Wealth Accumulation and Factors Accounting for Success

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Abstract

We use detailed income, balance sheet, and cash flow statements constructed for households in a long monthly panel in an emerging market economy, and some recent contributions in economic theory, to document and better understand the factors underlying success in achieving upward mobility in the distribution of net worth. Wealth inequality is decreasing over time, and many households work their way out of poverty and lower wealth over the seven year period. The accounts establish that, mechanically, this is largely due to savings rather than incoming gifts and remittances. In turn, the growth of net worth can be decomposed household by household into the savings rate and how productively that savings is used, the return on assets (ROA). The latter plays the larger role. ROA is, in turn, positively correlated with higher education of household members, younger age of the head, and with a higher debt/asset ratio and lower initial wealth, so it seems from cross-sections that the financial system is imperfectly channeling resources to productive and poor households. Household fixed effects account for the larger part of ROA, and this success is largely persistent, undercutting the story that successful entrepreneurs are those that simply get lucky. Persistence does vary across households, and in at least one province with much change and increasing opportunities, ROA changes as households move over time to higher-return occupations. But for those households with high and persistent ROA, the savings rate is higher, consistent with some micro founded macro models

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with imperfect credit markets. Indeed, high ROA households save by investing in their own enterprises and adopt consistent financial strategies for smoothing fluctuations. More generally growth of wealth, savings levels and/or rates are correlated with TFP and the household fixed effects that are the larger part of ROA.

1 Introduction

We use detailed income and balance sheet statements constructed for households in a long monthly panel in an emerging market economy to document and better understand the factors underlying success in achieving upward mobility in the distribution of net worth. The overall growth rate of wealth when accounting for inflation is only a modest 0.3% per year and the wealth distribution is highly skewed, with the relatively rich holding a third of net worth and the bottom half holding less than 10%. But the growth rate of wealth over time is sharply decreasing in initial wealth levels, that is, the relatively poor grow much faster than the rich, at 22% per year vs. 0.09% per year. Further decompositions show that overall inequality comes down substantially as households either transit upwardly over time across initial wealth quartiles or as wealth increases on average for the lower quartiles, so that the gaps across the quartiles narrow. Geographic location and occupation contribute less than what we might have expected to this story. There is initially increasing wealth inequality across regions for some occupations, increasing for fish/shrimp and cultivation overall and for labor and business initially. But the larger force, about 60%, is the reduction of inequality within the residual category.

Some of the more successful households experience large increases in their relative position in the wealth distribution, while others fall down. Approximately 7% of households in the survey stayed at the same relative position, 43% increased their position, and almost 50% have a negative change in position. The standard deviation of relative position change is 14 points, so again there is substantial mobility within the distribution.

The constructed accounts also allow an exact decomposition of these changes into net savings and incoming gifts/remittances. Savings accounts for 81% of the change, and, roughly, gifts decrease as initial wealth quartiles increase. The rich actually give some money away, for example. But for the second quartile of initial wealth, incoming gifts play a role equal to savings, even more so for households running businesses (as enterprises made losses in early years).

Another decomposition allows us to separate the increase in net worth into the role played by the savings rate versus how effectively those savings are used, that is, the return on assets (ROA). Growth of net worth is positively and significantly correlated with savings rates but less so than the high and consistently significant correlation of the growth of net worth with ROA, across the board. In this sense, successful households with high growth of net worth are the households who are productive – who utilize their existing assets to produce high per unit income streams.

In turn we can search for significant covariates of ROA. There is a positive correlation of high ROA with low initial net worth (i.e., the poor are especially productive), a higher education of the head or among household members (especially for those running businesses), a younger age of the head of the household, and a high debt/asset ratio (as we comment on below).

In the robustness checks we control for labor hours and, related, impute a wage cost to self-employment. We also correct for measurement error in initial assets and, in exploring covariates, use IV rather than OLS regressions. We also delete poor wage earning households with few assets. Results are robust to these specifications.

But by far the largest single factor in a decomposition of variance are household specific fixed effects. Related, there is considerable persistence. Households successful over the first half of the sample are very likely to be successful over the second, indicating that luck per se is not a likely explanation for this success. Auto-correlation numbers range from 0.15 to 0.83. In one fast-growing province in the poorer Northeast, persistence is much lower, and there is strong evidence that households are moving out of lower ROA occupations and into higher ones, as the local economy presents opportunities. Variability in household size also undercuts persistence, highlighting the importance of a successful individual rather than a successful household per se. Northeastern households experience more volatility in membership.

As noted in passing above, there is some borrowing, and indeed, high ROA households have higher debt/asset ratios. It thus appears that the financial system does manage to some degree to extend credit to the poor with high returns. Indeed, using more structure for production functions, and using instruments suggested by Olley and Pakes (1996), and Levinsohn and Petrin (2003), we find that high marginal product of capital (MPK) households are likely to borrow more relative both to their wealth and to others. However, there is still a divergence between estimated MPK and average interest rates, so in that sense some households are constrained (a related distortion, others utilize their own wealth at a low return rather than allowing it to be intermediated). Further, we allow interest rates to vary across households as measured in the survey data, as if there were a wedge or distortion from the average, as in Hsieh and Klenow (2009), Restuccia and Rogerson (2008), and

Fernandes and Pakes (2008). Re-estimated TFP is no longer correlated with the debt/asset ratio, as if we had now correctly accounted in this way for those credit market distortions, or other things.

The dynamics coming from the panel are revealing about the distortions which are harder to rationalize. Consistent with a literature on growth with financial frictions, we find, using monthly data, that households with high and persistent ROA are households that tend to save more. This is consistent with the models of Buera (2008) that poor households can save their way out of constraints, say to eventually enter high return businesses, or expand existing businesses. However, this result is not robust to annual data. In the model of Moll (2009) and Banejeree and Moll (2009) persistent ROA should increase the growth of net worth as households save their way out of constraints. Overall however savings levels and rates and growth of wealth are all correlated with the level of ROA, the household fixed parts of ROA, and measured TFP.

As further evidence of constraints, high ROA households tend to save by investing, that is, they accumulate physical assets. The top quartile of ROA households invest in their own enterprise activities, but this is not the case for the middle and lower ROA groups. Instead, for many, increases in net worth are accomplished with increases in financial assets or cash saving. Related, relative to others in the cross-section, high ROA households are less likely to use capital assets to smooth consumption. Instead, they use consumption to finance investment deficits. High ROA households are more actively involved in financial markets month by month, in the sense of using formal savings accounts and sources of borrowing, and engage less in informal markets, i.e., receiving fewer gifts. But high ROA households do use cash more than the low ROA households, as well. Indeed, relatively high ROA households surprisingly do seem to seek financial autarky over time; in the long run reducing their debt, reducing the amount of gifts they receive, and increasing the amount in formal savings accounts. This even though they retain a relatively high ROA.

As ROA is a widely accepted indicator of success in corporate accounting, but less so in economic theory, we also estimate total factor productivity (TFP) as was anticipated earlier. We find that it is correlated with ROA and in turn with candidate covariates, but less than before. The data are also adjusted for aggregate risk, consistent with the perfect markets, capital asset pricing model at the village level, utilizing the work of Samphantharak and Townsend (2009). We find a correlation of risk-adjusted returns with ROA, as a measure of individual talent, and a correlation of risk-adjusted returns with growth of net worth. But overall results are weaker, for example, high risk-adjusted return households do not invest more in their own enterprises. This suggests again that the capital markets are not perfect in these data, though there remains some consumption anomalies which we discuss at the end.

This paper is organized as follows. Section 2 describes the data, starting from a macro-level perspective as background and moving to the micro-level of selected areas from which we have detailed information on assets, liabilities, wealth, income, consumption, investment, and financial transactions. Section 2 also describes the wealth distribution and its decomposition. Section 3 decomposes growth of net worth into productivity and saving rates, and uses correlation analysis to show their relative importance to the growth of net worth. Section 4 uses regression analysis to find out what factors are associated with success as measured by a high rate of return on assets. Section 5 shows that ROA has considerable persistence, indicating that luck per se is not systematically related to success. Section 6 shows the predictive power of ROA on physical assets accumulation. Section 7 studies the financial strategies that high ROA households use and related imperfections in credit markets. Section 8 provides a short story of a selected successful household, as a case study, to complement the overall statistical analysis, and section 9 concludes.

2 Data

This paper uses data from the Townsend Thai monthly survey,[1] an ongoing panel of households being collected since 1998. The survey is conducted in 4 provinces (or changwat in Thai), the semi-urban changwats of Chachoengsao and Lopburi in the Central region and the more rural Buriram and Sisaket in the poorer Northeast region (see the map in Figure 1 below). This paper studies the balanced panel of 531 households that are interviewed on a monthly basis, dating from January, 1999, to December, 2005 (seven years).[2] In each province one tambon (county) and four villages per tambon were selected at random from a larger 1997 survey. With only 16 villages overall, this naturally raises some questions about the representativeness of the sample. So we also report here on the background from secondary sources, which is largely consistent.

For comparability over time we put variables into real terms with 2005 as the benchmark for both data sets.

[1] See further details of sampling design of this survey from Binford, Lee and Townsend (2004).

[2] Attrition is typically one of the most serious problems involving panel data, and this survey is no exceptioin. For those households with incomplete panel, the two main reasons are temporary migration (42%) and household member with relevant information is not available (26%). However, 60% of the incomplete panel consist of wage earner, and below we drop all wage earner from some of the analysis for other reasons.

2.1 Background at Macro-Provincial Level

Figure 1 is from the Thai Socio-Economic Survey, a nationally representative household survey conducted by the National Statistics Office of Thailand. Unfortunately there is no time series of wealth data in this survey. So we pick per capita net income to represent levels and what has happened over the past eighteen years. As is evident from the right panel, with all provinces depicted and the sample provinces highlighted, Buriram and Sisaket in the Northeast are among the poorest provinces in the entire nation. Chachoengsao and Lopburi are in the upper end of the distribution, though not the very highest (we do not have data in the SES for Chachoengsao over all years). However, it is also apparent that Lopburi is growing relatively faster.

Concentrating on the period of our own study here, the left panel is the ratio of per capita income from 1996 to 2006, relative to 1996. Here one can see the heterogeneity in growth, with high growth concentrated in the central region, but also in some parts of the Northeast and the South. Again, Lopburi stands out as growing relatively faster. Buriram is also doing quite well over this time frame. Chachoengsao and Sisaket are in the lower quartile. Evidently Sisaket is poor and tends to stay poor. Chachoengsao is relatively rich, but not growing much.

[Figure 1 here]

2.2 Poverty Reduction

Over the seven year time frame of the survey, many households work their way out of poverty. We use two measures of the poverty line here. First is the Thai official number for each province, which we can compare to either per capita income or to consumption. Second is a standard benchmark consumption of $2.16 a day at 1993 PPP. These two poverty lines generate some differences in the measure of poverty.

By location, there are many more poor in the Northeast. As is evident in Figure 2, income (especially for farmers) is erratic: monthly income displays nontrivial fluctuations. But we can still look at trends, that is, the overall picture and whether the number of poor people is decreasing over time by occupation, and by location (not shown). Using these high frequency monthly data, the headcount ratio fluctuates with a clear cycle in the Northeast. Poverty drops at harvest, the time when many households receive income from cultivation. This figure also indicates that the fraction of poor households in business is declining substantially. There are gains for livestock and modest gains for labor. But in terms of change, the biggest gains are in Buriram (not shown).

[Figure 2 here]

Using consumption numbers, there are a lower numbers of poor than by using the income measure, especially in the Central region. By location, the biggest gains are still in Buriram. By occupation, labor and business escape poverty relatively fast.

2.3 Measurement and the Accounting Framework

The Townsend Thai survey interviews households on a monthly basis (and bi-weekly for food consumption). Given that households are typically a production as well as a consumption unit, we treat households as corporate firms, as described in Samphantharak and Townsend (2009), and impose onto each of the transactions of the monthly data a financial accounting framework.

Each flow transaction is classified as being associated with production activities, consumption and expenditure, and financing and saving, for instance. This allows us to construct the balance sheet and the income statement of each household. Then we add the flow variables into the previous period stocks to get the current values of stock variables for each month for each household. The updated stock at the end of each month corresponds to the items in the balance sheet. Wealth or net worth in particular is equal to total assets minus total liabilities. It must also be equal to contributed capital plus cumulative savings.

We then derive the statement of cash flow from the constructed balance sheet and income statement and double check accounting identities between the balance sheet, the income statement and the statement of cash flow of each household, month-by-month, to make sure that the accounting framework is correctly imposed.

As the survey was not initially designed for this purpose, we sometimes have to make assumptions and refine the value of a transaction before we enter it into the appropriate line item. For instance, when household members migrate to work somewhere else, we do ask them when they returned how much they earned while they were away. If this is labor earnings, then this will show up as labor income. But they often send home remittances while they are away (thus treated as non-household member while away), and if we do not adjust for this, we may be double-counting, as otherwise we have both gift-in and labor income. In turn, we would overestimate the wealth of the household. Another example is cash holding. We do not ask for the amount of cash in hand, as this question might be sensitive and affect answers to other questions or even participation in the survey, but for any transactions we do ask whether it is done in cash, kind or on credit, so in principle we know the magnitude of all cash transactions. We then as a first step in an algorithm specify that initial cash is zero and then subsequently keep track of the changes. If they spend too much, cash balances will become negative. We reset the initial balance to a higher number such that in the data they never run out of cash. This algorithm, therefore, gives us a lower bound on cash holding. Sometimes discrepancies remain, and then we have to check manually, household by household, as the answers from a household can be more complicated than the existing code can accommodate. Additional difficulties are due to recall error, change in household composition, and appreciation in value of assets. Regarding recall error, a household may simply forget to tell us their relevant transaction at some point, but later with a myriad of additional questions we find out about that transaction. Then we have to go back and fix it. For change in household composition, an existing member might leave the household and a new member might move in, and as they often take some assets with them or bring new assets in, we have to take appropriately care. For value appreciation, especially land, it is possible that land was cheap in the past when the household started owning it, but that price went up by the time the household sold it. We take care of this by having capital gains items in the income statement and appropriately adjusting this appreciation in the balance sheet.

Though we believe that the accounting framework gives us a more accurate measurement than otherwise, measurement errors in the survey data cannot be avoided. We will keep the possibility of measurement errors in mind and revisit this in the appropriate sections below.

Lastly, there is the distinction between nominal and real terms. The accounting framework is constructed based on observed transactions, hence nominal units. We lose some of the identities when we convert the data to real terms. For most of the analysis in the paper we use real units for comparability over time. However, when we must rely on an accounting identity, we use nominal terms.[3]

2.4 Wealth Distribution in the Townsend Thai Monthly Survey

Table 1 reports the distribution of average wealth, by location and overall in 1999, in nominal baht value (the exchange rate was 37.81 baht for $1 in 1999, and on average 41.03 baht per $1 for 1999-2005). The median wealth in 1999 was about $20,000.

[Table 1 here]

[3] See further details of how to construct the account from the survey data from Pawasutipaisit, Paweenawat, Samphantharak and Townsend (2007).

By region, the top two provinces in the Central region are evidently wealthier than the bottom two in the Northeast. Within regions, Chachoengsao is wealthier than Lopburi, and Buriram is wealthier than Sisaket. These are consistent with the background data from the SES, even though income per capita was used there.[4]

There are five primary sources of income for households in the survey: cultivation, livestock, fish/shrimp, business and labor. Households in the survey typically have income from multiple sources, and one can label as the primary occupation the activity that generates the highest net income over some period. Table 2 shows the number of households in each occupation where we use the activity that generates highest net income over seven years (here by construction, these households do not "change" occupations/bins over time). As is evident, shrimp is associated with Chachoengsao, livestock with Lopburi.

[Table 2 here]

Table 3 reports the distribution of average wealth, by occupation, in 1999. By medians, fish/shrimp, livestock and business households are wealthier than those in cultivation.[5] Labor households appear to be the least wealthy, both in mean and median.

[Table 3 here]

We now focus on the distribution of wealth.[6] Table 4 shows that households in the top 1% of the wealth distribution hold around one-third of the total wealth in the survey, the top 5% hold about half of the total wealth. Half of the households in the survey own less than 10%. These numbers may understate wealth inequality if the rich are undersampled. These observations as given are similar to findings from developed countries like the United States, Britain (see Atkinson (1971), Kennickell (2003), Piketty and Saez (2003)).[7]

[Table 4 here]

[4] The minimum wealth in Sisaket in particular is negative, there are 2 households that are excessively indebted in 1999, even if they liquidate all their assets, they would not be able to pay back all their debts.

[5] The highest net worth household is one with cultivation, but that is an exception.

[6] Because households in this survey are selected by random sampling, and the survey is not explicitly designed to measure the distribution of wealth, therefore the actual wealth distribution might be worse than what we report here if the rich are undersampled.

[7] The degree of wealth inequality varys across location, however, it is highest in Chachoengsao while lower in other provinces. The top 1% in Lopburi own less than 13% while the top 1% in Sisaket own less than 18% of the total wealth in their province.

Though Table 4 shows the overall picture of wealth inequality, it does not keep households in the same group over time. Because we have panel data, we can track wealth dynamics at the household level. Using all observations (household-years), with groups defined from the distribution of average wealth in year 1999, we track the same group over time.

[Table 5 here]

Table 5 indicates that wealth share is rising for many groups but, especially for the initially poor. An observation common to all provinces is that the bottom half has a rising share.

By this standard, wealth inequality is thus going down over time. Other well known measures of inequality give similar reductions. For instance, the aggregate level of wealth inequality dropped from 0.71 in 1999 to 0.67 in 2005 if we use the Gini coefficient, and inequality went down from 1.26 in 1999 to 1.10 in 2005 if we use the Theil-T index.

2.5 Average Growth of Wealth by Initial Quartile, Location and Occupation

Table 6 documents a salient feature, that growth is decreasing in initial wealth. Every quartile has positive growth, but the magnitude is indeed remarkable for the poorest group, about 22% per year.

[Table 6 here]

To see where this movement comes from, Table 7 reports the growth of selected assets in household balance sheet. Land is typically the largest component in household portfolio but it is not the prime mover of wealth. The growth of household assets is decreasing in initial wealth, and though other types of fixed assets are not strictly monotone decreasing in initial wealth more upward movement comes from the bottom 50%. Growth of inventory is also large and decreasing in initial wealth, although inventory is not a big component of total assets. For financial assets, growth of deposits in financial institutions is also decreasing in initial wealth, and the growth of cash largely shares the same pattern, highest for the least wealthiest group and lowest for the wealthiest group, though mixed in the middle.

