THREAT ANTICIPATION

POVERTY, INEQUALITY, AND TERRORISM
Kuznets Curve – see stages marked
Levels not low compared to others
Facts – Informative of Underlying Economy/Heterogeneity
Crisis: Has little impact

Table 1: Summary Statistics of Income in Thai SES

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Quintile level is fixed at that of 1990.
CONSTRUCT
COMPREHENSIVE
RESEARCH/DATA BASE
ARCHIVE
Thailand Database Research Archive

Thailand Project

This site contains a variety of databases for Thailand and a number of models that can be used to understand the Thai economy. These can be used as an integrated research and advisory tool for academics and policy makers. The data include microeconomic data on households and farms as well as macroeconomic data from the Bank of Thailand and the National Economic and Social Development Board (NESDB), intermediate between these two are village-level data from the Community Development Department (CDD) and provincial-level domestic product data from the NESDB.

The purpose of having multiple data sources easily available and easily accessible is to further research on the microeconomic foundations of the macro economy, that is, to develop microeconomic and macroeconomic models, ideally combining the two. Specifically, these data can be used to construct and estimate general equilibrium models with households and with heterogeneity across households and farms. The user can choose the appropriate degree of aggregation of the macroeconomic data, or go back and forth between micro and macro. Indeed, this archive facilitates fact-finding missions. Several of the individual databases have automated search and data extraction facilities. Several of the microdata files include geographic identifiers at the parish, village, sub-district ( tambon), county (amphoe), or province (changwat) level, thus enabling use of an accompanying Geographic Information System.

The larger goal of this web-based archive is to facilitate the integration of theory with measurement. Frequently the data a theorist might need to calibrate or estimate a model is not available in the single database on hand, hence the inclusion of multiple databases here. Frequently, the necessary data are not available at all. That is, existing surveys do not include variables critical to theoretical models. For example, until recently, there were no longitudinal data for Thailand. A key component of this website is a panel database derived from micro surveys designed from a theoretical perspective. This collection, known as the Townsend Thai Project, is available from this site. The other databases Related Thai data are also available.

The project was funded primarily by US government foundations, specifically the National Institute of Health (NIH) and the National Science Foundation (NSF), with Robert M. Townsend as principal investigator. Gifts from the Ford Foundation, Melton Foundation and the University of Chicago are also gratefully acknowledged.

Papers and publications that use the data available in this archive and describe the details of
A stratified, three-stage sampling design was used. The primary sampling units were Amphoe districts and subsequent sampling units were villages for non-municipal areas or urban areas. For all surveys, stratification was by region (North, North East, Central, South and Bangkok Metropolitan) and community type (urban, rural and suburban). Within strata, sampling units were chosen randomly using probability proportional to population. But across strata, households were not equally likely to be drawn - in particular, urban areas were generally over-sampled relative to rural areas.

Although different households were not equally likely to be drawn for sampling, survey weights are provided with the SES results, and can in principle be used to calculate unbiased aggregate statistics. However, some doubt exists regarding these weights - in particular, the weights are based on planned, rather than actual, survey sites in the different provinces. Hyoeon Jeong has calculated alternative weights using the following simple method:

For each survey, calculate the number of enumerated survey households for each region and community type combination. Then take the ratio of these values to the total number of households in each region and community type (taken from the Report of the Household Socio-Economic Survey, for example see page 47 of the 1996 publication). The inverse of this ratio gives the sampling weights.

These alternative weights have been calculated for all surveys, except the 1996 survey for which the Report of the Household Socio-Economic Survey publication is not yet available.

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Join Data

Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.

What do you want to join to this layer?

Join attributes from a table

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2. Choose the table to join to this layer, or load the table from disk:
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   - Show the attribute tables of layers in this list

3. Choose the field in the table to base the join on:
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Southern Thailand

Townsend's Southern Survey:
Amphoe Selection Highlighted in Red

Area of Reference
The survey included separate instruments for the households, village heads as key informant, local financial institutions, and joint-liability BAAC groups. Approximately 25% of the interviewed households were also running some kind of business. There are also direct, environmental measurements of the local village environment. Soil samples were taken, administered with a separate soil questionnaire and plot photos. Finally there are overhead air photos of each of the survey villages, going back three decades.

