategories. One possible way would be to use change in average total log consumption for the village. However, then the model does not fit the data well, with the adjusted R-square being zero or very close to zero. I replace $\Delta \ln C_{vt}$ by time fixed effects when regressing the change in subcategories of food and non-food goods.

When studying the different margins of adjustment that the household may employ to smooth consumption during a drought shock, I use the following regression equation.

$$Y_{h,p,t} = \alpha + \beta Drought_{p,t} + \gamma Y_{h,p,t-1} + \delta_h + \delta_t + \epsilon_{h,p,t}$$

where h is the household, t is the time variable in months, and p is the province household is located in. I have included household and time fixed effects in my model. Y includes employment, balance sheet, and income variables. They are transformed by an inverse hyperbolic sine function. This is a substitute for logarithmic transformation that is common in this literature (Pence (2006)), especially when the variables contain a significant number of zero values. I include household level fixed effects to absorb unobserved time-invariant household heterogeneity that could otherwise bias the coefficients. I include time-fixed effects to control for factors changing each month that are

common to all households. I also use robust standard errors.

3.5 Results

3.5.1 Consumption

A drought shock led to 0.719% reduction in total consumption with 0.632% increase in food consumption. Both results are significant at 5%. There was no statistically significant impact on non-food consumption.

Food consumption can be further subdivided into rice, grain, meat, milk-oil, fruit-vegetable, condiments, prepared food, and beverages and tobacco products. A drought shock corresponds to a 1.49% decrease in fruits and vegetable, a 3.78% decrease in condiments, and 2.64% decrease in beverages and tobacco products.

Non food Products can be further subdivided into weekly essentials, household operations, rent, transport, entertainments, clothing, personal, maintenance, education, religion and miscellaneous. A drought shock corresponds to a 3.23% decrease in weekly, and 4.16% decrease in education.

I also divide non-food consumption by the type of transaction. There is no statistically significant impact in total cash or credit based non-food consumption. There is a 5.9% increase in gift based non-food consumption. Gift includes both aid and transfer from government, and informal help from friends and family.

Table 3.2: Consumption: Drought

	All	Food Consumption	Non-Food Consumption
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.229***	0.105***	0.274***
	(0.00641)	(0.00395)	(0.00866)
$\Delta \ln I_{ivt}$	0.000892***	0.000970***	0.00141***
	(0.000295)	(0.000222)	(0.000423)
Drought	-0.00719**	-0.00632**	-0.00211
	(0.00324)	(0.00258)	(0.00488)
N	113108	113108	113108
adj. R^2	0.026	0.010	0.016

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 3.3: Food Subcategories I

	Rice	Grain	Meat	MilkOil
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln I_{ivt}$	0.000185	-0.0000674	0.00112***	-0.000300
	(0.000424)	(0.000733)	(0.000366)	(0.000483)
Drought	-0.0108	0.0191	0.000906	0.0128
	(0.00829)	(0.0141)	(0.00738)	(0.00910)
N	113107	112540	112540	112540
adj. R^2	0.002	0.004	0.011	0.016

Standard errors in parentheses

Time fixed effect used instead of difference in average village log consumption

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 3.4: Food Subcategories II

	FruitVeg	Condiment	PrepFood	BevTob
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln I_{ivt}$	-0.000290	0.000586	0.00218***	0.00642***
	(0.000459)	(0.000555)	(0.000752)	(0.000773)
Drought	-0.0149*	-0.0378***	-0.00501	-0.0264*
	(0.00893)	(0.0116)	(0.0143)	(0.0147)
N	112540	112540	112540	112540
adj. R^2	0.014	0.013	0.005	0.013

Standard errors in parentheses

Time fixed effect used instead of difference in average village log consumption

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 3.5: NonFood: Subcategories I

	Weekly	HhOp	Rent	Transport	Entertainment	Clothing
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln I_{ivt}$	0.00434***	0.00167***	0.000475***	-0.00138	0.000726	0.00320**
	(0.000586)	(0.000421)	(0.000155)	(0.000860)	(0.000579)	(0.00153)
Drought	-0.0323***	0.00338	-0.00150	0.000261	-0.0188	-0.0154
	(0.0123)	(0.00991)	(0.00295)	(0.0188)	(0.0125)	(0.0317)
N	112540	113104	113104	113104	113104	113104
adj. R^2	0.006	0.007	0.001	0.001	0.016	0.012