[Table 7 here]

The annual percentage increase in net worth by location is presented in Table 8. On average, total growth rate is about 0.3% per year, but this varies. On average, Lopburi has the highest growth rate (1.7%). Buriram has the lowest growth due to negative initial growth during the first three years, although it reaches the highest number in the Table in 2003-04 at 6.8%. Chachoengsao, in contrast, is slowing down and Sisaket is closest to 0 and does not change much compared to the others. Much of this is consistent with the national background presented earlier.

[Table 8 here]

The annual percentage increase in net worth by occupation is presented in Table 9. On average, households with livestock have the highest growth rate (2.2%) and households with business the second highest (1.5%). In contrast, cultivation and fish/shrimp households have negative growth where the lowest growth is at fish/shrimp (-0.58%). Labor has positive growth (1.28%) but is lower than livestock and business. All occupations experience negative growth in some periods.

[Table 9 here]

2.6 Decomposition of Wealth Inequality Change by Initial Quartile or Decile

We can also look at entire distributions of wealth. Figure 3 shows estimates of the kernel densities of wealth distributions (in log scale) when we classify households into four groups, by initial quartile, and follow each group over time[8]. The wealth distribution of the poorest group and the second poorest group shift toward the right, and for the second group it has a wider support. The wealth distribution of the relatively wealthy group (lower left panel) also become wider. The wealth distribution of richest group (lower right panel) shifts slightly toward the right, but this is not noticeable from the picture.

[Figure 3 here]

One question is how much of the reduction in wealth inequality is due to the fact that poor households grow faster, as opposed to other forces. One well known and widely used measure of inequality is the Theil-L index, which is additively decomposable. Let $W_t^{j,g}$ be the wealth of household j which belongs to group g at time t, and N_t be total number of household at time t. Then the Theil-L index is defined by

$$I_t = \log\left(\frac{1}{N_t}\sum_{j,g} W_t^{j,g}\right) - \frac{1}{N_t}\sum_{j,g}\log\left(W_t^{j,g}\right).$$

[8] It might seem that the distribution of initial wealth would have four humps when we pull all groups together. But this is only an artifact of the four separate kernel estimations. If the four histograms of initial wealth were plotted and presented in one column, it would be obvious that they are non-overlapping across the four panels.

Also let

$$\begin{aligned} N_t^g &= \text{total number of households in group } g \text{ at time } t \\ W_t^g &= \frac{1}{N_t^g}\sum_j W_t^{j,g} \\ I_t^g &= \log\left(W_t^g\right) - \frac{1}{N_t^g}\sum_j \log\left(W_t^{j,g}\right). \end{aligned}$$

Then inequality can be decomposed to a within (WI_t) and across (AI_t) component

$$\begin{aligned} I_t &= AI_t + WI_t \\ AI_t &= \log\left(\frac{1}{N_t}\sum_{j,g} W_t^{j,g}\right) - \sum_g \frac{N_t^g}{N_t}\log\left(W_t^g\right) \\ WI_t &= \sum_g \frac{N_t^g}{N_t} I_t^g. \end{aligned}$$

Thus total change inequality must come from changes in each component:

$$\Delta I = \Delta AI + \Delta WI.$$

To simplify the notation, let W_t be an aggregate mean of wealth at time t, p_t^g be the population share of subgroup g at time t. Then ΔWI and ΔAI each can be further decomposed into two subcomponents, [9]

$$\begin{aligned} \Delta AI &= \sum_g \left(\overline{\frac{p^g W^g}{W}} - \overline{p^g}\right)\Delta\log W^g + \sum_g \left(\overline{\frac{W^g}{W}} - \overline{\log\frac{W^g}{W}}\right)\Delta p^g \\ \Delta WI &= \sum_g \overline{p^g}\Delta I^g + \sum_g \overline{I^g}\Delta p^g \end{aligned}$$

where Δ and the overbar denote the time difference operator and the time average operator, respectively.

Each subcomponent has its own interpretation: $\sum_g \overline{p^g}\Delta I^g$ is intragroup inequality dynamics or change in inequality within group, $\sum_g \overline{I^g}\Delta p^g$ is composition dynamics through shifts across group with different degrees of inequality, $\sum_g \left(\overline{\frac{p^g W^g}{W}} - \overline{p^g}\right)\Delta\log W^g$ is wealth-gap dynamics or change in wealth differential across group, and $\sum_g \left(\overline{\frac{W^g}{W}} - \overline{\log\frac{W^g}{W}}\right)\Delta p^g$ is composition dynamics in changes in AI. The latter is the Kuznets effect, i.e., shifts by the poor into higher quartiles.

[9] See Mookherjee and Shorrocks (1982) where ΔWI is exact decomposition while ΔAI is approximate decomposition.

If we use the quartile of the wealth distribution in 1999 to define group then $p^g_{1999} = 1/4$ for all g, but again we allow people to move across groups over time, and also the number of households in each group may vary overtime. Some households with increasing wealth may move up, while those with decreasing wealth may fall down. Although the boundaries of each cell are fixed over time, many households move in and out of the cells. The transition matrix from 1999 to 2005 where group is initial quartile on the left, and by initial decile for comparison on the right, are each reported in Table 10[10].

[Table 10 here]

By quartile, about 20% of households move up and 8% of households fall down. There seems to be a considerable amount of persistence over time, as almost 72% stay in the same group. However, by deciles there is more mobility, as 37% of households move up, 21% of households fall down and only 41% stay in the same group.

[Table 11 here]

Table 11 for deciles reports the percentage of the contribution of each subcomponent to the total reduction in wealth inequality, year by year and overall from beginning to end. The biggest contribution comes from compositional Kuznets change and the wealth gap dynamics. The contributions from the two within components are smaller and sometimes negligible.

For the whole period of 1999-2005, the last row indicates that the decrease in wealth inequality is due to a compositional change, and to convergence in the wealth differential across groups, that is, 51% and 49% of the reduction in wealth inequality are due to these two components, respectively. Note that the former is the source of inequality dynamics which Kuznets emphasized, though it was income that he had in mind, while the latter indicates the convergence in wealth across groups.[11]

The last two columns indicate that overall within group inequality and a composition effect can be negative. For example, in the last overall row, the composition effect goes in the opposite direction from overall inequality, i.e., there are shifts into higher inequality groups.

By region, wealth inequality in both regions is decreasing. The Central region has much higher inequality (Theil-L is 1.1019 in 1999) than the Northeast (Theil-L is 0.6098 in 1999), but inequality

[10] The number in each cell is the number of households. One can convert these to fractions (probabilities as in the conventional transition matrix) by dividing it by sum of the number in each cell across column for each row.

[11] Using quartiles yields similar results but the orders of magnitude are lower because we have fewer bins, i.e., the decrease in wealth inequality for the whole period 1999-2005 is due to a compositional change (44.67%), and to convergence of the wealth differential across groups (39.87%). The two within components account for the rest (15.46%).

also decreases faster (Theil-L is 0.8611, and 0.5072 in 2005 for the Central and the Northeast regions). Table 12 reports the same type of decomposition by region.

[Table 12 here]

The biggest contribution still comes from compositional Kuznets change and the wealth gap dynamics, while the contributions from the within components are smaller. The Kuznets effect is the largest in both regions. However, the change in wealth differential across groups is relatively more important in the Northeast. As inequality is decreasing in both regions, this means that the average wealth of the lower and higher wealth deciles are converging, especially in the Northeast, in addition to people moving across the deciles. In contrast, the latter is the primary force in the Central region. Both are consistent with results from Tables 4 and 5, that wealth share of the rich is decreasing while wealth share of the poor is increasing.

2.7 Decomposition of Wealth Inequality Level by Location and Occupation

Let us suppress the time subscript for the moment and let W_{OL}^{j} be wealth of household j with occupation O at location L. Then the Theil-L index is defined by

$$I = \log\left(\frac{1}{N}\sum_{j,O,L} W_{OL}^{j}\right) - \frac{1}{N}\sum_{j,O,L}\log\left(W_{OL}^{j}\right)$$

where N is total number of households. We can decompose I to [12]

$$I = \left(\log\left(\frac{1}{N}\sum_{j,O,L} W_{OL}^{j}\right) - \sum_{L}\frac{N_L}{N}\log\left(W_L\right)\right) + \sum_{L}\frac{N_L}{N}\left[\left(\log\left(W_L\right) - \sum_{O}\frac{N_{OL}}{N_L}\log\left(W_{OL}\right)\right) + \sum_{O}\frac{N_{OL}}{N_L}I_{OL}\right],$$

where W_{OL} is average wealth of occupation O, at location L, W_L is average wealth of location L, N_{OL} is total number of households in occupation O and location L, N_L is total number of households in location L, and I_{OL} is Theil-L measure of wealth inequality of occupation O at location L i.e.,

$$I_{OL} = \log\left(W_{OL}\right) - \frac{1}{N_{OL}}\sum_{j}\log\left(W_{OL}^{j}\right).$$

Let $AL = \log\left(\frac{1}{N}\sum_{j,O,L} W_{OL}^{j}\right) - \sum_{L}\frac{N_L}{N}\log\left(W_L\right)$ denote inequality across locations, $AOWL = \sum_{L}\frac{N_L}{N}\left(\log\left(W_L\right) - \sum_{O}\frac{N_{OL}}{N_L}\log\left(W_{OL}\right)\right)$ denote the (sum of) inequality across occupations, but

[12] See Acemoglu and Dell (2009) for a related application.

within location, and $WOWL = \sum_L \frac{N_L}{N}\left(\sum_O \frac{N_{OL}}{N_L} I_{OL}\right)$ denote the (sum of) inequality within occupations, within locations.

[Figure 4 here]

[Table 13 here]

Overall, the within location occupation category is the largest. The second largest is across location, and the across occupation within location effect is the smallest. These are plotted in Figure 4 but on different scales.

In terms of changes, Table 13 and Figure 4 confirm that overall inequality I (Theil-L) is going down over time, where the residual WOWL is the biggest component among the three.

Wealth inequality across locations AL has an inverted U-shape, i.e., increasing until 2002 and decreasing after that, and wealth inequality across occupation but within location has a decreasing trend.

Within occupation/location, inequality is not decreasing everywhere. For example, business almost everywhere has an increasing trend (except Sisaket). Still, cultivation and labor have decreasing inequality everywhere and the biggest drop is in cultivation in Chachoengsao. Since most households have labor and cultivation as a primary occupation, these together drive down the aggregate value of this component, WOWL.

We can also reverse the order in decomposition and then look at inequality across occupations, and inequality within occupations but across locations:

$$
\begin{aligned}
I &= \left(\log\left(\frac{1}{N}\sum_{j,O,L} W_{OL}^j\right) - \sum_O \frac{N_O}{N}\log(W_O)\right) \\
&\quad + \sum_O \frac{N_O}{N}\left[\left(\log(W_O) - \sum_L \frac{N_{OL}}{N_O}\log(W_{OL})\right) + \sum_L \frac{N_{OL}}{N_O} I_{OL}\right],
\end{aligned}
$$

where W_O is average wealth of households with occupation O, and N_O is total number of households with occupation O.

Let $AO = \log\left(\frac{1}{N}\sum_{j,O,L} W_{OL}^j\right) - \sum_O \frac{N_O}{N}\log(W_O)$ denote inequality across occupations, $ALWO = \sum_O \frac{N_O}{N}\left(\log(W_O) - \sum_L \frac{N_{OL}}{N_O}\log(W_{OL})\right)$ denote the (sum of) inequality across location, but within occupation, and $WLWO = \sum_O \frac{N_O}{N}\sum_L \frac{N_{OL}}{N_O} I_{OL}$ the same as before, i.e., residual is a residual. The following Table 14 and Figure 5 are the decompositions of their Theil-L indices by occupation and location.

[Table 14 here]

[Figure 5 here]

Of course, the within occupation and within location number is the same as before and the largest. Inequality across occupations is the second largest, but the difference between the first and second rows is smaller than before. In terms of changes, Table 14 shows that ALWO has an inverted U-shape. Inequality across locations is increasing as before, up to about 2002, now controlling in a sense for occupation. We also see that inequality across occupations, not controlling for location, is now slightly increasing at the beginning, i.e., going against the overall trend. These are plotted in Figure 5 but on different scales.[13]

2.8 Decomposition of Growth of Net Worth: The Mechanics

We return to the financial accounts (in nominal terms) to begin to get at the mechanics of the change in net worth for each household. The change in net worth of each household must come from savings and net gifts received. That is, let $\Delta W_t^i = W_t^i - W_{t-1}^i$ be the change in net worth at time t of household i, S_t^i and G_t^i be savings (saved if positive or dissaved) and gifts (received if positive or given) at time t of household i. Hence:

$$W_t^i = W_{t-1}^i + S_t^i + G_t^i.$$

More generally, wealth or net worth at time t can also be expressed as initial wealth W_0^i plus accumulated savings and net gifts received up to time t:

$$W_t^i = W_0^i + \sum_{j=1}^{t} \left(S_j^i + G_j^i\right).$$

We may ask which component is the larger part of the rate of total wealth accumulation in this economy in the aggregate:

$$\frac{\frac{1}{N^g}\sum_{i=1}^{N^g}\left(W_t^i - W_0^i\right)}{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i} = \frac{\frac{1}{N^g}\sum_{i=1}^{N^g}\sum_{j=1}^{t} S_j^i}{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i} + \frac{\frac{1}{N^g}\sum_{i=1}^{N^g}\sum_{j=1}^{t} G_j^i}{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}, \tag{1}$$

[13] Looking at the subcomponents of ALWO by occupation makes it clearer why both AL and ALWO have inverted U shapes, due to business and labor. But ALWO is increasing for cultivation, fish/shrimp, while decreasing for livestock. That is, the premia across location, the wealth differential according to location, is going up consistently for cultivation and fish/shrimp, increasing until 2002 and decreasing after that for business and labor while the one for livestock is going down consistently. As we add them up, the combination of these forces together produce the picture of ALWO as inverted U-shape as seen in Figure 5, which is also similar to the picture of AL in Figure 4.

where N^g is the total number of households in a group g. Thus, the left-hand side variable measures the overall aggregate growth rate of the net worth of group g.

We can now decompose the aggregate growth rate into a weighted sum of growth from these subgroups by group g. Using the notation defined as before, let W_t be aggregate mean of wealth at time t, and let p_t^g and W_t^g be population share and mean of subgroup g, respectively. Then the aggregate mean change in levels can be decomposed into two parts, due to a change in the mean of subgroups and a change in population shares:

$$\Delta W = \sum_{g=1}^{G} \overline{p^g} \Delta W^g + \sum_{g=1}^{G} \overline{W^g} \Delta p^g,$$

where again Δ and the overbar denote the time difference operator and the time average operator, respectively. The first term captures intragroup growth, while the second term captures growth due to compositional change in population. But as a subgroup is defined by the distribution of initial wealth, e.g., quartiles, and we follow households in the same group over time, then p_t^g will not change over time so,

$$\Delta W = \sum_{g=1}^{G} p^g \Delta W^g.$$

Dividing both sides by W_0 to compute the overall aggregate growth rate, the latter is related to growth rate of the subgroup by:

$$\frac{\frac{1}{N}\sum_{i=1}^{N}\left(W_t^i - W_0^i\right)}{\frac{1}{N}\sum_{i=1}^{N} W_0^i} = \sum_{g=1}^{G} p^g \frac{\frac{1}{N^g}\sum_{i=1}^{N^g}\left(W_t^i - W_0^i\right)}{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i} \frac{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}{\frac{1}{N}\sum_{i=1}^{N} W_0^i}. \tag{2}$$

Substituting (1) into (2), we can thus decompose the overall aggregate growth of each group into three components: wealth weight in the total, savings, and gifts.

$$\frac{\frac{1}{N}\sum_{i=1}^{N}\left(W_t^i - W_0^i\right)}{\frac{1}{N}\sum_{i=1}^{N} W_0^i} = \sum_{g=1}^{G} p^g \left(\frac{\frac{1}{N^g}\sum_{i=1}^{N^g}\sum_{j=1}^{t} S_j^i}{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i} + \frac{\frac{1}{N^g}\sum_{i=1}^{N^g}\sum_{j=1}^{t} G_j^i}{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i} \right) \frac{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}{\frac{1}{N}\sum_{i=1}^{N} W_0^i} \tag{3}$$

Each element in (3) is presented in Table 15 where again group g refers to initial quartiles and takes t to be the terminal period that the data is available. Table 15 reports overall growth rate, savings and gift components (annualized value), and wealth weight that can account for the growth of each group.

[Table 15 here]

The growth of wealth is decreasing in initial wealth, as noted earlier across the quartiles. The savings component is the one that accounts for most of the growth rate. Largely, the contribution of gifts decreases as wealth increases, except for the second quartile where both savings and gift components are roughly the same. The wealthiest group has a negative gift component, that is, they give more than they receive on average, and that brings down its growth of net worth. Even though the least wealthy group has a growth rate of over 25%, its fraction of initial mean wealth is only 6%, while the wealthiest group, with its 1.5% in growth rate, has an initial mean out of aggregate of over three-fold. Thus, the overall growth of the (nominal) net worth of the economy is about 2.7% per year, and 81% of this growth is accounted for by the savings component.

Although the wealth of all groups is growing, the process not smooth, especially at high temporal frequencies. If we look at the monthly aggregate change in the net worth of each group (from January, 1999, to December, 2005), this can be decomposed again into aggregate savings and gifts of that quartile group g :

$$\frac{1}{N^g}\sum_{i=1}^{N^g}\Delta W_t^i = \frac{1}{N^g}\sum_{i=1}^{N^g}\left(S_t^i + G_t^i\right).$$

We can see from Figure 6 that all groups experience negative growth at some points.

[Figure 6 here]

Another way to look at the role of savings and gifts in the change in net worth is to use a variance decomposition. By the accounting identity, again, change in net worth of each household must be equal to savings plus net gifts received. This identity can be translated to a statistical relationship:

$$1 = \frac{cov\left(\Delta NW^i, S^i\right)}{var\left(\Delta NW^i\right)} + \frac{cov\left(\Delta NW^i, G^i\right)}{var\left(\Delta NW^i\right)} \text{ for all } i,$$

that is, normalized wealth change can be accounted by the co-movement of wealth change with saving and the same with net gifts. By this metric, the variation in wealth change for most households is, again, better explained by variation in savings rather than gifts, as the savings distribution is centered around 100 and gift around 0 (not shown). This pattern holds for all changwats with the lowest peak in Buriram (a hint that something more complicated is going on there).