**SAMPLE DESIGN**

Two separate regions were deliberately picked, the more highly developed region Central Region near to Bangkok and the poorer south and Northeast. Four provinces (changwats) were chosen in total, two in the Central region—Lop Buri and Chachoengsao—and two in the Northeast—Sakon Nakhon and Buriram. These particular provinces were chosen as each one contained one county (amphoe) that had been sampled every year of the Thai SES, available from the Thai data archives, thus providing us with benchmark or comparative information. The two regions, the Central and Northeast regions, can also be ordered from relatively wealthy to relatively poor not only by wealth and income but also by soil moisture, soil chemistry, and other environmental characteristics.
The survey included separate instruments for the households, village heads as key informant, local financial institutions, and joint-liability BAAC groups. Approximately 25% of the interviewed households were also running some kind of business. There are also direct, environmental measurements of the local village environment. Soil samples were taken, administered with a separate soil questionnaire and plot photos. Finally there are overhead air photos of each of the survey villages, going back three decades.

SAMPLE DESIGN

Two separate regions were deliberately selected. The more highly developed region, Central Region near to Bangkok and the poorer south and Northeast. Four provinces (changwat) were chosen in total, two in the Central region – Lopburi and Chachoengsao – and two in the Northeast – Sakon and Buriram. These particular provinces were chosen as each one contained one county (amphoe) that had been sampled every year of the Thai SES, available from the Thai data archive, thus providing us with benchmark or comparative information. The two regions, Central and Northeast regions, can also be ordered from relatively wealthy to relatively poor not only by wealth and income but also by soil moisture, soil chemistry, and other environmental characteristics.
Southern Thailand vs Northeast

A comparison of southern Thailand with that of the north, northeast, central, and east. Summaries are based on multiple datasets from research archive.
THE ENVIRONMENT
INCOME, CONSUMPTION, AND WEALTH
Per Capita GPP

- National Account Division, Office of the National Economic and Social Development Board, 1999. Gross provincial product at current market prices and per capita income by region and province 1999: In comparison to the other regions in Thailand the south has a high GPP Per Capita. The region as a whole is second only to the central region which includes Bangkok.
  - The provinces of Surat Thani, Krabi, Phangnga, Satun, and Songkhla are in the second highest quintile.

NESDB - gross provincial product
Per Capita Income

- **Townsend Survey**: Southern Thailand is poorer than CN/E and has less sources of income.
  - Gross income: 9,913 baht in the South, 15,796 in the CNE.
  - Net income: 7,344 baht in the South, 9,891 in the CNE.
  - Satun comparable to Buriram
  - Yala is lowest

- **Socio-Economic Survey 2000**: The southern region of Thailand, with the exception of Pattani, Yala, and Narathiwat, have a high per capita current income.
  - The southern provinces of Songkhla, Trang, Phatthalung, and Surat Thani are in the same quintile (3,500-8,200 baht) as that of the central region, which includes Bangkok.

Source: Thailand Human Development Report 2003 (UNDP)
Per Capita Expenditure

- **Townsend Survey:**
  - The level of expenditure is higher in the South than in the CNE, which translates in higher savings in the CNE than in the South. South households spend 10% more than CNE households in "Household repairs", 14% more in "vehicle repairs", 67% in "education", 140% more in "clothing" and 23% more in "food eaten away".

- **Socio-Economic Survey 2000:**
The southern region of Thailand, with the exception of Narathiwat, has above average levels of expenditures. The central region has the highest levels of consumption-expenditure (2,500-5,300 baht).

Source: Thailand Human Development Report 2003 (UNDP)
Assets: Television

- Townsend Survey: In general CNE household hold more assets than south household, but there are some interesting exceptions, like ”VCR”: 31% of the households in the south has it and 17% in the CNE; however ”TV” is less common in the South (75% vs 84%).

Source: Thailand Human Development Report 2003 (UNDP)
Assets:
Vehicle Registration / Cars

•“Cars” are more common in the south (8% vs. 2.5%),
•but not ”bicycles” (25% vs 56%).