Standard errors in parentheses

Time fixed effect used instead of difference in average village log consumption

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 3.6: NonFood: categories

	Personal	Maintenance	Education	Religion	Misc
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln I_{ivt}$	0.00186***	0.00534***	-0.000206	-0.00232***	-0.00141
	(0.000657)	(0.00158)	(0.000836)	(0.000832)	(0.00108)
Drought	-0.0144	-0.0153	-0.0416**	0.00281	0.0255
	(0.0125)	(0.0300)	(0.0169)	(0.0153)	(0.0189)
N	113104	113104	113104	113104	113104
adj. R^2	0.001	0.001	0.106	0.001	0.003

Standard errors in parentheses

Time fixed effect used instead of difference in average village log consumption

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table 3.7: NonFood: type of transaction

	Cash	Credit	Gift
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln I_{ivt}$	-0.000935**	0.00130***	0.000226
	(0.000421)	(0.000410)	(0.000547)
Drought	0.00175	0.00298	0.0590***
	(0.00825)	(0.00823)	(0.00938)
N	112537	112537	112537
adj. R^2	0.011	0.011	0.026

Standard errors in parentheses

Time fixed effect used instead of difference in average village log consumption

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

3.5.2 Margins of Adjustments

Households smooth consumption, that is, reduce the effect on consumption. I find the mechanism that works for households in Thailand. The mechanisms I check for include employment, the scope of the business, balance sheet item adjustments.

There is a 2% increase in cultivation activity days with no significant change in time spent in any other activity corresponding to a drought shock. With the drought, productivity in cultivation should fall. With this fall in the marginal product of labor, increasing labor supply constitutes a misallocation of labor. This result is shared with other studies done on Indian villages.

Households do not use balance sheet adjustments often to deal with the shocks, apart from a 3% decrease in inventory. I do find a significant decrease of 0.9% in ROSCA credit during this period. ROSCA acts like a microcredit unit and has proved beneficial in dealing with other idiosyncratic shocks.

There is a fall in revenue during drought. However, the costs of running a business fall as well. This depicts that households can adjust their business scale flexibly to reduce the loss during these shocks. Income, when calculated as the difference between revenue and costs, does not decrease as a whole. However, there is a 8.69% decrease in cultivation and a 5.11% decrease in labor income; both of these fall for poor households. This shows that poor households are worse hit by these shocks.

The tables with these results are included in the appendix.

3.6 Conclusion

Households aim to smooth consumption during negative productivity shocks, represented by a drought shock in this paper. There is no significant effect on total non-food consumption; however, households respond by reducing mainly food consumption. It is an interesting result because drought is a negative income shock, which should increase the food share of the budget and decrease the non-food share due to the non-homothetic nature of preferences documented for the data. This provides scope for further research. A potential extension of the work would be to differentiate between temporary and permanent shocks. I also found that to cope with the shock, households increase labor supply and deplete inventory. Both revenue and costs of family business/farm decreases. There are no major balance sheet item adjustments.

APPENDIX A

Consumption Patterns in a developing country

A.0.1 AIDS and QUAIDS

AIDS demand system Deaton and Muellbauer (1980)

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log x/P$$

Restrictions on the parameters of the AIDS equation:

$$\sum_{i=1}^{n} \alpha_i = 1 \ \sum_{i=1}^{n} \gamma_{ij} = 0 \ \sum_{i=1}^{n} \beta_i = 0$$

$$\sum_j \gamma_{ij} = 0$$

$$\gamma_{ij} = \gamma_{ji}$$

These restrictions ensure that equation represents a system of demand functions which add up to total expenditure ($\sum w_i = 1$) are homogeneous of degree zero in prices and total expenditure taken together.