[Table 16 here]

In Table 16, we further decompose the growth of each group by primary occupation. The extra column (fraction) indicates how many households of that occupation are in that wealth group. All occupations of the least wealthiest group (group 1) have a relatively high rate of growth in net worth, as might have been anticipated. And this negative monotonicity is largely true as one move across quartiles by occupation. But the highest growth by occupation varies across the quartiles.

The majority of households in the lowest quartile group are classified as labor (about 65%), and their growth in net worth is about 32% per year, the highest of all groups. Almost two-thirds of this growth is accounted for by the savings component. Although the fraction of initial wealth of this group is the smallest, the total weight (by population multiplied by initial wealth) is highest among all occupations. Therefore, the high growth in net worth of group 1 is mainly due to this subgroup. The highest growth rate of groups 2 and 4 are from households with livestock as the primary occupation, again mostly accounted for by savings. The highest growth rate of group 3 is from households with fish/shrimp as the primary occupation, and almost 100% of this growth is accounted for by savings. However, the savings component is negative for business households of the first and second quartiles, and thus contribution from gifts to their growth rate is over 100%. In other words, business households of these two groups either made losses rather than profits and/or consumed more than earned, but were still growing due to net gifts received.

2.9 Return to the Heterogeneity in the Growth of Net Worth

We have seen that household net worth is growing on average, but not all households are experiencing the same thing. Table 17 is the distribution of the average growth of net worth over seven years. It emphasizes the heterogeneity in the data: there is a positive real growth rate on average, as both mean and median are positive, but strikingly 44% of households in the survey have negative growth of net worth. This number varies by location, with a smaller fraction of households in the Central region at 46% and 28% in Chachoengsao and Lopburi, respectively and about 53% of households in the Northeast (57% and 50% in Buriram and Sisaket, respectively). However, the spread of the distribution is much wider in the Northeast where the absolute values of the highest and the lowest growth rates are several times larger than that of the Central region.

[Table 17 here]

Related, taking advantage of the long monthly panel, we can track the relative position of net worth within each changwat for each household. Figure 7 shows a histogram of change in *relative* positions over seven years. This is naturally centered at zero, but note that the standard deviation is 13.75, the minimum is -57 and the maximum is 80. Forty-three percent of households in the survey increase their relative position, almost 50% of households have a negative change in relative position, and 7% stay at the same position using percentiles. Figure 8 is example of some households in each changwat who experience relatively large increases and decreases in their relative position. Most of these changes are gradual increases or decreases of their relative positions, but some of them experience sudden change.

[Figure 7 here]

[Figure 8 here]

3 Growth of Net Worth: A Decomposition into Productivity and Savings Rate

As savings can better explain wealth accumulation than gifts for most households, we turn our attention to it. Savings of household i at time t, S_t^i can be written as a combination of savings *rate* s_t^i (savings divided by net income), productivity ROA_t^i (net income π_t^i divided by assets, that is, the return on assets as typically used in corporate finance) and assets A_t^i itself, i.e.,

$$\begin{aligned} S_t^i &= \frac{S_t^i}{\pi_t^i}\frac{\pi_t^i}{A_t^i}A_t^i \\ &= \left(s_t^i ROA_t^i\right) A_t^i. \end{aligned}$$

That is, how much household i can generate income from a given level of assets level A_t^i is measured by the rate of return on assets (ROA_t^i) and how much a household chooses to save out of income generated is captured by the saving rate (s_t^i). If two households have the same asset levels and savings levels, then both households will have the same change in net worth (setting net gifts received equal to zero for both households, for the sake of simplicity). In this case, if one household has a higher profit, for fixed level of A and S, this higher ROA will also mean that the saving rate is lower, and the difference will go to consumption. So both experience the same change in net worth, but one household is better off than another because it has higher productivity and is thus able to have higher consumption. Alternatively, as we focus on here, if for these two households consumption is the same, the one with the higher profit will have a higher growth rate.

While this interpretation is suitable for households that use assets to generate income, it is harder to interpret for households that have labor earnings as the primary source of income because the assets used are mainly human capital assets rather than physical capital. We do not measure human capital, so we thus adjust for this below.

More generally, in terms of the growth rate of net worth, we can write

$$\frac{\Delta W_t^i}{W_{t-1}^i} = \left(s_t^i ROA_t^i\right) \frac{A_t^i}{W_{t-1}^i} + \frac{G_t^i}{W_{t-1}^i}.$$

Thus both the savings rate and productivity can determine the growth of net worth. The order of magnitude in decomposition reduces to an empirical question.

Although correlations do not allow for causal or structural interpretation, they are still informative about the relative importance of different variables. In this sense, the savings rate is less important than productivity for the growth of net worth. We first study whether variation in the savings rate can help in explaining the growth in net worth.[14]

The sample contains a non-trivial portion of negative savings (when consumption is higher than net income) and in defining a savings rate as savings/net income, we run into trouble when net income is negative. We drop observations when net income is negative to get a more meaningful measure of the savings rate. However, this depends on how we aggregate the data. Using household-months as the data are originally collected, 29% of household months have negative net income. When we aggregate to an annualized value, observations with negative net income reduce to 14%, and when we aggregate over all seven years, negative net income reduces to 4%. Naturally, households experience some losses in the short run as there is a transitory component in income, but this is less likely to persist, and the permanent component in income will play a larger role in the longer run. Computing a savings rate has another problem when net income is positive but close to 0, as this drives the savings rate to a very high number. To deal with this, we raise the cutoff to some small positive number (100 baht). This drops more households from the analysis.[15] The median of the distribution of the savings rate is 25% regardless of the type of observation, but the mean is negative because some households have very high negative savings rates.

[14] In a continuous time model where the savings rate is actually savings out of profits $\dot{W}^i = S^i = \frac{S^i}{\pi^i}\frac{\pi^i}{W^i}W^i = s^i ROE^i W^i$ where ROE is the return on equity, not the return on assets. In discrete time, one can write $W^i_{t+1} = \frac{S^i_t + W^i_t}{\pi^i_t}\frac{\pi^i_t}{W^i_t}W^i_t = s^i_t ROE^i_t W^i_t$ which suggest that $Var(\log(W^i_{t+1}/W^i_t)) = Var(\log s^i_t) + Var(\log ROE^i_t) + 2Cov(\log s^i_t, \log ROE^i_t)$. In practice the covariance term is quite large and this decomposition fails to be very informative.

[15] Number of dropped observations when we compute the savings rate are as follows.

$\pi < 0$	% of dropped obs.	Chachoengsao	Buriram	Lopburi	Sisaket
HH-month	28.80	2508	3367	2852	4122
HH-year	9.49	121	124	54	54
HH	4.33	11	9	2	1
$0 < \pi < 100$					
HH-month	2.24	89	274	105	532
HH-year	0.96	6	12	6	12
HH	0.18	0	0	0	1

Tables 18 and 19 show the correlation of the growth of net worth and the savings rate, where we use household-months, averaged by mean over calendar time to get household-years, and averaged by mean to get a single number for each household. As there is some difference between labor and non-labor households in the interpretation of ROA, we separately report for each of them.

[Table 18 here]

[Table 19 here]

Correlations tend to be higher when we aggregate over calendar years, and over all seven years, that is, a stronger positive association of growth of net worth and savings rate over the longer run. By location, there is a significant, positive and large correlation between growth of net worth and savings rate in Chachoengsao at almost all levels for both non-labor and labor households. And there are more significant correlations for non-labor than labor households.

[Table 20 here]

In contrast, Table 20 shows significant and positive correlation between growth of net worth and ROA at all levels.[16] The correlation numbers naturally tend to be higher when we average over all seven years, and the correlation is highest for Buriram, though lowest for Sisaket.

[Figure 9 here]

Figure 9 plots the density of growth of net worth by ROA. The density shifts to the right as ROA increases. The quartile of households with the lowest ROA tends to have a lower growth of net worth. But there are quite a few exceptions, as we can see from long right tail of density. Also, higher ROA households tend to have more dispersion in terms of growth. These patterns are common across provinces, even if it is more difficult to see in the picture from Sisaket.

3.1 Assessing the Possibility of Mismeasured Total Assets and Net Worth

If initial wealth seems to be low because it is mismeasured, and later we get a more accurate, higher measure of wealth, then there would be a positive association of low levels and high growth. Likewise,

[16] In fact, most households in the survey have multiple sources of income, even for labor households where wage earning is their primary source of income, but most of them also have income from other sources. Therefore, ROA for them is not meaningless either. When we include all households in the calculation, the result is quite similar, that is, all of them are statistically significant with varying degrees of correlation, i.e., with labor households, the correlations are higher in the Central region but lower in the Northeast

this could make for a high correlation between ROA and growth of net worth, as an ill-measured low initial wealth means both high initial ROA, dividing by a small number, and high growth, as just mentioned. This may be happening despite the pains we take to measure accurately. Possibly households feel more comfortable giving information as they are reinterviewed or the enumerators are getting better over time in acquiring said information. However, the descipline of the accounts would mitigate this since households would have to report that they had purchased the additional assets since the last interview, or otherwise the enumerator is supposed to have gone back and made corrections on earlier data. Still, we can check on whether the picture we get is entirely spurious by an obvious robustness check. We compute ROA using income from the first subperiod divided by assets from the second subperiod. The correlation of the two measures of ROA is not low (0.5701) and is significant. For growth of wealth, we compute average wealth for the first half and the second half of the overall sample frame (3.5 years each) and then compute its growth rate. The correlation of two measures of growth of net worth is slightly lower than the one of ROA (0.5628) and is significant.

[Table 21 here]

Table 21 reassesses the correlation of growth of net worth and ROA. We obtain similar qualitative results, except for Buriram where correlation is now negative and not significant. The correlations are lower when we reassess the possibility of mismeasured total assets and net worth.

In summary, although both saving rates and productivity are potentially important in explaining the growth of net worth, productivity seems to drive growth of net worth more consistently. We next study what factors are associated with household success as measured by high ROA.

4 Factors Accounting for Success

We first look at education as a potential factor to explain ROA. Then we use multivariate regressions and consider additional variables that are emphasized in the literature: debt normalized by assets, initial wealth, and an occupation (dummy). We then recompute ROA by focusing on physical assets and see whether the results are robust. Lastly, we look at the persistence of ROA over time. We focus on nonlabor households for the suitability of the ROA concept.

4.1 Education and ROA

One may ask whether education as a measure of talent is related to ROA, the ability to make money from assets. As the unit of the survey is the household, we need a measure of education for the household, but this depends on household composition, which may change over time. Some household members may graduate or obtain higher education as time passes. Those who have higher education levels may leave, and this might affect the productivity of the reduced household unit. On the other hand, one can think of a longer lasting impact, even after a member has gone.

We can treat the head as a representative of the household, but this would be a static number, as most heads had completed their schooling before the beginning of the survey. An alternative takes each month and picks as education among existing members the one who has the highest level of education. Finally, one can take all the members in that month and use the mean or median as representative of that month. We denote these variables respectively by max_edu, $mean\_edu$, and $median\_edu$. To come up with one number for each household over the various months of the sample, we can average each of the three by either the mean or the median.

Averaging variables over monthly data by the median per year and regressing ROA on each measure of education with household-year observations, we have the following.

[Table 22 here]

Thus, high education is associated with high ROA for all measures, but particularly so for the max. We stratify by occupation in Table 23.

[Table 23 here]

Business households have a positive, highest, and most significant regression coefficient for all measures. Estimates are negative for livestock households. Cultivation and fish/shrimp households have slightly positive estimates and are weaker, with p-values at the 10% level. Using a different way to represent the data such as arithmetic mean would produce a quantitatively different result at the overall level. But the results by occupation are similar to Table 22, especially for business.

4.2 Multivariate Regressions

We consider variables that are emphasized in the literature as being able to explain differences in economic well-being: debt normalized by assets, initial wealth, occupation (dummy), family networks[17], division of labor within the household[18], and again education where we use *mean_edu*. Initial condition from previous generation might matter: we control for parental characteristics such as education of the father and the mother of head (and spouse), landholding of father and mother of head (and spouse), the latter as a proxy of how wealthy their parents were. We also include basic demographic variables such as household size, head's age and head's gender, sex ratio, and control for time and location by dummies. Moreover, we control for heterogeneity across households by putting a dummy variable for each household, to see whether the results are robust. We average by mean over months to get household-year observations for households with non-labor as the primary occupation. When running regressions, it is especially important to take the possibility of measurement errors in total assets and initial wealth into account, as we use them as covariates in regressions. Specifically, suppressing the household superscript for the moment, and assuming that total assets is the only variable measured with error, let

$$A_t = A_t^* \exp(e_t), \tag{4}$$

where A_t is measured assets, A_t^* is the true value $*$, and e_t is a measurement error. The reason we assume a multiplicative form is because assets enter as denominator in both the dependent variable and one of independent variables, and we want to handle measurement errors by a linear IV. That is, we use measured assets to compute ROA and the debt-assets ratio (L_t/A_t), and as a result both the ROA and debt-assets ratio are also contaminated with measurement error.

Assume the classical errors-in-variables:

$$cov(\log A_t^*, e_t) = 0.$$

[17] Network is defined by blood relationships and is meant to capture the effect of network (if any) on ROA.

[18] The division of labor is defined from the number of days each member spends on each task, a proxy for how well managed a household is (better management should result in a higher ROA).

It is well known that this will result in attenuation bias in the OLS.[19] We use the value of land at time t, and lag of wealth as instruments for assets A_t, and initial land value as an instrument for initial wealth W_0. Table 24 reports the results from the IV regression[20].

[Table 24 here]

The debt/asset ratio is positive and significant, as is household size, while initial wealth and head age are negative and significant (in the specification without household fixed effects), i.e., households with lower initial wealth and younger heads tend to have higher ROA. Education retains its positive significance in two out of four specifications. Own work is defined by the number of hours the household uses for its own enterprise (cultivation, livestock, fish/shrimp, business) and this is positive and significant. Paid work is positive and significant but the size of the estimate of paid labor supply is lower than own labor supply.[21] Other variables (not shown in the Table 24) that are positive and significant are education of head's father, and education of spouse's mother when we do not include household fixed effects. The results for family network and division of labor (not shown in the Table 24) are not significant.

There is an increasing trend in labor income and we do use net income from all sources to

[19]

$$\begin{aligned}\log\left(ROA_t^*\right) &= \log\left(ROA_t\right) + e_t \\ \log\left(\frac{L_t}{A_t^*}\right) &= \log\left(\frac{L_t}{A_t}\right) + e_t\end{aligned}$$

For initial wealth W_0, the true identity is

$$W_0^* = A_0^* - L_0$$

while the one constructed from the account by using measured total assets is

$$W_0 = A_0 - L_0.$$

As a result, initial wealth is also measured with error

$$W_0 = W_0^* + \eta_0,$$

where $\eta_0 = A_0 - A_0^*$, an additive measurement error in assets.

Therefore the regression in term of observables is

$$\log\left(ROA_t\right) = \beta_0 + \beta_1 \log\left(\frac{L_t}{A_t}\right) + \beta_2 W_0 + \sum_{i\geq 3} \beta_i X_i + \left[u_t + \left(\beta_1 - 1\right) e_t - \beta_2 \eta_0\right] \tag{5}$$

where $\{X_i\}_{i\geq 3}$ are the other control variables that are treated as exogenous and u_t is the original error term in the true regression.

[20] Only some selected estimates are reported here.

[21] One interpretation could be that the household is free from moral hazard or management problems with its own labor supply.

compute ROA. Thus, even though we exclude households with primary income from labor in the analysis of ROA, labor income and not profits from non-labor household activities may still play a role. As a robustness check, we subtract labor income from each household's net income and run the IV regression. We obtain similar qualitative result to Table 24, except for education.

4.3 Robustness Checks: OLS, and using physical assets only to compute ROA

As a robustness check, we regress annual ROA on the same set of explanatory variables in each specification by ordinary least squares.[22] Table 25 reports the adjusted R^2 of 5 specifications.

[Table 25 here]

The first column reports with only household dummy variables in the regression. The next 4 specifications correspond to the ones in Table 24. The explanatory power of these regressions increases several-fold when we include household fixed effects, indicating that factors accounting for success are specific to each household and an important part of reality. The notable difference is for education with a coefficient that is either negative or positive but not statistically significant.[23] Still other variables are similar in terms of sign and statistical significance, though the coefficient on the debt/asset ratio is higher, and household size and initial wealth are lower in absolute values.[24]

Thus far we have used all assets to compute ROA. We can be less conservative and use only physical assets to compute ROA (deleting currency and financial assets). Since the denominator is lower, mechanically ROA goes up. But the correlation between the two measures of ROA is quite high (0.7534) and statistically significant. We run the same set of regressions as before, but now using this new measure of ROA as another robustness check.

[22] About 9% of observations in LS regression are dropped when we run IV because we have to drop observations with negative net income when we take the logarithm.

[23] One possible interpretation for this negative effect of education is through self-selection: if there are jobs with high return to education in Bangkok but somehow high educated household members are still in the village, probably the member is less talented. See also Udry (1994).

[24] We have done further robustness checks. First, the dependent variable is changed to be the return after we subtract the estimated opportunity cost, and the results are quite similar when there is no household fixed effect. But when we include household fixed effect, none of the variables are significant, even though the signs are still much the same. Second, when we include households with labor as the primary occupation, the results are similar, except all coefficients of education are negative and not significant, and the coefficient on own work is not significant and lower than one of paid work.

With the instruments, the debt/asset ratio is positive and significant for all specifications. Education is positive and significant for three out of four specifications. And all other variables are similar in terms of sign and statistical significance. Again R^2 increases several-fold when we control for household specific fixed effects.

Using OLS and this new measure, the debt/asset ratio is now positive and significant only when we do not control for fixed effects. Estimates of household size are all positive, but significant only when we control for HHFE. Other variables are more or less the same: education is still not significant or significant with a negative sign, where head age and initial wealth are negative and significant.

5 Persistence of ROA

5.1 Scatter Plots

Factors specific to a household can account for variation in success. A related question is whether a high ROA household today is more or less likely to be a high ROA in the future.