Source: Thailand Human Development Report 2003 (UNDP)
PROBLEMS FOR THE FAR SOUTH
Demographics: Population Density

- Royal Thai Survey Department and Royal Forest Department, LANDSAT, 1998: The central and northeastern regions of Thailand have the greatest population density. The south in comparison has a few densely populated provinces.
  - Within the southern region the province of Pattani has the greatest population density. The next most densely populated provinces are Narathiwat, Songkla, Phatthalung, and Krabi.
Poverty::
Poverty Incidence

- **Socio-Economic Survey 2000:** In comparison to the other regions in Thailand the south has a lower poverty incidence rate. The exception to this is in the provinces of Yala, Pattani, and Narathiwat which are in the highest quintile (24-50%). The central region has by far the lowest poverty incidence rate in all of Thailand.

Source: Thailand Human Development Report 2003 (UNDP)
Education:
No Formal Education

- **Townsend Survey:**
  - No Education
    - Men: 9.7% south vs. 5.7% cne
    - Women: 18.5% south vs. 13.4% cne
  - P.4.
    - Men: 28.5% south vs. 44.4% cne
    - Women: 31.2% south vs. 42.6% cne
  - So the level of education is lower in the south than in the CNE.

Source: Thailand Human Development Report 2003 (UNDP)
Education:

Percent Illiterate

- Head of the households
- no education:
  - Men: 14% south vs. 9% cne
  - Women: 34% south vs. 22% cne
Education: Mean Years of Schooling

- Labor Force Survey, Round 3 (July-September), 2001: The southern region of Thailand, with the exception of Pattani and Narathiwat, have a high mean years schooling.
  - The southern region is in the same quintile as that of the central region, which includes Bangkok.

Source: Thailand Human Development Report 2003 (UNDP)
Employment:
Unemployment Rate

- Labor Force Survey, Round 3 (July-September) 2001, National Statistical Office: In comparison to the other regions of Thailand the south has an average level of Unemployment. The northeast has the highest unemployment rates in the country.
  - Within the southern region the province of Narathiwat has the largest unemployment rate. Followed closely by Satun, Nakhon Si Thammarat, and Phatthalung.

Source: Thailand Human Development Report 2003 (UNDP)
Health:
Infant Mortality Rate

- **Public Health Statistics 2002**, Health Information Division, Bureau of Health Policy and Planning, Ministry of Public Health: In comparison to the other regions in Thailand the south has patterns of disbursed IMR. There are high concentrations of IMR in the north along the Myanmar border and along the highway between Phitsanulok and Suphan Buri and in the northeast along the Lao Peoples Democratic Republic.
  - Within the southern region Yala, Narathiwat, Pattani, and Trang are in the lowest quintile with 8-15 per 1,000 dying. Followed closely by Songkhla and Krabi.

Source: Thailand Human Development Report 2003 (UNDP)
Health: Malnutrition

- Nutrition Surveillance in Children (0-60 months) Report, First Quarter/Fiscal Year 1998 (October-December 1997), Health Department, Ministry of Public Health: In comparison to the other regions in Thailand the south, with the exception of Yala, Narathiwat, and Satun, is doing well. The North and Northeast are the trouble areas for malnourished children under 5 years of age.
  - Within the southern region Yala and Narathiwat are in the lowest quintile with 10-15% malnourished. Followed closely by Satun.
Financial Intermediation
Financial Intermediation:
Use of Commercial Bank

Source: CDD
Financial Intermediation: Use of BAAC

Is the Bank of Agricultural Cooperatives being used by villagers as a credit source for agriculture?

Legend
AGRICULT.COOP.BANK
No
Yes
Note: Quintiles

Source: CDD
Percent of HH with Debt

LOW DEBT/ Low savings

- **Townsend Survey**: Savings in NE: 26,426
  Savings in South: 5761
- **Question**: Do you or member of your HH have any of the following kind of savings?
  - Savings in cash: 99.3% in NE, 65.8% in the south
  - Savings in BAAC: 50.7% in NE, 36.7% in the south
  - Savings in Commercial banks: 29.5% in the NE, 10.4% in the south
  - Rice in storage: 57.4% in the NE, 0.4% in the south

- **Socio-Economic Survey 2000**: The northeast has the largest percent of households with debt. In the southern region only Phangnga (5th quintile), Trang (4th quintile), and Phattalung (4th quintile) have above average levels of debt.