QUAIDS Demand System Banks et al. (1997)

$$w_i = \alpha_i + \sum_{j=1}^{n} \lambda_{i,j} \log p_j + \beta_i \log[\frac{m}{a(p)}] + \frac{\lambda_i}{b(p)} \{\log[\frac{m}{a(p)}]\}^2$$

where,

$$\log a(p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log p_i + \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \log p_i \log p_j$$

$$b(p) = \Pi_{i=1}^{n} {p_i}^{\beta_i}$$

$$\lambda(p) = \sum_{i=1}^{n} \lambda_i \log p_i, \ where \ \sum_i \lambda_i = 0$$

They use the same restrictions as AIDS.

Elasticities:

$$\frac{\partial \omega_i}{\partial \log m} = \beta_i + \frac{2\lambda_i}{b(p)} \left(\log\left(\frac{m}{a(p)} \right) \right)$$

$$\frac{\partial \omega_i}{\partial \log p_j} = \gamma_{ij} - \mu_i \left(\alpha_j + \sum_k \gamma_{jk} \log p_k \right) \frac{\lambda_i \beta_j}{b(p)} \left(\log\left(\frac{m}{a(p)} \right) \right)$$

APPENDIX B

Heterogeneous Consumption Responses to Fiscal Spending Shocks in a Developing Country

$$\Delta \ln C_{ivt} = a_1 \Delta \ln C_{vt} + a_2 FiscalShock_t + \delta_Q + \delta_Y + \epsilon_{i,t}$$

In the above equation, $\Delta \ln C_{ivt}$ is the first difference of real per-capita consumption, $\Delta \ln C_{vt}$ is the average consumption for the village household is located in, Fiscal Shock is as identified using SVAR. Instead of adding change in log income, δ_Q and δ_Y, quarter and year dummies, are included. The standard errors are robust.

Table B.1: Fiscal Shock: Liquidity

	(1) $\Delta \ln C_{ivt}$	(2) $\Delta \ln C_{ivt}$	(3) $\Delta \ln C_{ivt}$	(4) $\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.296***	0.290***	0.295***	0.290***
	(0.0134)	(0.0134)	(0.0135)	(0.0134)
GShock	0.288***	0.591	1.072**	0.429**
	(0.103)	(0.435)	(0.418)	(0.197)
GShock×LCashL		-0.0525		
		(0.0619)		
GShock×LInvL			-0.124**	
			(0.0596)	
GShock×LDepL				-0.0508
				(0.0419)
N	37448	36633	36776	36633
adj. R^2	0.031	0.030	0.031	0.030

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table B.2: Fiscal Shock: Cash

	All	Less than median cash	More than median cash
	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.296***	0.240***	0.356***
	(0.0134)	(0.0159)	(0.0227)
GShock	0.288***	0.285**	0.145
	(0.103)	(0.146)	(0.153)
N	37448	18315	18318
adj. R^2	0.031	0.027	0.034

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table B.3: Financial Institutions

	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$	$\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.284***	0.283***	0.283***	0.283***
	(0.0150)	(0.0150)	(0.0150)	(0.0150)
GShock	0.365***	1.368***	0.878***	1.155***
	(0.117)	(0.274)	(0.261)	(0.239)
NumInst		0.000247		
		(0.000261)		
GShock×NumInst		-0.0230***		
		(0.00579)		
InstScore1			0.00704	
			(0.00602)	
GShock×InstScore1			-0.538**	
			(0.236)	
InstScore2				0.000111
				(0.000167)
GShock×InstScore2				-0.0164***
				(0.00444)
N	28216	28216	28216	28216
adj. R^2	0.036	0.036	0.036	0.036

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table B.4: Fiscal Shock: Cash

	(All) $\Delta \ln C_{ivt}$	(Food) $\Delta \ln C_{ivt}$	(Non-Food) $\Delta \ln C_{ivt}$
$\Delta \ln C_{vt}$	0.296^{***}	0.144^{***}	0.350^{***}
	(0.0134)	(0.00842)	(0.0185)
GShock	0.288^{***}	0.308^{***}	0.205
	(0.103)	(0.0691)	(0.152)
N	37448	37448	37418
adj. R^2	0.031	0.027	0.026