We compute average ROA for the first half and the second half of the overall sample frame (3.5 years each) and then rank them for each time period (from lowest to highest), so that a low rank number indicates relatively low ROA in that period. Figure 10 shows scatter plots of the rank of ROA, its fitted linear value, 95% confidence interval, and a 45 degree line, by changwat, using all observations except labor households. Table 26 reports correlation of the rank across two time frames for each changwat.

[Figure 10 here]

[Table 26 here]

A household with a high rank of ROA in the first half is likely to have a high rank in the second half, that is, there is considerable persistence.[25] This is especially true for households in the three provinces other than Buriram. We also see that some households deviate from this pattern, as there are not a small number of points far from their initial position. A linear fitted line is not a 45 degree line, but rather has a slope of less than one: a household with low rank in the first period is likely to have a higher rank in the second period, and vice versa. But overall, households which are successful

[25] We also try with year by year, and basically find similar results, i.e., there is a considerable amount of persistence except for Buriram for 2000-2001. We also try by occupation and the results somehow vary, there is considerable amount of persistence for Cultivation, Business and Livestock, but less for Fish/Shrimp.

over the first half of the sample are likely to be successful over the second, indicating that luck per se is not an explanation for success. In Buriram, however, persistence is much lower (correlation is 0.15 and not statistically significant). There are two pieces of evidence that offer some explanation for Buriram: change in occupation and change in household composition.

5.2 Occupational Change and Selection into Higher Returns

Households in the survey typically have multiple sources of income. Thus far we have utilized the primary occupations of each household over all seven years. However, if we look at the activity that generates the highest net income over each year, and define that as the primary occupation of that year, there may be occupational changes over time. Households in the Northeast change occupations more often than those in the Central region, and the highest average number of changes is for Buriram. If we look at a correlation, or run a regression of average ROA on the total number of occupations over seven years, we find a negative and statistically significant estimate, that is, high ROA households are associated with having a low number of primary occupations. However, causality cannot be inferred. So, to aid in interpretation, we compare ROA before and after switching occupation, that is, we want to see for those who have an occupational change whether that household tends to switch into an occupation that gives it a higher rate of return. This is still only an association, of course, but it is highly suggestive. Table 27 reports mean-comparison tests of ROA before and after a household changes occupation.

[Table 27 here]

Using all the observations, ROA after occupational change is statistically higher than ROA before change. By province, ROA after switching occupation is higher and statistically significant only in Buriram, though it is positive but not significant in Lopburi and Sisaket.

5.3 Stability of Household Composition

Household size in Buriram also exhibits more instability than any other province. If ROA is related to individual talent, and individuals come and go, then a household in which most of the individuals change should have less persistent ROA over the two subperiods. Alternatively, coming and going could be deceptive if the housing structure is more of a boarding house. But again we cannot establish causality. An ill-performing household may generate turnover of individuals.

Consider the regression

$$ROA_{2,i} = b_0 + b_1 ROA_{1,i} + b_2 \left(ROA_{1,i} * sd(hhsize_i)\right) + b_3 sd(hhsize_i) + u_i$$

where $ROA_{2,i}$ and $ROA_{1,i}$ are the average ROA over the second half and first half of household i, and $sd(hhsize_i)$ is the standard deviation of household size. If the estimate of b_2 is negative, this would lower $b_1 + b_2$ and thus households with higher variation in household size will have less persistence. The regression result is reported in Table 28 as follows.

[Table 28 here]

The estimate of the interaction term is negative and significant, while the estimate of ROA_1 is as anticipated – positive and significant.

6 The Predictive Power of ROA

This section studies the predictive power of ROA, specifically the association of ROA with physical investment and financial asset accumulation. We have seen that ROA and the growth of net worth are positively correlated at almost all levels. Total assets can be classified into two types: financial and physical assets. In this section, we look at the association with both types of assets.

We use non-labor households and group them by ROA. In each changwat those with ROA in the fourth quartile are classified as the high ROA group, those with ROA in the first quartile as the low ROA group, and otherwise, households in the second and third quartiles in each changwat are classified as the middle group.

6.1 Physical Assets versus Financial Assets

[Figure 11 here]

[Figure 12 here]

The average value of physical assets for the high ROA group fluctuates with an increasing trend for all four changwats. The middle ROA group and low ROA group display quite different behavior from the high ROA group, i.e., fluctuate, but with decreasing trends for all four changwats. For brevity, we show only the figure for the high and middle ROA groups, as both middle and low ROA groups share similar patterns, i.e., decreasing trends. Evidently, high ROA households put their wealth back into their income generating activities, and that is why their physical assets have an increasing trend.

[Figure 13 here]

In Figure 13 we report the middle group for financial assets, to compare with Figure 12, the middle group for physical assets. In contrast, the average value of financial assets is growing, and this is true for almost all groups and regions. The only exception is for the low group of Buriram and Sisaket, and middle group of Buriram.[26]

7 Financial Strategies and Credit Market Imperfections

In fact, different households use different financial strategies. This section addresses the relationship of ROA with financial strategies and the debt-asset ratio. It also presents evidence indicative of imperfections in credit markets.

7.1 Financing cash flow deficit

From the household budget constraint,

$$C_t + I_t = Y_t + F_t^1 + ... + F_t^n,$$

where C_t, I_t, Y_t are consumption, investment and net income at time t, and F_t^i is a financing device i at time t. Let $D_t = C_t + I_t - Y_t$ be the overall deficit. It must by definition be financed by devices $F_t^1, ..., F_t^n$:

$$D_t = F_t^1 + ... + F_t^n.$$

One can derive from this equation a statistical relationship:

$$1 = \frac{cov\left(D, F^1\right)}{var\left(D\right)} + ... + \frac{cov\left(D, F^n\right)}{var\left(D\right)},$$

and this must be true for each household. We can then see by this metric which device each household uses to finance its deficit. In fact, two more types of deficits can be defined, a consumption deficit $(C - Y)$ and an investment deficit $(I - Y)$, and their variation can be decomposed in similar way, putting investment and consumption on the right hand side respectively. What we are interested in

[26] In Buriram, the financial assets of all groups have a decreasing trend, for the first three years even for the high ROA group. In Sisaket, the financial assets of low ROA group displays a decreasing trend for almost five years, but increasing after that. Evidently, the behavior which underlies financial assets is more difficult to discern.

here is not the financing device on its own, but whether financing strategies are related with ROA and growth of wealth.

We find that high ROA households are not using capital assets to smooth consumption, and conversely are using consumption to finance investment deficits. This is consistent with their trying to maintain, or increase, real physical assets. High ROA households are also more actively involved in financial markets in the sense of using formal savings accounts and borrowing, and less in informal markets, i.e., fewer gifts.[27]

7.2 Debt-Asset ratio

A household may be able to use debt to take advantage of its productivity, i.e., borrow to increase assets and earn a high return. The debt/asset ratio in the survey, even though relatively small, has an overall increasing trend. Table 29 shows the distribution of the debt/asset ratio, where we average by mean over seven years for each household. By location, the debt/asset ratio is lowest in Chachoengsao and highest in Sisaket and more generally lower in the Central region than the Northeast. Table 30 is the correlation of ROA and the debt/asset ratio, something we have seen earlier.

[Table 29 here]

[Table 30 here]

The correlations are higher when we aggregate over calendar years or over all seven years. The correlations are statistically significant everywhere with one exception: when we aggregate over

[27] Further details are as follows:

a. High ROA and high growth of net worth households rely more on cash to finance consumption deficit, more on borrowing to finance overall deficit, more on deposits to finance all kinds of deficit, more on consumption to finance investment deficit.

b. High ROA and high growth of net worth households rely less on gifts to finance overall deficits, less on investment to finance consumption deficit.

c. High growth of net worth households rely more on borrowing to finance overall and investment deficits, but rely less on borrowing to finance consumption deficit.

d. High ROA households in the Northeast rely less on gifts to finance deficits.

e. High ROA households in Sisaket rely more on lending to finance consumption and investment deficits.

f. High ROA and high growth of net worth households in Chachoengsao rely more on consumption to finance investment deficits, high growth of net worth households rely less on cash to finance investment deficits.

g. High ROA households in Lopburi rely more on gifts to finance consumption deficits.

seven years, and stratify by business. Evidently, financial markets work to some degree, but we need to look at decisions on the margin.

7.3 Potential Imperfection in Credit Markets

Suppose we impose the Cobb-Douglas functional form:

$$y_{jt} = A_{jt} K_{jt}^{\beta_K} L_{jt}^{\beta_L}, \tag{6}$$

where y_{jt}, K_{jt}, L_{jt} are value added from production activities (cultivation, livestock, fish/shrimp, business), level of physical assets, labor input of household j at time t (both hired and own), and $A_{jt} = \exp\{A_0 + \alpha_{jt} + u_{jt}\}$ where A_0 is common productivity or mean efficiency across households, α_{jt} is a specific fixed effect for household j at time t, and u_{jt} is the error term for household j at time t. Parameter α_{jt} can be interpreted as "entrepreneurial ability", or talent as in Evans and Jovanovic (1989), for example, or productivity of household j at time t in general. If talent is assumed to be time-invariant $\alpha_{jt} = \alpha_j$ for all j, then one can either put in a dummy variable for each household or use a fixed effect estimation to get a consistent estimate of (β_K, β_L). While assuming fixed talent over time (i.e., one is born with a level of talent that can never improve or worsen) simplifies the analysis, the assumption is probably too strong. We assume here instead that productivity can vary over time, and that prior to making production decision at t, α_{jt} is known to household j (but not to us). Future productivity is not known with certainty but serially correlated with current productivity. By this assumption, OLS of the log form of equation (6) will give us inconsistent estimates.

Olley and Pakes (1996) construct a structural model of a firm and use investment as a proxy for underlying productivity. Intuitively, since productivity is serially correlated, a productive firm today, knowing that it is likely that its productivity will also be high in the future, will invest more than a less productive one. One can thus use investment as a proxy for unobserved productivity. They also control for the fact that firm size and productivity is related to whether a firm will exit an industry. These allow them to consistently estimate their model. Levinsohn and Petrin (2003) argue that investment is costly to adjust. This results in most firms having zero investment and thus these observations will be truncated from the Olley-Pakes estimation routine. They do not model the exit decision but show that intermediate inputs can be used as proxies for underlying productivity and allow one to consistently estimate parameters of interest.

Investments in our data are mostly non-zero. The median and arithmetic mean of annual average investment in our data are 1,133 and 3,068 baht, respectively. We thus modify the Olley-Pakes estimation routine and use investment as a proxy to estimate (β_K, β_L).[28]

[Table 31 here]

The estimate of both capital and labor are positive and significant.[29] The estimate of β_K is about 0.5[30]. We can convert this to marginal product of capital (MPK) for each household and compare to the interest rate. The median of monthly interest rate is 0.75% (or 9% per year). Figure 14 plots the (time averaged) MPK of each household against log(K) and the (median) interest rate.

[Figure 14 here]

High capital households are naturally associated with low MPK. However, in a neoclassical world without any imperfection, every household faces the same interest rate, and MPK should be equal to that interest rate. Intuitively, those households with MPK higher than the interest rate should be willing to borrow more than the other group, and in a perfect market this drives MPK closer. Evidently, the divergence of MPK and the interest indicates that this is not entirely true in the data. Nevertheless, we examine whether these relatively more productive households (MPK higher than interest rate) have a higher debt/asset ratio than the other group (MPK less than interest rate). Figure 15 is a density of the debt/asset ratio of these two groups.

[Figure 15 here]

Overall it seems that the financial system is working to some extent, in that people with MPK higher than the average interest rate tend to borrow more than the other group. But again the system is not working perfectly either. Combining this with what we have seen before, it seems that

[28] However, we do not model entry and exit decisions. In Olley-Pakes, firms with productivity lower than the threshold will leave the industry, and this is potentially true also in the household survey. The attrition in household surveys can be due to the opposite reason also, i.e., households that do well no longer have time for the interview, and thus disappear from the survey. Here we use a balanced panel to study other related issues such as inequality change and wealth accumulation of each household over time, so we want to use the same sample to estimate the parameters of interest.

[29] We have done the following robustness checks. First, we try fuel and energy as proxies, as in Levinsohn and Petrin (2003). The estimates are lower for both labor and capital, and not significant for capital. Second, we assume that talent is time-invariant and thus use OLS with a dummy variable for each household to control for talent. The estimates are lower (0.12 for labor and 0.34 for capital) but significant for both labor and capital.

[30] We cannot reject the hypothesis of constant return to scale. Nevertheless if we impose constant return and estimate β_K by occupation, the number is lower (0.0405-0.4433). See below for further robustness check.

high ROA households are slowly accumulating physical capital. Such households seem to be able to borrow only to a limited extent, less than what it should be based on productivity, and that is why MPK and interest rate are not equalized.

If we use the estimate of A_{jt} in equation (6) as the measure of TFP for household j, we can see if that is related to ROA and our earlier results on growth of net worth. Table 32 shows these correlations.

[Table 32 here]

So household-specific TFP is related to ROA and more weakly to growth of net worth[31]. The picture we have been drawing with ROA seems not misleading.

Part of ROA is due to the difference in capital-output ratio, not only household-specific productivity. In other words, if the financial market is perfect, then MPK should be equalized for all households, and that should be equal to the interest rate, with different scales of K, depending on productivity. Again, there are indications this is not happening. Still, the TFP numbers may not have the interpretation we want. In a regression of TFP onto initial net worth and labor, we get significant coefficients, though those factors should not show up in the residual if we had the correct specification.

Nevertheless we use the estimate of the production function parameters and TFP to get an idea of the potential gain if capital were to be reallocated among households in the economy. If we fix the labor input at the level observed in the data, but allow only capital to adjust until the MPKs are the same, then according to the estimates, value added can increase by 200-300% (capital is now allocated to match with productivity better than before). If we allow both capital and labor to adjust, the allocation are exponential in productivity for both inputs and thus the efficiency gain will be even higher.[32] Although the magnitude of the efficiency gain is quite large, there are two practical issues. First what are the obstacles that prevent optimal allocation of K, and how one can reform a system such that the resource could be allocated more efficiently. Second one might still wonder whether these productive households can actually operate on a much larger scale, as one element in productivity might include factors like management, and a high estimate number is based

[31] Imposing constant returns to scale, the new TFP number is still correlated with ROA, but not with the growth of net worth. In a study of Korean businesses, Tae Jeong Lee (2008) finds that TFP and ROE are not related at all.

[32] Using microdata to examine manufacturing establishments, Hsieh and Klenow (2009) find that TFP gains from manufacturing are 30-50% in China and 40-60% in India when resources are hypothetically reallocated to the efficiency level observed in the United States. Using calibration, Restuccia and Rogerson (2008) find that policy distortion can decrease output and TFP by 30-50%.

on previously low level of input.[33] Finally all these relatively high gains reflect the reallocation of capital into the upper right trail of the distribuiton of productivity and hence numbers are sensitive to outliers.

We also adjust ROA for aggregate risk consistent with the complete markets, capital asset pricing model at the village level, utilizing data from Samphantharak and Townsend (2009). We find a correlation of risk adjusted returns with ROA as a measure of individual talent, and a correlation of risk adjusted returns with growth of net worth. But overall results are weaker. For example, with exceptions: high risk-adjusted return households do not invest more in their own enterprises. This suggests again that the capital markets are not perfect in these data.

From the estimates of parameters, we can also derive an alternative measure of TFP. Suppose for some reason that instead of facing the common interest rate, different households face a different level of interest rate and thus a different margin for marginal decisions. This can result in households having different MPKs. We do see in the data that many households borrow from various sources, and each household may face a distinct interest rate. We can then use the interest rate specific to each household and the estimate of (β_K, β_L) of equation (6) to compute a household's TFP. That is,

$$A_j = \left(\frac{R\left(1+\tau_{jk}\right)}{\beta_k}\right)^{\beta_k} \left(\frac{\pi_j}{1-\beta_k}\right)^{1-\beta_k} \frac{1}{L^{\beta_L}}, \tag{7}$$

where $R\left(1+\tau_{jk}\right)$ is interest rate that each household j is facing. The τ_{jk} looks like a wedge or distortion. We see whether computed TFP is correlated to any factors that can explain ROA. The following table reports the correlation coefficients.

[Table 33 here]

The correlation number between ROA and the new TFP number appears to be lower than before, but it is still positively significant. Education is positive and significant. Head's age is negative while household size is positive. There are two exceptions to previous results: here debt/asset ratio is positive but no longer significant, while initial wealth is now positive and significant. Adjusting the observed interest rate may remove static distortions but not intertemporal dynamics.

[33] See Bloom and Van Reenen (2007) on the importance of management in explaning productivity and what can empirically account for variation in management practices observed in their data.

7.4 Savings Behavior and Productivity

Some recent contributions in economic theory such as Buera (2008), and Moll (2009) illustrate the relationship of saving behavior and productivity. Buera (2008) studies the optimal saving decision of a household facing a choice between working for a wage or starting a business while Moll (2009) studies the effect of financial frictions on aggregate productivity emphasizing the role of persistent productivity shock i.e., if productivity shocks have enough persistence, self-financing by a household can eventually undo capital misallocation from financial frictions. Both models share a common feature that savings of a household or firm is higher as productivity increases. However, productivity in Buera's model is fixed, whereas it is allowed to change over time in Moll's model. Allowing for a more general functional form like CRRA utility might give Moll a savings rate which be increasing in persistence, but this is only a conjecture. The point of Moll's work as with others is that households who are consistently productive but facing constraints save their way out of these by increasing net worth. So we explore it here whether savings behavior and growth of wealth are related to productivity and its persistence.

This subsection employs correlation analysis using estimates of productivity from various places in the paper to examine the relationship of savings behavior and productivity, as suggested by these recent contributions. As measure of productivity, in addition to ROA, we can also use the estimate of TFP from equation (6), the estimate of household dummy in ROA regressions (IV and OLS). The following table reports the correlation of these various measures of productivity and savings (levels and rates), and growth of wealth.

[Table 34 here]

Although the size of correlations are not large (less than 0.21 for savings), most are positive and significantly different from 0. The exception is the correlation of savings level and household fixed effect from IV regression. Overall though, highly productive households seem to have higher savings rates and levels, and also higher growth of wealth. As household fixed effects in ROA are largely persistent, as shown when we subdivide the sample, the estimate of a household's dummy from the ROA regression is also an indicator of productivity. The savings and growth of wealth are also correlated with this measure.