Summary - low debt

Source: Thailand Human Development Report 2003 (UNDP)
However the south seems to rely more on relatives than CNE.

- Have you helped non-relatives who live in the village or tambon with money? 61% yes in the south and 25% yes in the CNE.
- Have non-relatives who live in the village or tambon helped you with money? 58% yes in the south, 26% in the CNE.

As a special case, let’s consider children living outside the house: in the south more help go to them (5,728 bath) that help came homes.

- Sisaket money sent by kids 7772 and sent to children 1621
- Yala money sent by kids, 335 and sent to children 7473

Special note: remittances are not incoming
Some migration from south in 1988
South migration very low by 1996, 1999

Figure 7: FRMIGHH96 VS. FRMIGHH99
Number of Deaths due to Murder for Adults 1994

Legend
- 0.000000 - 0.010000
- 0.010001 - 0.040005
- 0.040006 - 0.070023
- 0.070024 - 0.130223
- 0.130224 - 0.487500

Note: Quintiles
Violent Crimes Reported 2000 per 100,000 population

Legend

<table>
<thead>
<tr>
<th>VIOLCRM_00</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.00 - 7.00</td>
</tr>
<tr>
<td>7.01 - 12.00</td>
</tr>
<tr>
<td>12.01 - 15.00</td>
</tr>
<tr>
<td>15.01 - 20.00</td>
</tr>
<tr>
<td>20.01 - 33.80</td>
</tr>
</tbody>
</table>

Note: Quintiles
Evaluation strategy #4

Structural models
ROLE OF THE FINANCIAL SYSTEM
IN THE ALLOCATION OF PRODUCTIVE CREDIT:
INTERMEDIATION FROM SAVERS TO BORROWERS

Evaluation of Financial Liberalization:
A general equilibrium model with constrained occupation choice

Xavier Giné (World Bank)
&
Robert M. Townsend (University of Chicago)
Wealth facilitates entry into business
Facilitates INVESTMENT of existing businesses-ROA

Figure 1: Occupational Choice Map
- Wealth facilitates entry into business
- Facilitates INVESTMENT of existing businesses-ROA
2 Environment – A Representative Model

Firms \( q = f(k, l) = \alpha k - \frac{1}{2} \beta k^2 + \sigma kl + \xi l - \frac{1}{2} \rho l^2. \) -- Production

\[ H(x, m) = mx^2 + (1-m)x, \quad m \in [-1, 1]. \] -- if Talent high

investment

Setup costs are low
Profits of firms

\[ \pi(b, x, w) = \max_{k, l} f(k, l) - wl - k \]
\[ \text{s. t. } k \in [0, b - x], \quad l \geq 0. \]  

Invest, Finance
Constraint - from savings, no credit

Occupation Choice

Who can go into business?

Dynamics: ‘Myopic Savings’

\[ W(b, x, w) = \begin{cases} 
\gamma + b & \text{if a subsistence worker,} \\
w - \nu + b & \text{if a wage earner,} \\
\pi(b, x, w) - x - \nu + b & \text{if a firm.} 
\end{cases} \]  

\[ \max_{C, B} U(C, B) \]
\[ \text{s. t. } C + B = W \]  

\[ U(C, B) = C^{1-\omega} B^\omega. \quad \rightarrow \text{save } \omega \]
Intermediated Sector:

\[
W(b, x, w, R) = \begin{cases} 
\gamma + Rb & \text{as a subsister,} \\
 w - \nu + Rb & \text{as a worker,} \\
\pi(w, R) - Rx - \nu + Rb & \text{as an enterpreneur.}
\end{cases}
\] (24)

Deposit mobilization and lending

Neoclassical firm

\[
\pi^u(w, R) = \max_{k, l} f(k, l) - wl - Rk
\] (25)

which yields the optimal choices

\[
k^u(w, R) = \frac{\rho(\alpha - R) + \sigma(\xi - w)}{\beta \rho - \sigma^2} \quad \text{and} \quad l^u(w, R) = \frac{\sigma k^u + (\xi - w)}{\rho}
\] (26)

Optimal inputs not wealth-dependent, firm can borrow for investment
Estimation: Two Data Sets