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

APPENDIX C

Household Response to Productivity Shock in a Rural Economy

C.0.1 Summary Statistics

Table C.1: Consumption Summary Statistics

	mean	sd	min	max
Food	1207.36	1285.99	0	96495
Non-Food	4201.65	20341.85	0	3401629
Total	5413.26	20575.88	14	3403061
Weekly	901.16	1908.57	0	140000
Household Operation	684.64	1115.52	0	31000
Rent	5.51	556.79	0	127200
Transport	34.27	471.38	0	85700
Entertainment	10.57	138.57	0	35000
Clothing	135.90	708.30	0	195000
Personal	264.65	977.54	0	318000
Maintenance	758.53	15764.45	0	3400000
Education	545.68	1326.49	0	110000
Religion	581.74	8570.00	0	590000
Grain	46.51	103.60	0	12030
Meat	578.70	702.66	0	70208
Milk and Oil	303.46	387.59	0	11032
Fruit and Vegetables	288.35	314.63	0	15150
Condiment	215.08	262.67	0	8325
Prepared Food	412.26	665.70	0	15300
Beverages and Tobacco	336.67	817.38	0	60000
Rice	143.68	305.12	0	7783.07
N	114399			

Table C.2: Employment Sample Statistics

	mean	sd	min	max
Outside Paid Work Hour	.8165705	7.36349	0	240
Business Hour	2.042068	17.38767	0	390
Livestock Hour	.0402831	1.067511	0	60
Fish and Shrimp Hour	.0860731	1.744616	0	105
Cultivation Days	1.447794	1.554453	0	4.499933
N	106633			

Table C.3: Balance Sheet Items

	mean	sd	min	max
TotalAssets	2054919	6514053	0	1.46e+08
TotalLiabilities	127085.7	289388.8	0	7000000
Wealth	1927834	6461992	-845918.5	1.46e+08
Cash	471783.7	1182518	0	6.20e+07
AccountsRec	10108.62	197097.4	0	7044206
Deposits	83453.72	333005.6	0	7529458
ROSCA	923.08	6076.14	0	117170
OtherLending	7687.73	32666.11	0	550000
Inventories	131992.7	347254	0	9214374
Livestock	24256.92	148824.6	0	7007303
FixedAssets	96477.03	248055.3	0	1.29e+07
HhAssets	59003.86	120298.7	0	2068923
AgriAssets	26673.47	175931	0	1.24e+07
BusiAssets	10799.7	78856.04	0	6570893
Land	1168744	5819959	0	1.41e+08
LandImp	59491.35	215694.3	0	9621017
AccPayables	19000.3	73493.99	0	2189704
OtherBorrowing	107188	271447.4	0	7000000
ROSCACredit	897.38	5426.69	0	113000
N	119080			

Table C.4: Revenue, Cost and Income

	mean	sd	min	max
Total Revenue	25935.82	130427.1	0	1.22e+07
Cultivation Revenue	6250.40	40796.12	0	3900000
Labor Revenue	4501.67	13643.14	0	1820000
Livestock Revenue	312.06	3816.53	0	310000
Business Revenue	7802.79	48328.89	0	4050000
Fish and Shrimp Revenue	6543.98	111912.6	0	1.22e+07
Other Revenue	550.65	9217.77	0	2100000
Total Cost	12699.54	79974.94	0	7740682
Cultivation Cost	1764.29	13119.3	0	978339.1
Labor Cost	349.08	1890.48	0	133200
Livestock Cost	736.98	5930.21	0	293470.9
Business Cost	6091.71	39729.27	0	2995660
Fish and Shrimp Cost	1152.82	16684.03	0	1270551
Other Cost	289.72	5462.88	0	1220000
Total Income	13236.04	64085.86	-1209213	5254186
Cultivation Income	4486.11	30051.41	-95301.19	3873583
Labor Income	4152.58	13050.98	-130000	1820000
Livestock Income	-424.91	6830.75	-293470.9	307458
Fish and Shrimp Income	905.97	17437.61	-697270	1293137
Business Income	1711.08	19647.73	-439650	4050000
Other Income	260.97	10627.61	-1220000	2100000
N	119080			