As another measure of persistence, we regress monthly ROA on its own lag, household by household, to come up with an estimate of autocorrelation, normalized by the standard deviation, to take into account noise in the parameter estimate. The savings rate is computed for each month, then averaged by mean to get the average savings rate for each household. Pooling over all observations, the correlation of this measure of persistence and savings rate is 0.1571 and statistically significant at 1%. If we do not normalize by this standard deviation, and use the monthly data, the correlation is 0.1779 and significant at 1%. However using the growth of wealth and the level of savings, the correlation is -0.1088 and significant at 10% for the former, but not significant for the latter.[34]

8 Household Specific Fixed Effects : Story from a Selected Successful Household

From ROA regressions, a factor specific to households can account considerably for variation in success. On the one hand, this result is important in its own right. But on the other, we are left with no notion of what are the specific factors of each household that makes it successful. We now turn to a case study.

The case household singled out here is the highest ROA among those with livestock as primary occupation (16.85% APR) in Lopburi. The lower left panel of Figure 16 is the wealth accumulation of the case study household. Besides one big jump in 2002, wealth of this household has an overall increasing trend. There are three members and the size and composition of the household never changes, a prototypical nuclear household. At baseline (1998), the head was a 37 year old married male, with four years of education. The spouse was 30 years old with six years of education. They have one daughter, a 7 years old, and she was entering her last year of kindergarten, which lasts three years.

The prior primary occupation for both head and spouse was corn farmer, where head and spouse spent 19, 12 years respectively. The household has multiple sources of income (cultivation, livestock, business, labor and others), but the main source of income is livestock (dairy cows).

The idea of adopting the dairy cattle occupation came from observing neighbors, and milk cooperatives sent their workers to educate villagers as well. This household thought that this could be a good occupation compared to others, although they were not certain at that time whether the return would be high. This occupational change was not without an internal argument, as the head did not want to change while the spouse insisted. Also, there was a problem with a lack of sufficient funds for the initial investment, but this was alleviated by help from the father of the spouse who

[34] By location, the correlation is higher and statistically significant at 10% for Buriram (0.3076), and at 5% for Sisaket (0.2219), but lower and not significant for Chachoengsao (0.1260) and even negative for Lopburi (-0.0763). Also, oddly, the result is not robust when we annualize the data.

was willing to lend his land title to the household to use as collateral to get funds from the Bank for Agriculture and Agricultural Cooperatives (BAAC). Ex post, the result turned out to be very good.

The number of cows and total production of milk of this household has an increasing trend. Milk production, however, is not fully controllable, and the average milk per big cow, or productivity, fluctuates over time without a clear trend. The correlation of ROA and average productivity of the cows is 0.6946 and statistically significant.

Household net income fluctuates with the increasing trend overall, and consumption also has an increasing trend, but with less fluctuation. The regression coefficient of consumption on net income is 0.0824358, but it is significant (p=0.030). Household monthly saving is most often positive (about 3/4 of the seven years), with a mean 9,544 baht and median 7,000 baht. Change in net worth of this household is basically explained by saving, not gifts, but there is a huge increase in net worth at one point due to a large gift-in: the father of spouse gave land as inheritance, and this gift was intended for the spouse.

From personal interviews with the authors in the summer of 2008, the head said that their well-being improved after the occupational change and that there are many additional household assets that came from the earnings of this occupation. We also asked them what made them successful compared to many other livestock households. The head thought that it is mainly due to the selection of cows and to the attention they both pay to them. For selection, the spouse learned from cow merchants how they selected good cows, and they used this to try to acquire them. The spouse occasionally received extra training, and the head studied documents that she had received in the training.

The household plans to expand the dairy cow activities further, but the constraints are funds and labor, where funds are more important. If funds were needed, the household would borrow from BAAC using assets as collateral, and loan size is determined by collateral. This is higher than the alternative of joint liability group borrowing, so essentially these funds are limited by the amount of assets they can put up as collateral.

[Figure 16 here]

9 Conclusion

Rather than repeat our findings here, we refer the reader to the abstract and introduction. Instead, we conclude here with unanswered questions and anomalies that come from the analysis, which need to be addressed by future research.

The first one concerns household specific fixed effects. Though we are able to provide some suggestive information about this factor, from correlations in the data with education and particular case studies, we still do not understand what this household specific factor really is. If it is intrinsic ability, or attitudes, then that needs to be measured by tests and additional survey questions. We are working on this.

Second, and related, we know from this study that wealth inequality is declining, and that is largely due to poor households moving upward in the distribution of wealth and to wealth levels across initial quartiles converging. But we do not touch on the sources of this initial wealth inequality that is so salient to begin with. Such a study needs to takes into account heterogeneity in preferences, the history of credit markets, regional and economic growth, and, again entrepreneurial ability. These questions are the subject of current and continuing research.

Third, and also related, 81% of wealth accumulation is accounted for by savings. We have focused in the paper on persistence in high returns. Yet a preliminary result of Pawasutipaisit (2009) indicates that there are other motives. The precautionary motive may be dominant. In contrast, stratifying by age of household head, he rarely finds evidence of hump savings or saving for retirement, as in the Life Cycle hypothesis. Again, see Pawasutipaisit (2009).

Observed consumption puzzles present several anomalies. First, the distribution of consumption is much more compressed than the distribution of wealth. For instance, the consumption share of the top 1% households is around 4-6%, which is much lower than 33% share of wealth of the same group. The consumption share of the bottom 50% is about 1/3, although their wealth share is less than 10%. Regarding the consumption and wealth share of the top 1%, the numbers observed in the Townsend Thai survey are similar to those of the United States. Related, recent model contributions of Castañeda, Díaz-Giménez, and Rios-Rull (2003), and Cagetti and De Nardi (2007) generate the wealth share of the top 1% households at roughly 1/3 and the consumption share of the same group at approximately11-16%, though the latter share is still higher than the observed U.S. numbers (4-6%). It might be suggested that the US discrepancy is due to the fact that consumption and wealth are measured in different surveys. Again our Thai numbers here come from the same survey and are similar to the US numbers. We have yet to understand the compression.

Second, consumption is higher than income (thus negative saving) for households with negative growth of net worth, and we are not sure what the financial strategies of these households are, that is, what they have in mind for the future (we remain concerned that the definition of the household implicit in what we do is not adequate for these households). Third, though high ROA households tend to increase consumption, overall ROA is not correlated with consumption growth, despite the fact that high ROA is associated with high physical and financial assets accumulation (an exception is Sisaket, however). So what are these households saving for?

Actually, this evidence fits better the complete market framework. In solutions to a planning problem, the consumption allocation is determined by the equality of weighted marginal utility across households. So, if Pareto weights are not related to productivity, then high ROA households will not have high consumption. More generally, consumption growth depends on preference, those with relatively low risk aversion and/or low inter-temporal discount rates will have higher consumption growth. So, again, if productivity and preferences are not related, then high ROA households will not be associated with high consumption growth.

On the other hand, we have found in this paper strong evidence of potential imperfections in the credit market: in production function estimation and the divergence of marginal products of capital from the average interest rate, the correlation of savings with persistence of ROA, in the reinvestment of the profits of high ROA households into their own enterprises, and in financial strategies, that high ROA households are not using capital assets to smooth consumption and conversely are using consumption to finance investment deficits. We are working with these data toward a better characterization of the effective financial regime in place. The interaction of talent and financial market imperfections must be a huge part of what we are observing.

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Table 1. Distribution of Net Worth in 1999

	min	max	mean	std. dev.	first quartile	median	third quartile
Chachoengsao	46,795	163,025,232	4,869,498	14,999,152	420,599	1,275,083	3,093,290
Lopburi	33,108	15,054,802	1,878,238	2,237,228	418,380	1,178,969	2,559,019
Buriram	38,741	14,966,253	993,141	1,772,507	293,521	561,562	1,030,033
Sisaket	-181,188	9,193,252	813,438	1,122,624	216,064	486,545	1,096,106
All	-181,188	163,025,232	2,220,442	8,028,631	314,217	758,426	1,784,110

Table 2. Number of Households in Each Occupation

Primary Occupation	Cultivation	Livestock	Fish/Shrimp	Business	Labor
Chachoengsao	28	3	28	12	70
Buriram	17	0	0	18	69
Lopburi	53	31	0	8	55
Sisaket	87	0	2	13	37
Total	185	34	30	51	231

Table 3. Distribution of Net Worth in 1999, by Occupation

	min	max	mean	std. dev.	first quartile	median	third quartile
Cultivation	-10,694	163,025,232	2,733,186	12,451,801	372,901	904,721	1,980,860
Livestock	241,640	41,304,880	3,567,741	7,363,605	563,000	1,598,373	2,948,033
Fish/Shrimp	42,532	23,857,906	6,950,250	7,012,790	1,787,554	3,630,631	13,178,301
Business	76,703	7,757,663	1,568,968	1,640,035	528,157	1,121,270	2,057,202
Labor	-181,188	17,567,808	1,141,070	2,295,764	169,364	478,980	1,060,595

Table 4. % of Net Worth Held by Various Groups Defined by Percentiles of the Wealth Distribution

	Year						
Percentile	1999	2000	2001	2002	2003	2004	2005
0-49.9	7.0969	7.4090	7.6326	7.9308	8.2568	8.5838	8.8987
50-89.9	29.6281	29.7482	30.0591	30.3522	30.8362	31.6430	32.0325
90-94.9	11.4451	11.5570	11.5567	11.6503	11.6095	11.6438	11.6950
95-98.9	18.2311	17.6575	17.5615	17.4351	17.3048	17.0155	16.9196
99-100	33.5984	33.6280	33.1899	32.6314	31.9926	31.1137	30.4540

Table 5. % of Net Worth Held by Various Groups Defined by Percentiles of the Wealth Distribution in 1999

	Year						
Percentile	1999	2000	2001	2002	2003	2004	2005
0-49.9	7.0969	7.4880	7.8921	8.3557	8.9835	9.5554	10.1682
50-89.9	29.6281	29.7035	30.0337	30.4163	30.7713	31.5393	31.7903
90-94.9	11.4451	11.6228	11.5214	11.4426	11.2984	11.1476	11.0729
95-98.9	18.2311	17.5574	17.3956	17.2364	17.0702	16.7458	16.6094
99-100	33.5984	33.6280	33.1570	32.5487	31.8762	31.0117	30.3590

Table 6. Growth of Net Worth by the Initial Wealth Distribution (%)

Intial wealth	1^{st} quartile	2^{nd} quartile	3^{rd} quartile	4^{th} quartile
Growth of Wealth	21.9735	5.2500	3.1597	0.0984

Table 7. Growth of Assets by the Initial Wealth Distribution (%)

	Intial wealth			
Growth of	1^{st} quartile	2^{nd} quartile	3^{rd} quartile	4^{th} quartile
Land	-0.6287	-1.4747	-1.4521	-2.0327
Household Assets	17.7873	11.8007	8.1558	1.5013
Agricultural Assets	3.7354	2.2807	2.3511	0.5250
Business Assets	4.3394	6.4423	2.9185	-1.5138
Inventory	38.7774	24.9481	21.9198	12.0782
Cash[35]	20.8346	10.4451	11.7238	9.6324
Deposits	17.4923	10.5349	4.9382	-3.6677

Table 8. Annual Percentage Increase in Net Worth by Location

	Year						
	99-00	00-01	01-02	02-03	03-04	04-05	Average
Chachoengsao	1.1769	1.1223	1.3684	0.5450	-2.1385	-2.8640	-0.1316
Buriram	-7.6151	-3.8233	-0.3564	2.2057	6.8570	-1.0318	-0.6273
Lopburi	1.9094	1.4476	2.6554	2.5882	2.0597	0.0162	1.7794
Sisaket	-0.0145	-0.4705	0.3269	0.6961	-0.0945	0.1955	0.1065
Total	0.4640	0.6492	1.4455	1.1797	-0.2303	-1.7057	0.3004

Table 9. Annual Percentage Increase in Net Worth by Occupation

	Year						
	99-00	00-01	01-02	02-03	03-04	04-05	Average
Cultivation	0.1744	-0.5438	0.3573	-0.0960	-0.7858	-2.4409	-0.5558
Livestock	3.8177	1.8945	5.2613	3.3591	-0.2723	-0.8516	2.2014
Fish/Shrimp	1.1317	2.0675	-0.4985	-0.0792	-3.0835	-3.0560	-0.5863
Business	-2.6687	2.6728	4.0802	3.2116	3.4860	-1.4962	1.5476
Labor	-0.1010	0.6141	2.4504	2.8415	1.8395	0.0912	1.2893

Table 10. Transition Matrix from 1999 to 2005

	Year 2005				
	Quartile	1	2	3	4
Year 1999	1	85	37	10	0
	2	16	81	34	2
	3	0	15	97	20
	4	1	2	12	119

Decile	1	2	3	4	5	6	7	8	9	10
1	17	15	12	3	5	1	0	0	0	0
2	4	17	21	2	6	4	0	0	0	0
3	4	13	12	8	7	5	3	1	0	0
4	0	3	11	10	16	10	1	1	0	0
5	0	0	3	11	19	11	6	3	0	0
6	0	0	0	0	12	23	11	7	1	0
7	0	0	0	1	2	17	17	13	1	1
8	1	0	0	0	1	2	11	22	13	3
9	0	0	0	1	0	0	1	11	33	8
10	0	0	0	0	0	0	0	0	4	49

Table 11. Decomposition of Wealth Inequality Change by Decile (%)

	Across-group inequality		Within-group inequality	
	Wealth-gap	Composition	Intragroup	Composition
1999-2000	44.95	74.93	-17.25	-2.66
2000-2001	128.24	-23.33	4.39	-9.54
2001-2002	-90.64	184.62	-5.62	11.64
2002-2003	20.60	73.16	5.14	1.09
2003-2004	162.07	-42.08	-10.18	-9.90
2004-2005	7.42	72.89	10.97	8.72
1999-2005	48.72	50.96	0.15	-0.06

Table 12. Decomposition of Wealth Inequality Change by Decile (%), by Region

	Across-group inequality		Within-group inequality	
	Wealth-gap	Composition	Intragroup	Composition
	Central			
1999-2000	16.70	81.41	1.97	-0.10
2000-2001	-20.88	109.05	10.02	1.82
2001-2002	34.45	60.71	3.66	1.17
2002-2003	27.11	72.39	1.50	-1.02
2003-2004	28.00	65.50	2.94	3.56
2004-2005	63.41	33.66	2.16	0.78
1999-2005	20.46	74.85	3.66	1.03
	Northeast			
1999-2000	17.55	86.39	-14.48	10.56
2000-2001	23.93	60.46	13.09	2.54
2001-2002	-115.77	247.44	-43.10	11.44
2002-2003	65.67	26.64	4.64	3.05
2003-2004	219.60	-164.86	67.95	-22.78
2004-2005	132.09	-47.41	13.36	1.46
1999-2005	41.59	51.85	3.48	3.03

Table 13. Decomposition of Theil-L Index by Location and Occupation

	Year						
	1999	2000	2001	2002	2003	2004	2005
AL	0.2552	0.2701	0.2806	0.2839	0.2795	0.2645	0.2553
AOWL	0.1345	0.1319	0.1272	0.1234	0.1203	0.1193	0.1178
WOWL	0.6815	0.6530	0.6155	0.5954	0.5640	0.5548	0.5329
I	1.0712	1.0551	1.0233	1.0028	0.9638	0.9386	0.9061

Table 14. Decomposition of Theil-L Index by Occupation and Location

	Year						
	1999	2000	2001	2002	2003	2004	2005
AO	0.2437	0.2477	0.2465	0.2406	0.2338	0.2218	0.2136
ALWO	0.1552	0.1631	0.1700	0.1749	0.1740	0.1699	0.1673
WLWO	0.6723	0.6443	0.6068	0.5872	0.5561	0.5470	0.5252
I	1.0712	1.0551	1.0233	1.0027	0.9639	0.9386	0.9061

Table 15. Growth of Net Worth and Its Components Held by Various Groups

Defined by by Percentiles of the Initial Wealth Distribution

Percentile	Growth of Wealth	$\frac{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}{\frac{1}{N}\sum_{i=1}^{N} W_0^i}$	Saving Component	Gifts Component
0-24.9	25.5632	0.0679	16.1035	9.4598
25-49.9	7.1841	0.2252	3.5927	3.5914
50-74.9	4.8868	0.5362	3.6121	1.2747
75-100	1.5224	3.1638	1.5781	-0.0557
Total	2.6991	1	2.2099	0.4892

Table 16. Growth of Net Worth and its Components Held by Various Occupations

Group 1 (0-24.9)

Occupation	Growth of Wealth	Fraction	$\frac{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}{\frac{1}{N}\sum_{i=1}^{N} W_0^i}$	Savings	Gifts
Cultivation	13.0416	0.2727	1.1945	7.8134	5.2282
Livestock	6.9493	0.0152	1.7715	7.7090	-0.7597
Fish/shrimp	21.9301	0.0227	1.2395	15.7833	6.1468
Business	13.1656	0.0303	1.1532	-2.4516	15.6172
Labor	31.7788	0.6591	0.8865	20.5883	11.1905
Total	24.0804	0.2485	0.0679	15.1404	8.9400

Group 2 (25-49.9)

Occupation	Growth of Wealth	Fraction	$\frac{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}{\frac{1}{N}\sum_{i=1}^{N} W_0^i}$	Savings	Gifts
Cultivation	4.6225	0.3534	0.9638	0.6601	3.9623
Livestock	18.4396	0.0526	0.9665	12.7406	5.6990
Fish/shrimp	6.5792	0.0150	1.4026	5.4533	1.1259
Business	3.0652	0.1128	1.0538	-1.1467	4.2118
Labor	7.9964	0.4662	1.0052	5.3798	2.6166
Total	6.7625	.2504	0.2252	3.3726	3.3899

Group 3 (50-74.9)

Occupation	Growth of Wealth	Fraction	$\frac{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}{\frac{1}{N}\sum_{i=1}^{N} W_0^i}$	Savings	Gifts
Cultivation	3.4940	0.3684	1.0143	1.7822	1.7118
Livestock	7.7690	0.0752	1.0469	7.5508	0.2181
Fish/shrimp	12.0465	0.0226	1.0626	12.0484	-0.0018
Business	4.6544	0.1278	1.0078	3.3590	1.2954
Labor	4.4952	0.4060	0.9724	3.5409	0.9543
Total	4.5803	.2504	0.5362	3.3798	1.2004