Table 1: MLE Results

<table>
<thead>
<tr>
<th></th>
<th>$s^a$</th>
<th>$\gamma$</th>
<th>$m$</th>
<th>$\alpha$</th>
<th>$\beta$</th>
<th>$\rho$</th>
<th>$\sigma$</th>
<th>$\xi$</th>
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<tr>
<td>Townsend-Thai</td>
<td>1.4338</td>
<td>0.01538</td>
<td>0.00559</td>
<td>0.97545</td>
<td>0.00330</td>
<td>0.00966</td>
<td>0.00432</td>
<td>0.12905</td>
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<tr>
<td></td>
<td>(0.03978)</td>
<td>(0.00408)</td>
<td>(0.17056)</td>
<td>(0.00191)</td>
<td>(0.00013)</td>
<td>(0.00692)</td>
<td>(0.00157)</td>
<td>(0.04146)</td>
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<tr>
<td>SES</td>
<td>1.4236</td>
<td>0.02744</td>
<td>-0.59330</td>
<td>0.54561</td>
<td>0.39064</td>
<td>0.03384</td>
<td>0.10210</td>
<td>0.25826</td>
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<tr>
<td></td>
<td>(0.00881)</td>
<td>(0.00119)</td>
<td>(0.05801)</td>
<td>(0.06711)</td>
<td>(0.09028)</td>
<td>(0.00364)</td>
<td>(0.02484)</td>
<td>(0.03523)</td>
</tr>
</tbody>
</table>

Calibration

Cost of living $\eta$

Savings rate $\omega$

Subsistence income

growth rate $\gamma_{gr}$

6.2.1 Initial Wealth Distribution

6.2.2 Calibration - The Metric

$$C = \sum_{s=1}^{5} \sum_{t=1976}^{1996} w_{st} \left[ \frac{z_{st}^{\text{sim}} - z_{st}^{\text{ec}}}{\mu_{z,s}} \right]^2$$  \hspace{1cm} (40)
Figure 6: Benchmark Model: Best Overall Fit (SES Data).

Legend: — Thai Economy, — Simulation.
MACRO SIMULATION: CREDIT MATTERS

Eventual diminishing Returns, BUT WE GET TFP

INVESTMENT WILL MOVE TOO

DYNAMICS DUE TO IMPROVED INTERMEDIATION,

Figure 11: Robustness of the model (Townsend-Thai Data).
Legend: --- (dash-dash) Thai Economy, -- (solid) Simulation at estimated parameters, -. (dash-dot) Mean Simulation, ··· (dot-dot) Confidence intervals.
COST BENEFIT ANALYSIS
AT HH LEVEL!

MICRO-WELFARE
Distribution of
Gains and losses

Poverty Reduction is a
Laudable Goal

Here its linked to macro

Increase in wages might
hurt larger business
Table 2: Welfare Gains and Losses

<table>
<thead>
<tr>
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<th>Intermediated Ec. Wealth Dist</th>
<th>Non-Intermediated Ec. Wealth Dist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Townsend-Thai Data, 1979</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare Gains</td>
<td></td>
<td></td>
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<tr>
<td>Mean</td>
<td>82,376</td>
<td>3,295</td>
</tr>
<tr>
<td>Median</td>
<td>22,839</td>
<td>914</td>
</tr>
<tr>
<td>Mode</td>
<td>7,779</td>
<td>311</td>
</tr>
<tr>
<td>Pct. of Population</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>SES Data, 1996</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welfare Gains</td>
<td></td>
<td></td>
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<tr>
<td>Mean</td>
<td>76,840</td>
<td>3,074</td>
</tr>
<tr>
<td>Median</td>
<td>25,408</td>
<td>1,016</td>
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<tr>
<td>Mode</td>
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<td>1,026</td>
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<td>Pct. of Population</td>
<td>86</td>
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Welfare Losses

<table>
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<tr>
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<th>Intermediated Ec. Wealth Dist</th>
<th>Non-Intermediated Ec. Wealth Dist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>117,051</td>
<td>107.59</td>
</tr>
<tr>
<td>Median</td>
<td>113,705</td>
<td>104.51</td>
</tr>
<tr>
<td>Mode</td>
<td>117,486</td>
<td>107.99</td>
</tr>
<tr>
<td>Pct. of Population</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

ESTIMATING THE IMPACT OF INCREASED ACCESS
Fig. 7. Foreign capital inflows and financial liberalization. Legend: — Foreign cap. Inflows as a fraction of GDP, — — Fraction of population with access to intermediation.