C.0.2 Regression Results: Margins of Adjustment

Table C.5: Employment

	(1)	(2)	(3)	(4)	(5)
	OutsidePaid	BusinessHh	Livestock	FishShrimp	CultivateDays
Drought	-0.000786	0.00169	0.00103	-0.000225	0.0182*
	(0.00253)	(0.00262)	(0.000712)	(0.000508)	(0.0100)
L.OutsidePaid	0.802***				
	(0.0367)				
L.BusinessHh		0.868***			
		(0.0199)			
L.Livestock			0.845***		
			(0.0411)		
L.FishShrimp				0.864***	
				(0.0311)	
L.CultivateDays					0.597***
					(0.00768)
Household Fixed Effects	✓	✓	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓	✓
Adjusted R2	0.638	0.754	0.720	0.747	0.449
N	105119	105119	105119	105119	104961

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table C.6: Revenue

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	TotalRev	CultRev	LiveRev	FishRev	BusRev	LabRev	OtherRev
Drought	-0.112***	-0.0966***	0.0274	0.0329**	-0.00312	-0.0568**	0.00439
	(0.0332)	(0.0298)	(0.0214)	(0.0163)	(0.0154)	(0.0255)	(0.0246)
L.TotalRev	0.405***						
	(0.0125)						
L.CultRev		0.276***					
		(0.0103)					
L.LiveRev			0.0451***				
			(0.00863)				
L.FishRev				0.408***			
				(0.0447)			
L.BusRev					0.722***		
					(0.0147)		
L.LabRev						0.621***	
						(0.0122)	
L.OtherRev							0.428***
							(0.0145)
_cons	3.830***	1.925***	0.816***	0.721***	0.336***	1.429***	0.560***
	(0.156)	(0.119)	(0.0824)	(0.0853)	(0.0578)	(0.100)	(0.0739)
Household Fixed Effects	✓	✓	✓	✓	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓	✓	✓	✓
Adjusted R2	0.196	0.144	0.0272	0.173	0.521	0.393	0.188
N	118286	118296	118277	118296	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table C.7: Cost

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	TotalCost	CultCost	LiveCost	FishCost	BusCost	LabCost	OtherCost
1.Drought	-0.192***	-0.111***	-0.0180***	0.0162	0.000573	-0.0716***	0.0953***
	(0.0231)	(0.0241)	(0.00662)	(0.0142)	(0.00915)	(0.0144)	(0.0161)
L.TotalCost	0.544***						
	(0.0155)						
L.CultCost		0.106***					
		(0.00997)					
L.LiveCost			0.861***				
			(0.00706)				
L.FishCost				0.0333			
				(0.0229)			
L.BusCost					0.856***		
					(0.0156)		
L.LabCost						0.713***	
						(0.00967)	
L.OtherCost							0.218***
							(0.0151)
_cons	2.514***	0.861***	0.544***	0.324***	0.0829***	0.195***	0.619***
	(0.128)	(0.0841)	(0.0313)	(0.0639)	(0.0307)	(0.0454)	(0.0739)
Household Fixed Effects	✓	✓	✓	✓	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓	✓	✓	✓
Adjusted R2	0.331	0.124	0.822	0.00431	0.734	0.552	0.0745
N	118296	118296	118296	109935	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table C.8: Income

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	TotalIncome	CultIncome	LiveIncome	FishIncome	BusIncome	LabIncome	OtherIncome
Drought	-0.0417	-0.0869***	0.0464	0.0160	-0.00835	-0.0511*	-0.0506
	(0.0554)	(0.0299)	(0.0345)	(0.0160)	(0.0162)	(0.0267)	(0.0329)
L.TotalIncome	0.362***						
	(0.0115)						
L.CultIncome		0.275***					
		(0.00992)					
L.LiveIncome			0.168***				
			(0.00912)				
L.FishIncome				0.427***			
				(0.0404)			
L.BusIncome					0.736***		
					(0.0125)		
L.LabIncome						0.595***	
						(0.0154)	
L.OtherIncome							0.340***
							(0.0124)
_cons	1.871***	1.867***	-2.196***	0.630***	0.0962	1.502***	0.180
	(0.241)	(0.118)	(0.142)	(0.0832)	(0.0646)	(0.107)	(0.110)
Household Fixed Effects	✓	✓	✓	✓	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓	✓	✓	✓
Adjusted R2	0.170	0.131	0.0876	0.187	0.549	0.361	0.123
N	118296	118296	118296	118296	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table C.9: Balance Sheet Items