Group 4 (75-100)

Occupation	Growth of Wealth	Fraction	$\frac{\frac{1}{N^g}\sum_{i=1}^{N^g} W_0^i}{\frac{1}{N}\sum_{i=1}^{N} W_0^i}$	Savings	Gifts
Cultivation	1.7362	0.3759	0.7572	1.5700	0.1662
Livestock	4.1846	0.1128	0.9696	3.8592	0.3254
Fish/shrimp	0.7946	0.1654	2.2519	1.2653	-0.4707
Business	2.2681	0.1203	0.4934	2.5979	-0.3298
Labor	0.3411	0.2256	0.7719	0.0384	0.3027
Total	1.4419	.2504	3.1638	1.5012	-0.0593

Table 17. Distribution of Growth of Net Worth (% per year)

	min	max	mean	std. dev.	first quartile	median	third quartile
Chachoengsao	-22.2502	51.6785	5.1254	12.0369	-1.7828	1.0123	9.1470
Lopburi	-15.2999	35.0945	5.1970	8.9357	-.6547	3.1131	9.3896
Buriram	-322.3219	183.4458	1.0576	39.1593	-4.6787	-1.1281	5.4534
Sisaket	-306.5071	148.2795	3.5287	34.7254	-2.6326	.0594	4.2867
All	-322.3219	183.4458	3.9306	25.9758	-2.3448	.7861	7.5045

Table 18. Correlation of Growth of Net Worth and Savings Rate for Non-labor Households

	All	Chachoengsao	Buriram	Lopburi	Sisaket
HH-month	0.0035	0.0292*	0.0398	0.0102	0.0031
	(0.6532)	(0.0542)	(0.1113)	(0.4446)	(0.8246)
HH-year	0.0314	0.1049**	0.1768**	0.0719**	0.0171
	(0.1722)	(0.0291)	(0.0144)	(0.0782)	(0.6586)
HH	0.2016	0.3790**	0.2142	0.4887***	0.1367
	(0.0006)	(0.0017)	(0.2472)	(0.0000)	(0.1773)

Notes: number in parenthesis is the significance level

*,**,*** represent significance at the 10, 5, and 1 percent level, respectively

Table 19. Correlation of Growth of Net Worth and Savings Rate for Labor Households

	All	Chachoengsao	Buriram	Lopburi	Sisaket
HH-month	0.0013	0.0113	0.0021	0.0107	0.0007
	(0.8747)	(0.4253)	(0.8971)	(0.5042)	(0.9730)
HH-year	0.0257	0.1742***	0.0455	0.0722	0.0527
	(0.3253)	(0.0003)	(0.3565)	(0.1633)	(0.4094)
HH	0.1710**	0.5161***	0.1589	0.0855	0.1672
	(0.0107)	(0.0000)	(0.2099)	(0.5350)	(0.3089)

Notes: number in parenthesis is the significance level

*,**,*** represent significance at 10, 5, and 1 percent level, respectively

Table 20. Correlation of Growth of Net Worth and ROA for Nonlabor Households

	All	Chachoengsao	Buriram	Lopburi	Sisaket
HH-month	0.3576***	0.5664***	0.7394***	0.5497***	0.2665***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
HH-year	0.4040***	0.5081***	0.7661***	0.5270***	0.3301***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
HH	0.5256***	0.6830***	0.7366***	0.6853***	0.4423***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Notes: number in parenthesis is the significance level

*** represents significance at 1 percent level

Table 21. Correlation of Growth of Net Worth and ROA for Nonlabor Households

All	Chachoengsao	Buriram	Lopburi	Sisaket
0.3172***	0.5235***	-0.0934	0.4290***	0.2859**
(0.0000)	(0.0000)	(0.5936)	(0.0000)	(0.0037)

Notes: number in parenthesis is the significance level

,* represent significance at 5, and 1 percent level, respectively

Table 22. Regression Coefficient of ROA on Education

max_edu	mean_edu	median_edu
.134956***	.068116***	.0555616***
(0.000)	(0.000)	(0.000)

Notes: number in parenthesis is the p-value

*** represents significance at the 1 percent level

Table 23. Regression Coefficient of ROA on Education, by Occupation

	Cultivation	Livestock	Fish/Shrimp	Business
max_edu	.0265635*	-.0572225*	.0681653**	.1756315***
	(0.092)	(0.095)	(0.015)	(0.001)
mean_edu	.0303029*	-.0697562**	.0633666*	.1543303***
	(0.067)	(0.044)	(0.067)	(0.007)
median_edu	.0314343*	-.0697973**	.0619228*	.1424772*
	(0.057)	(0.044)	(0.063)	(0.012)

Notes: number in parenthesis is the p-value

*,**,*** represent significance at 10, 5, and 1 percent level, respectively

Table 24. IV regression (using all assets to compute ROA)

	Dependent variable : log(ROA)			
log(Debt-Asset Ratio)	0.2067***	0.06687**	0.2116***	0.06048*
	(0.000)	(0.039)	(0.000)	(0.061)
Education	0.01636	0.135***	-0.01551	0.1186***
	(0.362)	(0.000)	(0.388)	(0.000)
Household Size	0.1185***	0.1856***	0.1207***	0.1715***
	(0.000)	(0.000)	(0.000)	(0.000)
Head Age	-0.01944***		-0.01802***	
	(0.000)		(0.000)	
Initial Wealth	-1.9e-08***		-2.1e-08***	
	(0.000)		(0.000)	
Own Hour Work			.00566***	.00449***
			(0.000)	(0.000)
Paid Hour Work			.00277***	.0016**
			(0.000)	(0.019)
Household Fixed Effect	No	Yes	No	Yes
Number Obs.	1,125	1,653	1,125	1,653
Adjusted R^2	0.2519	0.5933	0.2933	0.6010

Notes: number in parenthesis is the p-value

*,**,*** represent significance at 10, 5, and 1 percent level, respectively

Table 25. Adjusted R^2 from OLS regression (using all assets to compute ROA)

	Dependent variable : ROA				
Adjusted R-Squared	0.561	0.164	0.565	0.177	0.566
Household Fixed Effect	Yes	No	Yes	No	Yes
Labor Supply	No	No	No	Yes	Yes
Other Covariates	No	Yes	Yes	Yes	Yes

Table 26. Correlation of Rank of ROA (First Half and Second Half)

Chachoengsao	Buriram	Lopburi	Sisaket
0.7229***	0.1569	0.7373***	0.8307***
(0.0000)	(0.3682)	(0.0000)	(0.0000)

Notes: number in parenthesis is the significant level

*** represent significance at 1 percent level

Table 27. Mean-comparison tests H_0: difference in ROA = 0, H_1: difference in ROA>0

	Obs	Mean	Std. Err.	Std. Dev.	Lower	Upper	Pr(T > t)
Chachoengsao	170	-.0283246	.0904854	1.179785	-.2069518	.1503026	0.6227
Buriram	179	.4188116	.1259209	1.684706	.1703218	.6673014	0.0005
Lopburi	130	.0776118	.1006854	1.14799	-.1215967	.2768203	0.2211
Sisaket	238	.0618619	.1106396	1.706865	-.1561008	.2798246	0.2883
All	717	.1324474	.0562019	1.50491	.0221072	.2427876	0.0094

Table 28. Regression coefficient of ROA on household stability

ROA_1	$ROA_1 * sd(hhsize)$	$sd(hhsize)$	adj-R^2	Number Obs.
.6444308***	-.1778253**	-.0071196	0.3712	298
(0.000)	(0.030)	(0.936)		

Notes: number in parenthesis is the p-value

*,**,*** represent significance at 10, 5, and 1 percent level, respectively

Table 29. Distribution of Debt-Asset Ratio

	min	max	mean	std. dev.	first quartile	median	third quartile
Chachoengsao	0.0000	0.3950	0.0367	0.0660	0.0021	0.0126	0.0507
Buriram	0.0004	0.2724	0.0704	0.0635	0.0270	0.0497	0.1221
Lopburi	0.0000	0.3830	0.0772	0.0718	0.0235	0.0590	0.1104
Sisaket	0.0000	0.8242	0.0919	0.1103	0.0200	0.0664	0.1263
All	0.0000	0.8242	0.0717	0.0871	0.0133	0.0440	0.1036

Table 30. Correlation of ROA and debt-asset ratio (non-labor households)

	All	Chachoengsao	Buriram	Lopburi	Sisaket
HH-month	0.0962***	0.0468***	0.0853***	0.1270***	0.1177***
	(0.000)	(0.0003)	(0.000)	(0.0000)	(0.0000)
HH-year	0.2675***	0.1969***	0.2267***	0.3105***	0.3418***
	(0.000)	(0.0000)	(0.0003)	(0.0000)	(0.000)
HH	0.3982***	0.3289***	0.4113**	0.4136***	0.4827***
	(0.000)	(0.0051)	(0.0141)	(0.0000)	(0.000)

	Cultivation	Livestock	Fish/Shrimp	Business
HH-month	0.1033***	0.1279***	0.0817***	0.0539***
	(0.000)	(0.000)	(0.0000)	(0.0004)
HH-year	0.3172***	0.2314***	0.3543***	0.1125**
	(0.000)	(0.0003)	(0.0000)	(0.0319)
HH	0.4222***	0.4392***	0.5932***	0.2058
	(0.000)	(0.0094)	(0.0006)	(0.1432)

Notes: number in parenthesis is the significance level

*,**,*** represent significance at 10, 5, and 1 percent level, respectively

Table 31. Estimates of Production Function

β_K	β_L	Number Obs.
.5029177**	.4238552***	1,966
(0.026)	(0.000)	

Notes: number in parenthesis is the p-value

, * represent significance at 5 and 1 percent level

Table 32. Correlations of TFP, ROA, Growth of Wealth

	TFP	ROA
ROA	0.4962***	
	(0.0000)	
Growth of Wealth	0.3226***	0.5256***
	(0.0000)	(0.0000)

Notes: number in parenthesis is the significance level

*** represents significance at 5 percent level

Table 33. Correlation of TFP Derived from Equation (7)

ROA	Debt-Asset Ratio	Education	Household Size	Head Age	Initial Wealth	Network	Division of labor
0.1226**	0.0064	0.1506**	0.1254**	-0.2057***	0.1655***	-0.0504	0.2291***
(0.0429)	(0.9160)	(0.0172)	(0.0384)	(0.0006)	(0.0061)	(0.4073)	(0.0001)

Notes: number in parenthesis is the significance level

,* represent significance at 5, and 1 percent level, respectively

Table 34. Correlation of productivity and savings level, rate and growth of wealth

	ROA	TFP	FE (IV)		FE (OLS)	
			w/o labor	w/ labor	w/o labor	w/ labor
savings level	0.1400***	0.0437*	0.0593	0.0348	0.2097***	0.1372**
	(0.0012)	(0.0526)	(0.3426)	(0.5758)	(0.0003)	(0.0182)
savings rate	0.2059***	0.0476**	0.1531**	0.1651***	0.1258**	0.0362
	(0.0000)	(0.0425)	(0.0138)	(0.0075)	(0.0308)	(0.5355)
growth of wealth	0.5256***	0.3226***	0.1838***	0.2491***	0.3774***	0.4056***
	(0.0000)	(0.0000)	(0.0030)	(0.0000)	(0.0000)	(0.0000)

*,**,*** represent significance at 10, 5, and 1 percent level, respectively

number in parenthesis is the significance level

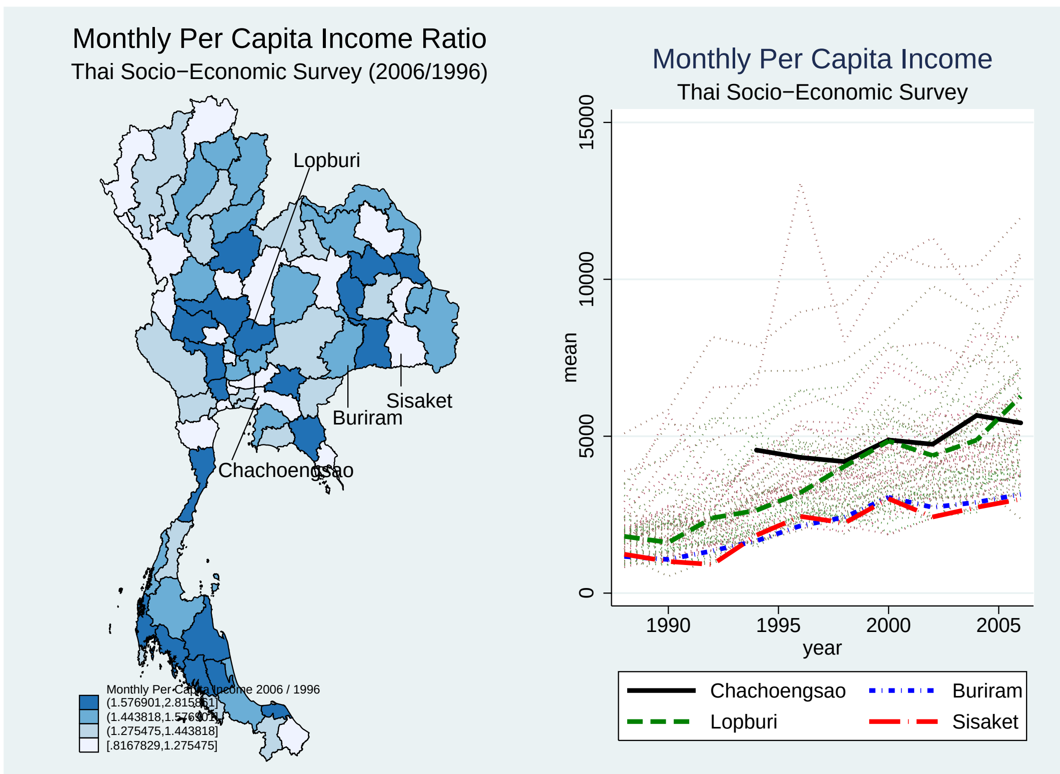

Monthly Per Capita Income Ratio
Thai Socio−Economic Survey (2006/1996)
Lopburi
Sisaket
Buriram
Chachoengsao
Monthly Per Capita Income 2006 / 1996
(1.576901,2.815861]
(1.443818,1.576901]
(1.275475,1.443818]
[.8167829,1.275475]
Monthly Per Capita Income
Thai Socio−Economic Survey
mean
0
5000
10000
15000
1990
1995
2000
2005
year
Chachoengsao
Buriram
Lopburi
Sisaket

Figure 1:

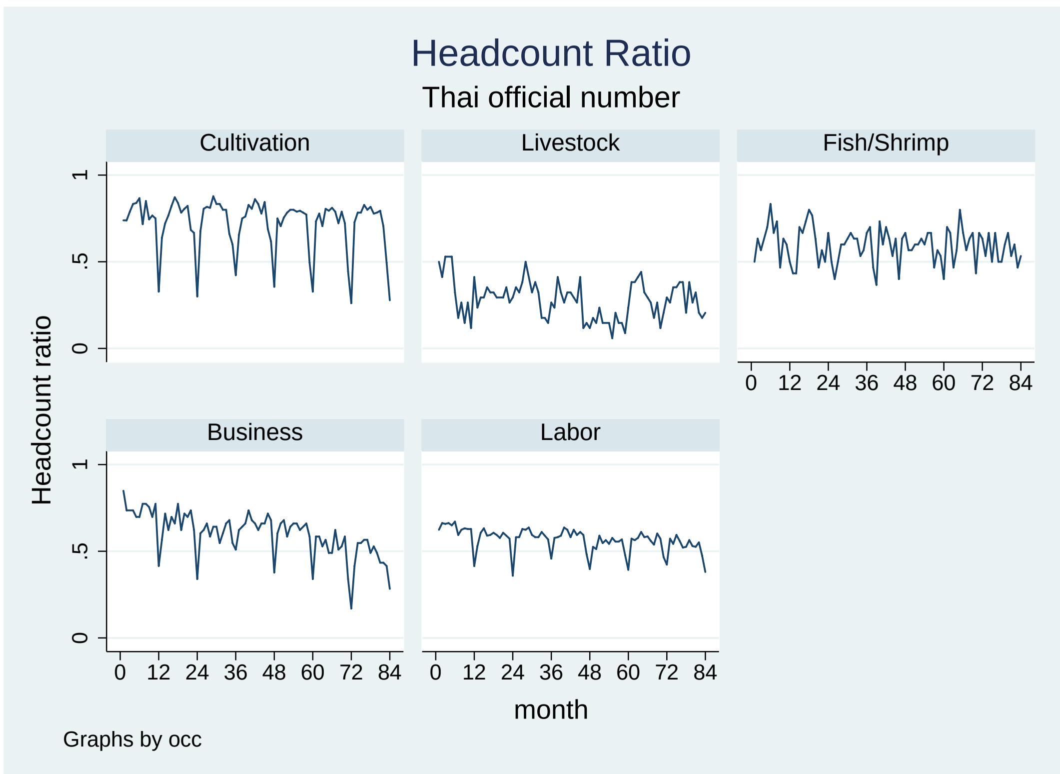
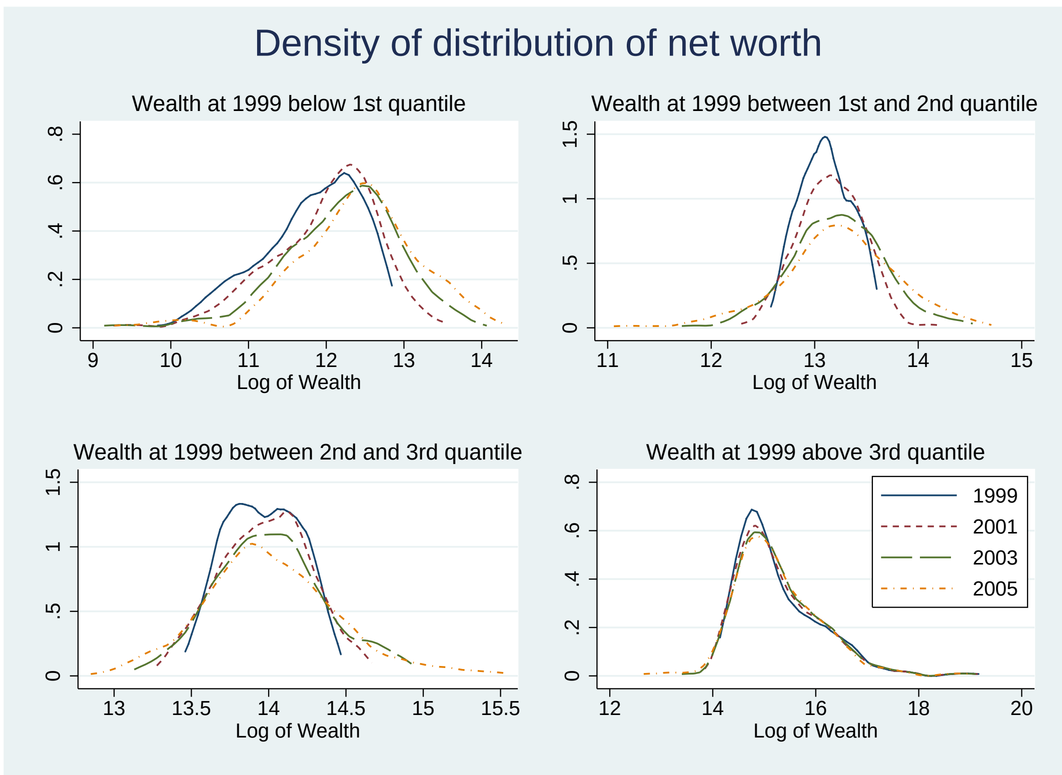