Fig. 8. Access to capital and foreign cap. Inflows: SES (left) and Townsend-Thai (right). Legend: — (thick) Thai economy, — Closed economy, — — Economy with capital flows and linear participation.
SECOND ROLE OF FINANCIAL SYSTEM -- ALLOCATION OF RISK

Transitional Growth with Increasing Inequality and Financial Deepening

Robert M. Townsend
and Kenichi Ueda(IMF)
3. Model - Environment

Objective: Discounted Expected Utility Over Infinite Horizon

\[ E_t \left[ \sum_{t=1}^{\infty} \beta^{t-1} u(c_t) \right] \]

Technology Shocks

\( \delta = \text{safe return} \)

\( \theta + \epsilon = \text{risky return} \)

Essential staple consumption,

HIGH MEAN, HIGH RISK

Aggregate Shock + Idiosyncratic

Autarky Sector: Isolated Households and Firms

\[ k_{t+1} = s_t (\phi_t (\theta_t + \epsilon_t) + (1 - \phi_t) \delta) \]

Savings rate

Share invested in Risk Technology: Limited by income today
OPTIMAL ENDOGENOUS EXPANSION

- First, there is a one time entry fee or a fixed cost $q > 0$ incurred at entry (infrastructure, learning something new.

- Also there is a variable cost

\[ k_{t+1} = s_t r(\theta_t). \]

- Advantage - pooling all idiosyncratic risk leaving only the aggregate shock which all bear together

- Advanced information on sector, activity to invest in

- But what are these transactions costs?

- MODEL PRESUMES FINANCIAL INSTITUTIONS PLAY THIS ROLE BUT SEE BELOW FOR TESTS
Calibration/Data Sources

Table 1: Benchmark Parameter Values

<table>
<thead>
<tr>
<th>σ</th>
<th>q</th>
<th>δ</th>
<th>θ</th>
<th>ε</th>
<th>β</th>
<th>γ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>1.054</td>
<td>[1.047, 1.147]</td>
<td>[−0.6, 0.6]</td>
<td>0.96</td>
<td>0</td>
</tr>
</tbody>
</table>

Thai project, data on rates of return! Income/asset ratios
BIG SURVEY
MONTHLY MICRO SURVEY -- EVEN HIGHER?

MACRO SHOCKS- PART OF FLUCTUATIONS, COUNTRY RISK
MACRO SIMULATION
APPLICATION VILLAGE LEVEL
Entrepreneurial Activity Growth
Percent Change, 1986-1996
By Quintiles

Percent Growth
- Major Roads
-89.06284498
-89.06284495 - 417.7657958
417.7657959 - 1,431.422647
1,431.422648 - 3,965.564801
3,965.564802 - 129,659.0156
LEB 5-Bin Simulated Change in Entrepreneurial Activity
Percent Change: 1986 to 1996
Growth in Entrepreneurial Activity in Reds,
Decrease in Entrepreneurial Activity in Blues
(By Quantiles)
Figure 18: LEB Simulation Residuals
Local Moran Map at P=.05 Cut-Off Value

Distance Weights: 10 Nearest Neighbors

Figure 19: LEB Distance-Modified (5 Bin) Simulation Residuals
Local Moran Map at P=.05 Cut-Off Value

Distance Weights: 10 Nearest Neighbors
1996 LEB Experiment from New Intersections
Minus 1996 5-Bin LEB Simulation (Distance Modified):
Reds are areas with higher simulated fraction of entrepreneurs from LEB experiment;
Greens are areas with lower values.
10 nearest villages, divided by distance ^ 1.5. By Deciles.
Figure 20: 1996 GJ Access Index Simulation Differences: Binary Values

Differences are Between Actual and Simulated

Reds are Areas of Model Over-Prediction,
Greens are Areas of Model Under-Prediction