	(1)	(2)	(3)
	TotalAssets	TotalLiabilities	Wealth
Drought	0.000338	0.00116	0.000272
	(0.000806)	(0.00829)	(0.00462)
L.TotalAssets	0.985***		
	(0.000984)		
L.TotalLiabilities		0.925***	
		(0.00405)	
L.Wealth			0.949***
			(0.00822)
_cons	0.215***	0.609***	0.687***
	(0.0136)	(0.0581)	(0.110)
Household Fixed Effects	✓	✓	✓
Time Fixed Effects	✓	✓	✓
Adjusted R2	0.981	0.882	0.913
N	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table C.10: Balance Sheet Items: Assets

	(1) Cash	(2) AccRec	(3) Deposits	(4) ROSCA	(5) OtherLend	(6) Inventories	(7) FixedAssets	(8) Land	(9) LandImp
Drought	0.0212**	-0.000870	0.0216***	0.00364	-0.00369	-0.0399***	0.000138	0.00339	-0.00314
	(0.00974)	(0.00190)	(0.00423)	(0.00493)	(0.00896)	(0.00723)	(0.00208)	(0.00289)	(0.00587)
L.Cash	0.728***								
	(0.0139)								
L.AccRec		0.968***							
		(0.00559)							
L.Deposits			0.960***						
			(0.00243)						
L.ROSCA				0.888***					
				(0.00888)					
L.OtherLend					0.934***				
					(0.00309)				
L.Inventories						0.773***			
						(0.0121)			
L.FixedAssets							0.966***		
							(0.00274)		
L.Land								0.977***	
								(0.00230)	
L.LandImp									0.953***
									(0.00150)
_cons	3.354***	0.0288	0.312***	0.105***	0.133***	2.116***	0.364***	0.225***	0.175***
	(0.170)	(0.0193)	(0.0283)	(0.0279)	(0.0344)	(0.125)	(0.0299)	(0.0234)	(0.0387)
Household Fixed Effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Time Fixed Effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Adjusted R2	0.559	0.940	0.942	0.796	0.877	0.659	0.937	0.955	0.961
N	118296	118296	118296	118296	118296	118296	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table C.11: Balance Sheet Items: Asset

	(1)	(2)	(3)
	HhAssets	AgriAssets	BusiAssets
Drought	-0.000454	-0.00330	-0.00171
	(0.00242)	(0.00331)	(0.00289)
L.HhAssets	0.960***		
	(0.00317)		
L.AgriAssets		0.975***	
		(0.00123)	
L.BusiAssets			0.973***
			(0.00209)
_cons	0.411***	0.152***	0.0264***
	(0.0346)	(0.00785)	(0.00418)
Household Fixed Effects	✓	✓	✓
Time Fixed Effects	✓	✓	✓
Adjusted R2	0.928	0.955	0.952
N	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table C.12: Balance Sheet Items: Liability

	(1)	(2)	(3)
	AccPayables	OtherBorrowing	ROSCACredit
Drought	0.00180	0.00290	-0.00990*
	(0.00827)	(0.00836)	(0.00513)
L.AccPayables	0.947***		
	(0.00222)		
L.OtherBorrowing		0.919***	
		(0.00432)	
L.ROSCACredit			0.914***
			(0.00758)
_cons	-0.0148	0.709***	0.0106
	(0.0443)	(0.0613)	(0.0228)
Household Fixed Effects	✓	✓	✓
Time Fixed Effects	✓	✓	✓
Adjusted R2	0.921	0.865	0.846
N	118296	118296	118296

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

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