Headcount Ratio
Thai official number
Cultivation
Livestock
Fish/Shrimp
Business
Labor
Headcount ratio
0
.5
1
0 12 24 36 48 60 72 84
month
Graphs by occ

Figure 2:



Density of distribution of net worth
Wealth at 1999 below 1st quantile
Wealth at 1999 between 1st and 2nd quantile
Wealth at 1999 between 2nd and 3rd quantile
Wealth at 1999 above 3rd quantile
Log of Wealth
1999
2001
2003
2005

Figure 3:

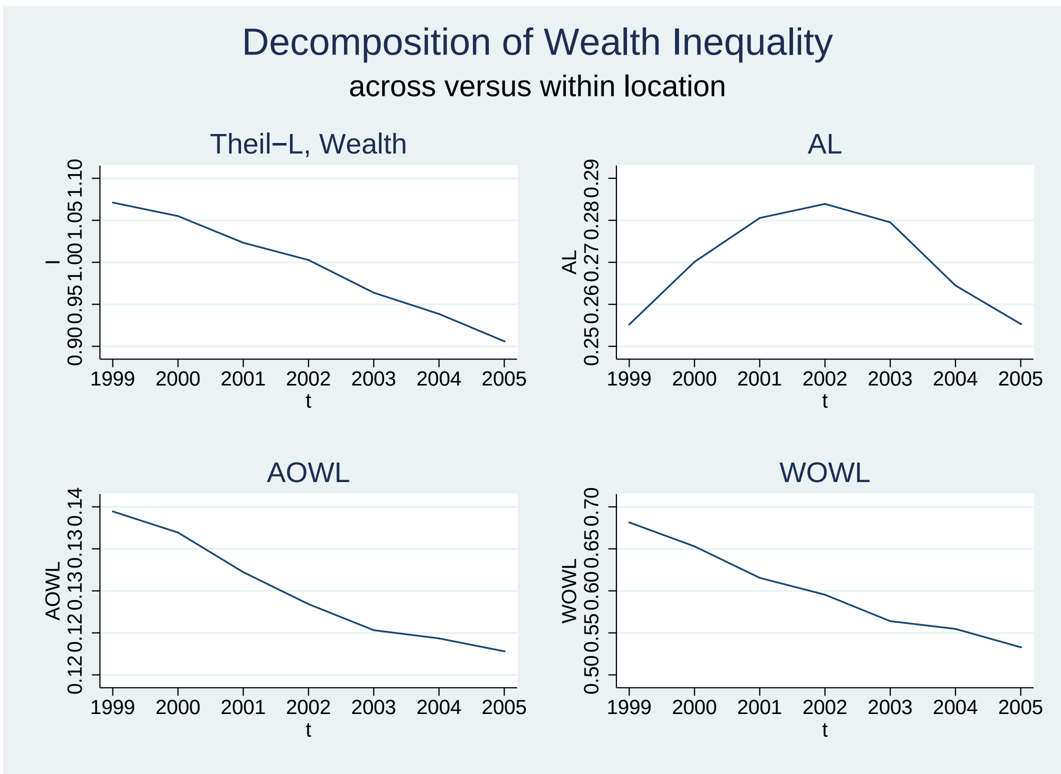

Decomposition of Wealth Inequality
across versus within location
Theil−L, Wealth
AL
AOWL
WOWL
I
0.90 0.95 1.00 1.05 1.10
0.25 0.26 0.27 0.28 0.29
0.12 0.12 0.13 0.13 0.14
0.50 0.55 0.60 0.65 0.70
1999 2000 2001 2002 2003 2004 2005
t

Figure 4:

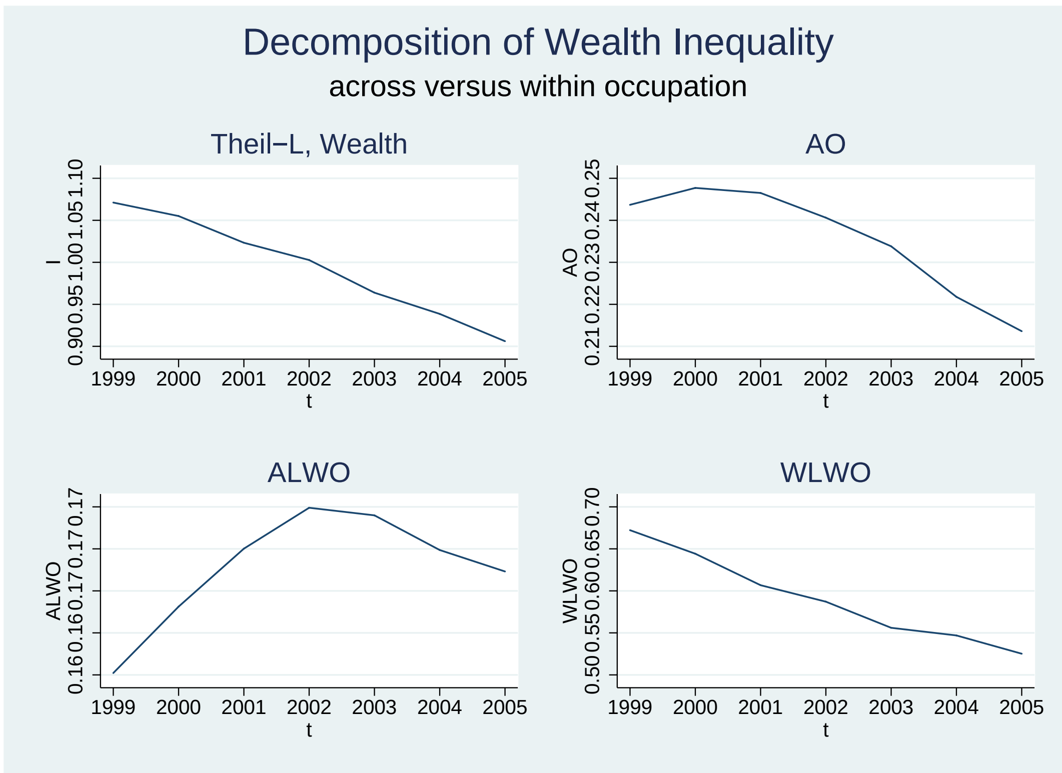

Decomposition of Wealth Inequality
across versus within occupation
Theil−L, Wealth
AO
ALWO
WLWO
I
0.90 0.95 1.00 1.05 1.10
0.21 0.22 0.23 0.24 0.25
0.16 0.16 0.17 0.17 0.17
0.50 0.55 0.60 0.65 0.70
1999 2000 2001 2002 2003 2004 2005
t

Figure 5:

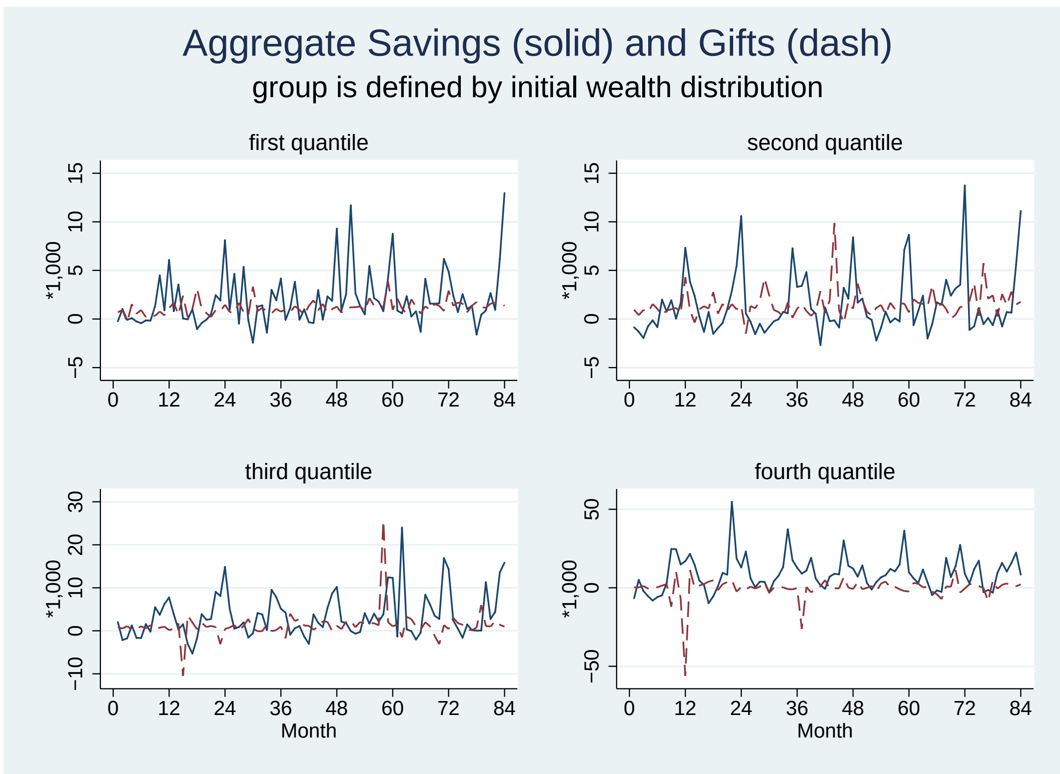
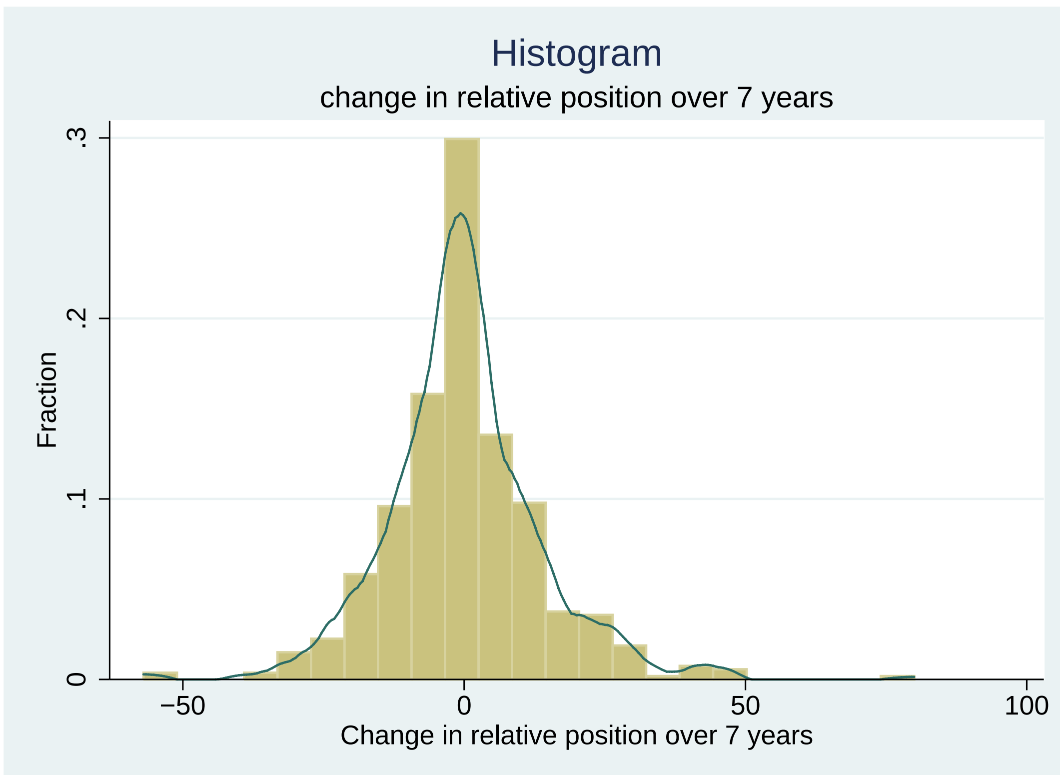

Aggregate Savings (solid) and Gifts (dash)
group is defined by initial wealth distribution
first quantile
second quantile
third quantile
fourth quantile
*1,000
*1,000
*1,000
*1,000
Month
Month
−5
0
5
10
15
−5
0
5
10
15
−10
0
10
20
30
−50
0
50
0
12
24
36
48
60
72
84
0
12
24
36
48
60
72
84
0
12
24
36
48
60
72
84
0
12
24
36
48
60
72
84

Figure 6:



Histogram
change in relative position over 7 years
Fraction
0
.1
.2
.3
−50
0
50
100
Change in relative position over 7 years

Figure 7:

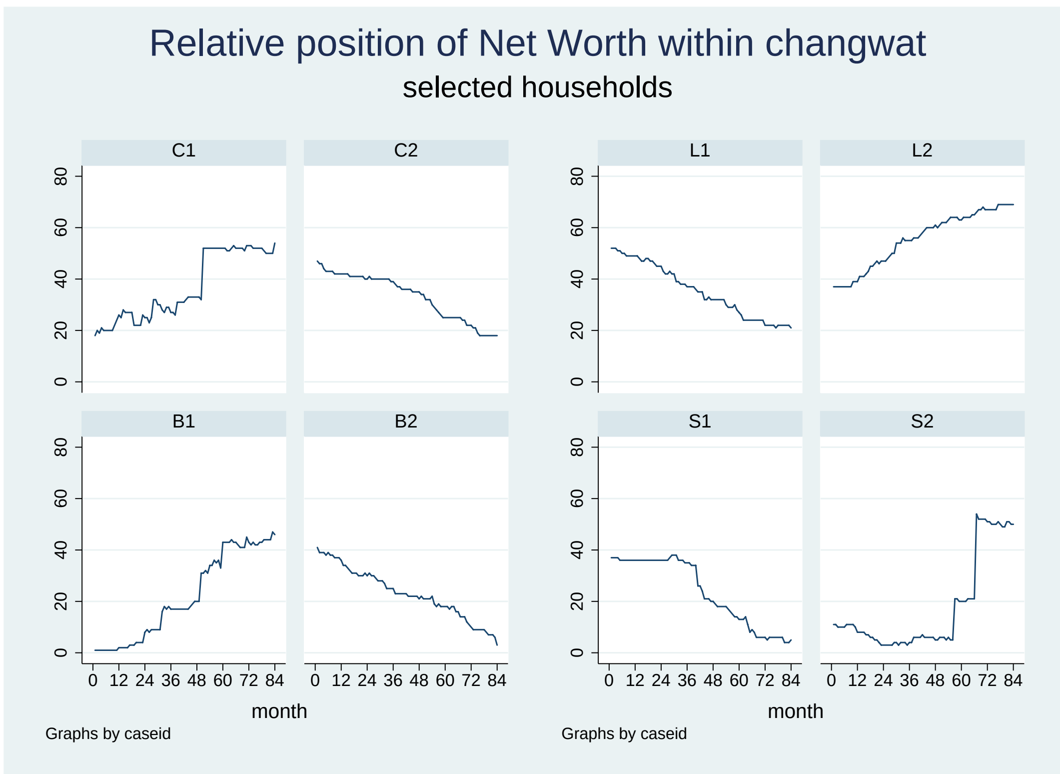

Relative position of Net Worth within changwat
selected households
C1
C2
L1
L2
B1
B2
S1
S2
0
20
40
60
80
0 12 24 36 48 60 72 84
month
Graphs by caseid

Figure 8:

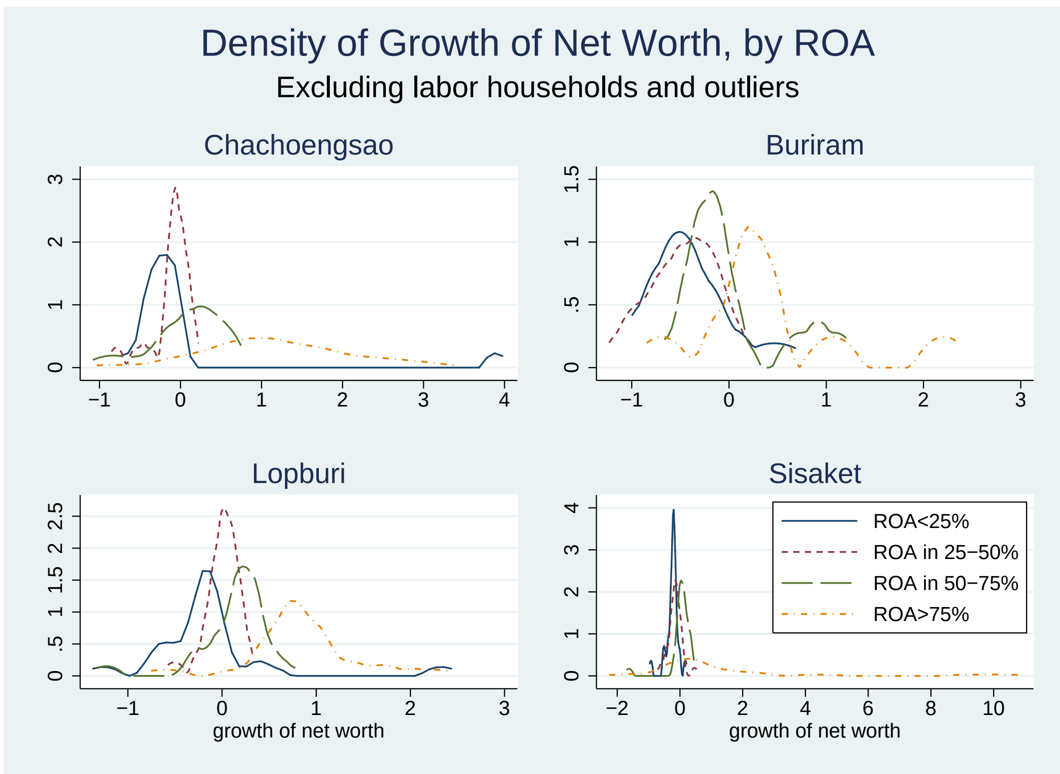

Density of Growth of Net Worth, by ROA
Excluding labor households and outliers
Chachoengsao
Buriram
Lopburi
Sisaket
ROA<25%
ROA in 25−50%
ROA in 50−75%
ROA>75%
growth of net worth
growth of net worth