Binary Differences
- Major Roads
- No Data
- Over-Prediction of Under-Prediction of

Distance Weights: 10 Nearest Neighbors

Figure 21: GJ Wealth Simulation Residuals Local Moran Map at $P=0.05$ Cut-Off Value

Moran Scatterplot Quadrant
- Major Roads
- High-High
- Low-Low
- High-Low
- Low-High
COMING ATTRACTIONS
Remedy? Financing income generating activities
Figure 2: South

Debt to Income ratio
Kernel density estimation (South)
Figure 3: Poorest Quartile

Income to Wealth ratio (South)

First quartile
Figure 5: Becoming an entrepreneur and wealth

Starting a business and wealth (South)

Non-parametric estimation
Figure 4A: Whole Sample

Notes to Figures 4A – 4C: These figures depict the likelihood of starting a business as a function of wealth six years prior to the survey. The wealth variable is normalized by dividing household wealth by the maximum value of household wealth in the sample, so that normalized wealth lies in a range from zero to one. For the structural estimates, the likelihood of starting a business is found by calculating the likelihood function for each model at the maximized parameter values as a function of wealth. See footnote 5 for details on how the non-parametric estimates of the likelihood of starting a business were created.
Figure 4B: Wealth < Median

Predicted Probability from Various Models, Wealth < Median
REMEDY - BETTER REALLOCATION OF RISK
Table 3: **Worst year for household income**

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>last year</td>
<td>32.0</td>
<td>13.3</td>
</tr>
<tr>
<td>two years ago</td>
<td>27.0</td>
<td>11.3</td>
</tr>
<tr>
<td>three years ago</td>
<td>29.0</td>
<td>12.1</td>
</tr>
<tr>
<td>four years ago</td>
<td>14.0</td>
<td>5.8</td>
</tr>
<tr>
<td>five years ago</td>
<td>28.0</td>
<td>11.7</td>
</tr>
<tr>
<td>no changes</td>
<td>110.0</td>
<td>45.8</td>
</tr>
<tr>
<td>Total</td>
<td>240.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Source: Townsend South Data*

Table 4: **reasons for bad year**

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>flood</td>
<td>1.0</td>
<td>0.8</td>
</tr>
<tr>
<td>not enough rainfall</td>
<td>4.0</td>
<td>3.1</td>
</tr>
<tr>
<td>crop yield low for other reason</td>
<td>26.0</td>
<td>20.0</td>
</tr>
<tr>
<td>low price for output</td>
<td>63.0</td>
<td>48.5</td>
</tr>
<tr>
<td>high input prices</td>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>education expenses are higher</td>
<td>8.0</td>
<td>6.2</td>
</tr>
<tr>
<td>high investment costs</td>
<td>1.0</td>
<td>0.8</td>
</tr>
<tr>
<td>illness</td>
<td>9.0</td>
<td>6.9</td>
</tr>
<tr>
<td>worked fewer days</td>
<td>10.0</td>
<td>7.7</td>
</tr>
<tr>
<td>other</td>
<td>6.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Total</td>
<td>130.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Source: Townsend South Data*
Household $i$'s income at time $t$ consists of a permanent component and transitory component: $y_{it} = y^P_{it} + y^T_{it}$. The permanent component is assumed to be a linear function of a vector of fixed household characteristics $X_{it}$, such as the age-structure composition of the household, education of household members, household landholdings, the time dates over which the household is observed, and the physical location of the household: $y^P_{it} = \alpha_0 + X_{it}\alpha_1$.

Unlike the components of permanent income, shocks to transitory income affect income in the current period, but their effect on income in future periods become arbitrarily small over time (that is $y^T_{it}$ is a stationary process). Here we use rubber price shocks as an exogenous source of variation in income, consumption and savings, so transitory income is decomposed as $y^T_{it} = \alpha_2E_{it}R_t + \varepsilon_{it}$. $R_t$ is the price of rubber at time $t$, and $E_{it}$ indexes the household’s sensitivity to rubber price shocks, while $\varepsilon_{it}$ captures other sources of transitory fluctuations in income.

Substituting these in, household income is given by:

$$y_{it} = \alpha_0 + X_{it}\alpha_1 + \alpha_2E_{it}R_t + \varepsilon_{it}$$  \hspace{1cm} (1)

We also start by assuming household consumption is a linear function of the same vector of explanatory variables. This is generally no more than a convenient linear approximation (see Blundell, Pistaferri and Preston, 2002 for the derivation of the approximation), although will be exactly true in a model with CARA utility and normally distributed shocks:

$$c_{it} = \delta_0 + X_{it}\delta_1 + \delta_2E_{it}R_t + u_{it}$$  \hspace{1cm} (2)
Townsend and Vickery “Commodity Price Shocks”

\[ c_t = \mu + (1 - \beta)W_t + \frac{1 - \beta}{1 - \rho \beta}[y_t - \mu] - \frac{\beta}{1 - \beta} \frac{1}{2} \sigma^2 \gamma \]

\[ s_t = -(1 - \beta)W_t + \frac{\beta(1 - \rho)}{1 - \rho \beta}[y_t - \mu] + \frac{\beta}{1 - \beta} \frac{1}{2} \sigma^2 \gamma \]
Figure 1: Real rubber price (1996 Thai baht / kg * $\frac{1}{100}$. Source IFS)
Occupation: HH Engaged in Rubber or “other”

- **Townsend Survey**: The percentage of households involved in agricultural activities is very similar in both regions (91% in the south and 95% in the CNE), however, there is an important difference in the number of households involved in business (20% in the south and 52% in the CNE).
  - The most important primary occupation in the south is ”orchard farmer” (48%), and ”rice farmer” in the CNE (29%).
  - Most important source of income: ”rubber” with 41,796 bath (35% of gross income) in the South.

Source: CDD
Table 2
Basic results

Estimation by least squares (first part of table) and median regression (second part of table). Robust standard errors. Regression also includes a constant and: (i) 8 dummies for the sex and education level of household head (ii) controls for number of children in 5 different sex-age categories (ii) dummies for changwat (province) location of household (iii) dummies for the year-quarter the household was surveyed (iv) 5 dummies for the amount of land held by the household and/or whether the household was a renter (v) 8 dummies for the socio-economic class of the household head (vi) 13 dummies for the type of enterprise the household head was primarily occupied with.

(A) Least squares

<table>
<thead>
<tr>
<th>Dep. Variable:</th>
<th>h.h.income</th>
<th>h.h.saving</th>
<th>h.h.consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>rubber_prop</td>
<td>-938.642</td>
<td>-371.956</td>
<td>-566.686</td>
</tr>
<tr>
<td></td>
<td>(465.414)**</td>
<td>(440.771)</td>
<td>(265.694)**</td>
</tr>
<tr>
<td>rubber_prop * time</td>
<td>73.314</td>
<td>16.958</td>
<td>56.356</td>
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<td></td>
<td>(52.758)</td>
<td>(50.310)</td>
<td>(31.439)*</td>
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<td>rubber_prop * rubber_price</td>
<td>521.445</td>
<td>37.741</td>
<td>483.703</td>
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<tr>
<td></td>
<td>(131.282)***</td>
<td>(149.130)</td>
<td>(124.259)***</td>
</tr>
<tr>
<td>Number of observations</td>
<td>44009</td>
<td>44009</td>
<td>44009</td>
</tr>
<tr>
<td>R²</td>
<td>0.15</td>
<td>0.04</td>
<td>0.18</td>
</tr>
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</table>

(B) Median regression

<table>
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<th>h.h.consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>rubber_prop</td>
<td>-139.344</td>
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<td>(163.798)</td>
<td>(112.071)**</td>
<td>(128.721)*</td>
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<td>rubber_prop * time</td>
<td>28.714</td>
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<td>(19.532)</td>
<td>(13.361)***</td>
<td>(15.353)</td>
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<tr>
<td>rubber_prop * rubber_price</td>
<td>243.363</td>
<td>15.499</td>
<td>231.589</td>
</tr>
<tr>
<td></td>
<td>(62.091)***</td>
<td>(42.473)</td>
<td>(48.823)***</td>
</tr>
<tr>
<td>Number of observations</td>
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<td>44009</td>
<td>44009</td>
</tr>
</tbody>
</table>

* significant at 10%; ** significant at 5%; *** significant at 1%