Figure 9:

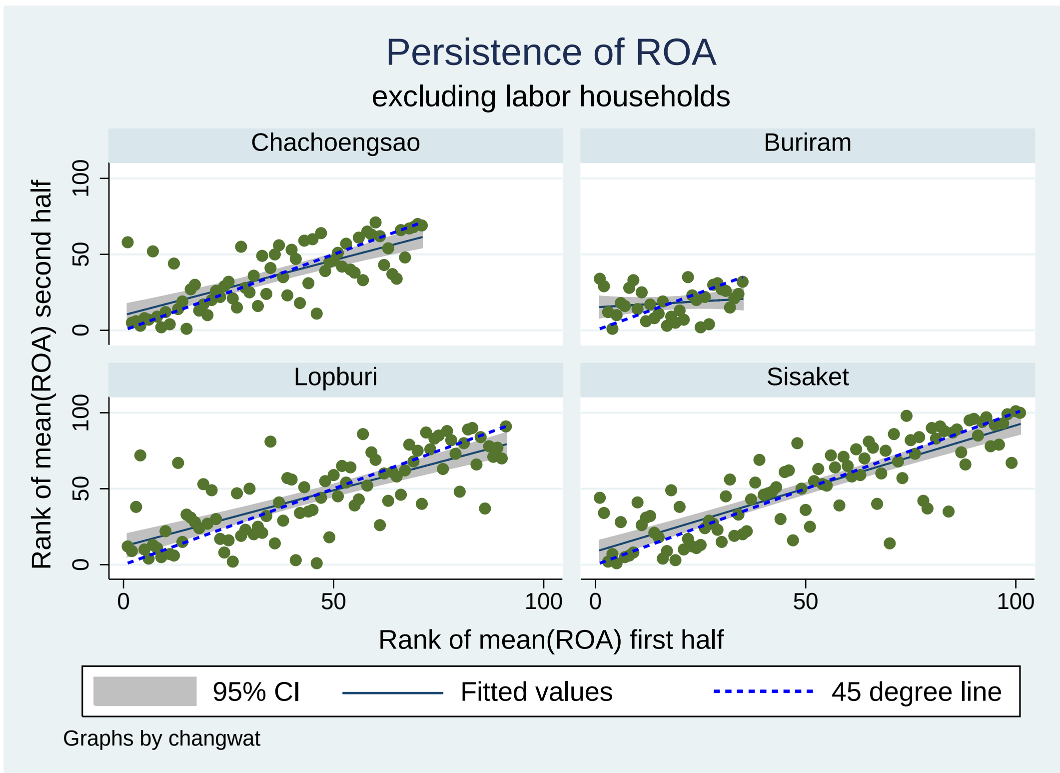

Persistence of ROA
excluding labor households
Chachoengsao
Buriram
Lopburi
Sisaket
Rank of mean(ROA) second half
0
50
100
Rank of mean(ROA) first half
95% CI
Fitted values
45 degree line
Graphs by changwat

Figure 10:

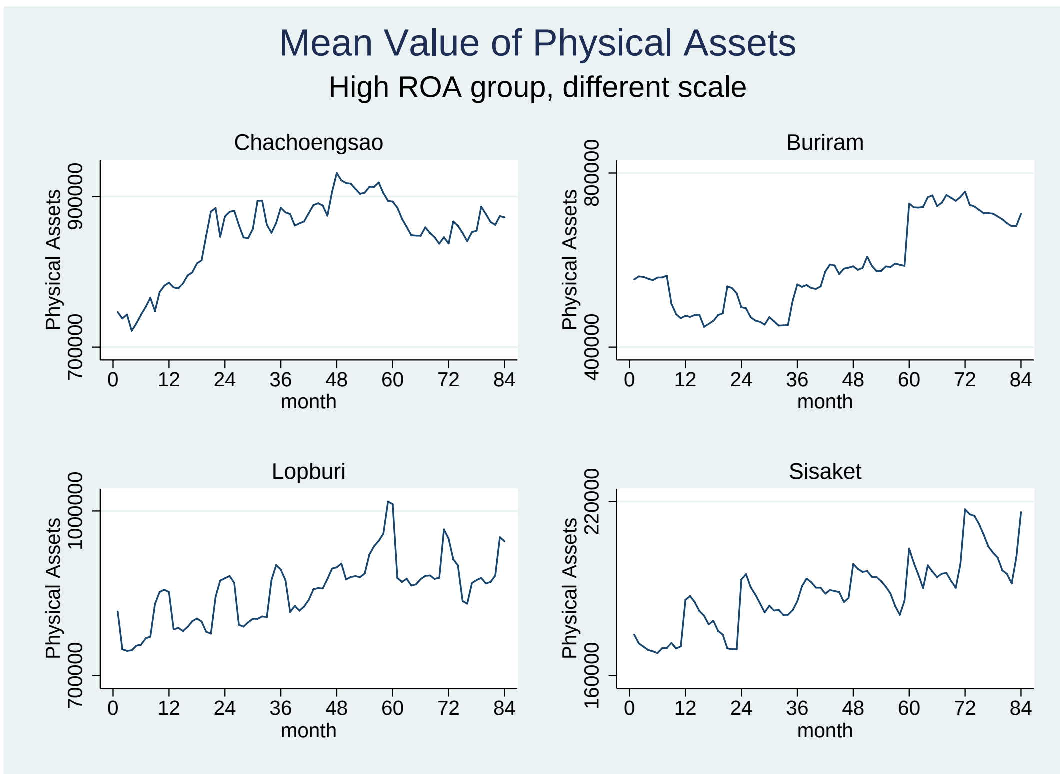
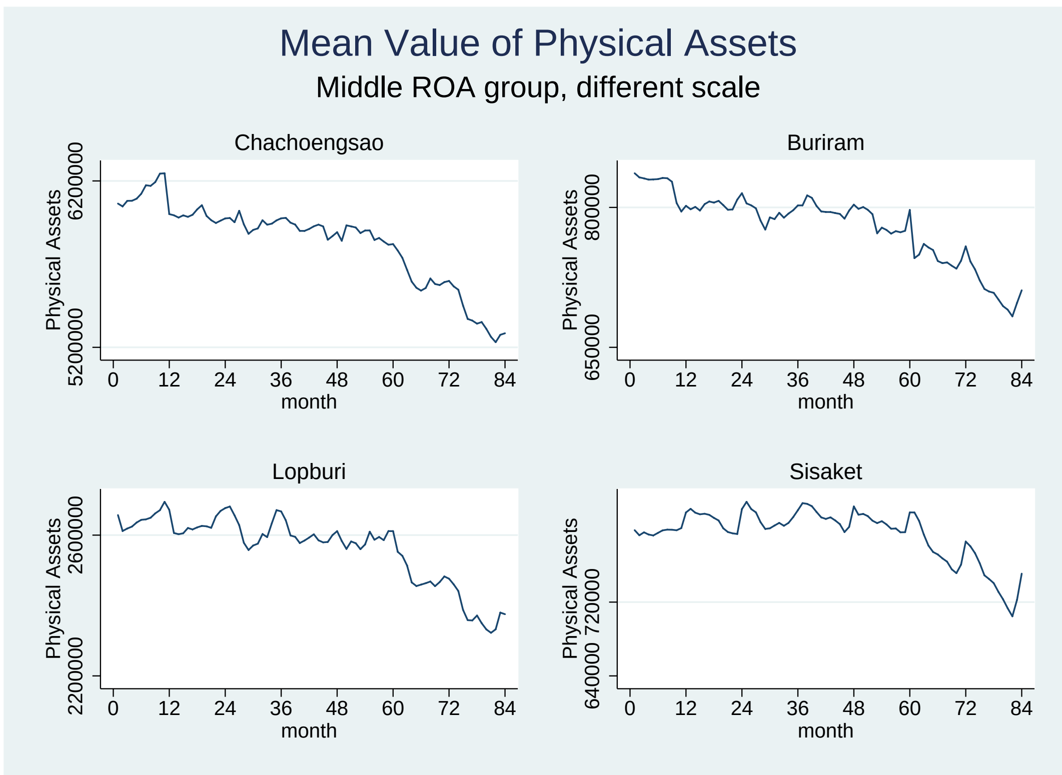
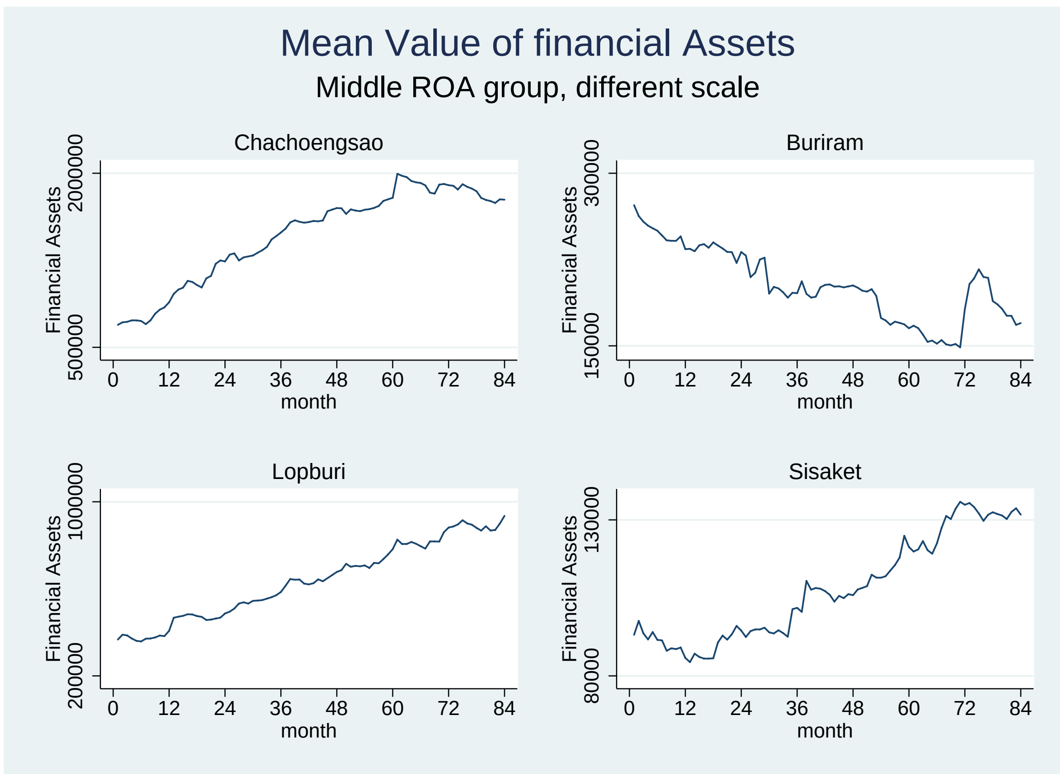

Mean Value of Physical Assets
High ROA group, different scale
Chachoengsao
Buriram
Lopburi
Sisaket
Physical Assets
month
700000
900000
400000
800000
1000000
160000
220000
0
12
24
36
48
60
72
84

Figure 11:



Mean Value of Physical Assets
Middle ROA group, different scale
Chachoengsao
Physical Assets
6200000
5200000
0 12 24 36 48 60 72 84
month
Buriram
Physical Assets
800000
650000
0 12 24 36 48 60 72 84
month
Lopburi
Physical Assets
2600000
2200000
0 12 24 36 48 60 72 84
month
Sisaket
Physical Assets
640000 720000
0 12 24 36 48 60 72 84
month

Figure 12:



Mean Value of financial Assets
Middle ROA group, different scale
Chachoengsao
Financial Assets
500000
2000000
0
12
24
36
48
60
72
84
month
Buriram
Financial Assets
150000
300000
0
12
24
36
48
60
72
84
month
Lopburi
Financial Assets
200000
1000000
0
12
24
36
48
60
72
84
month
Sisaket
Financial Assets
80000
130000
0
12
24
36
48
60
72
84
month

Figure 13:

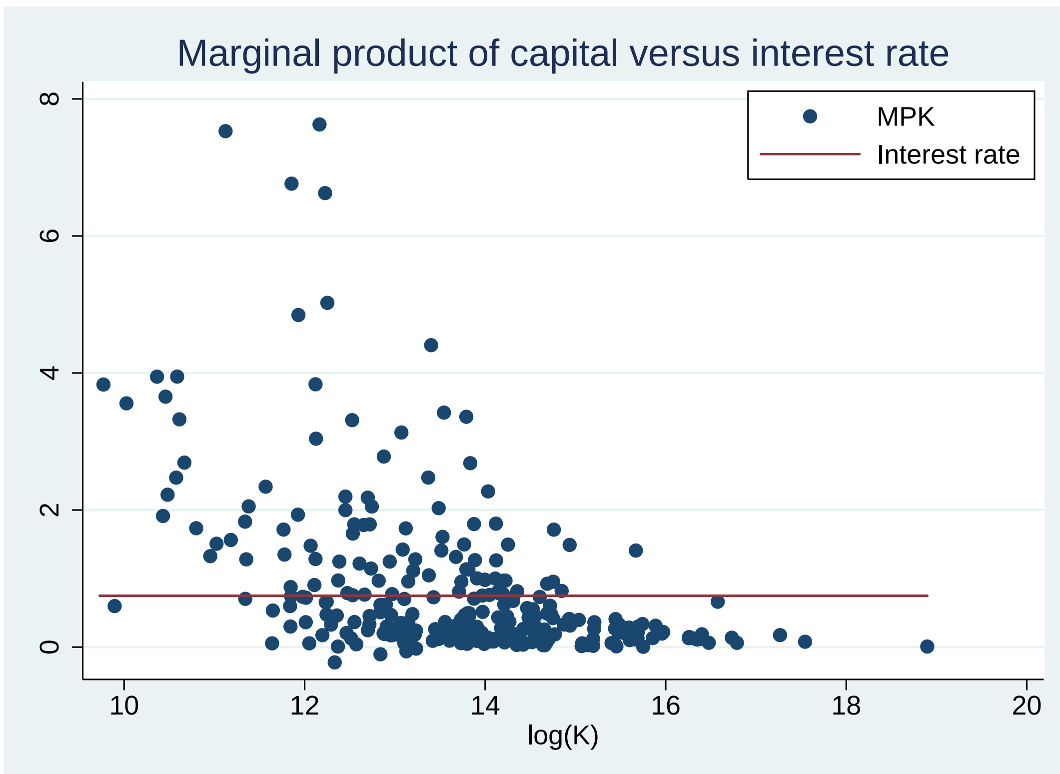

Marginal product of capital versus interest rate
MPK
Interest rate
0
2
4
6
8
10
12
14
16
18
20
log(K)

Figure 14:

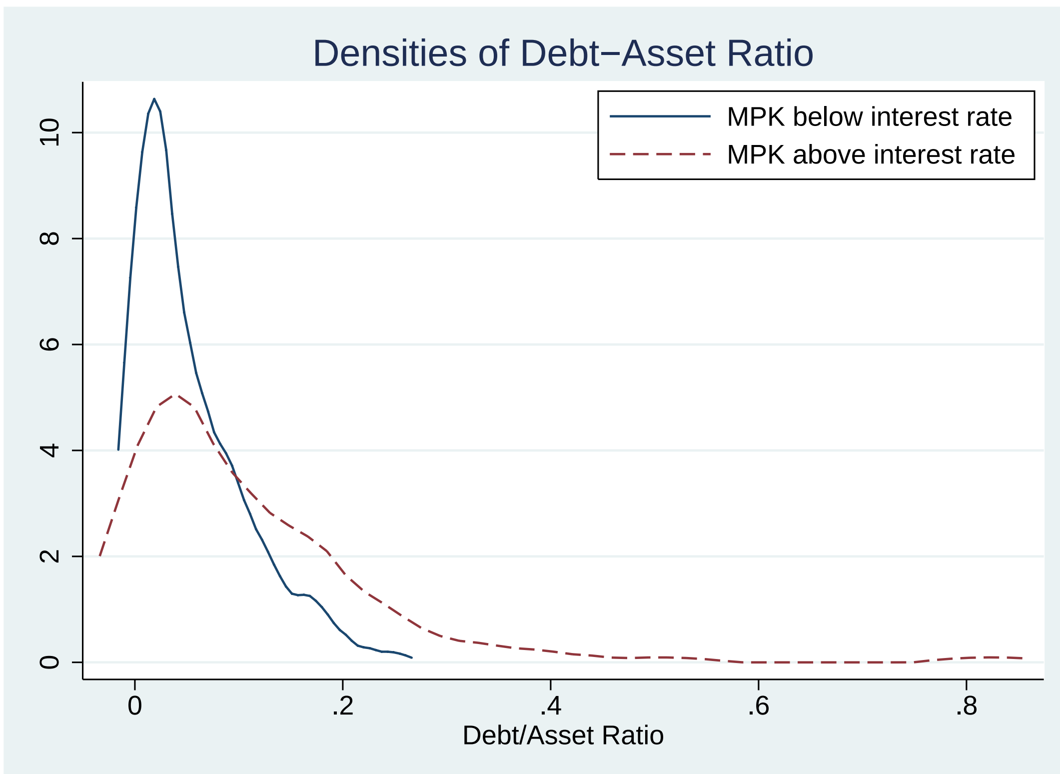

Densities of Debt−Asset Ratio
MPK below interest rate
MPK above interest rate
0
2
4
6
8
10
0
.2
.4
.6
.8
Debt/Asset Ratio

Figure 15:

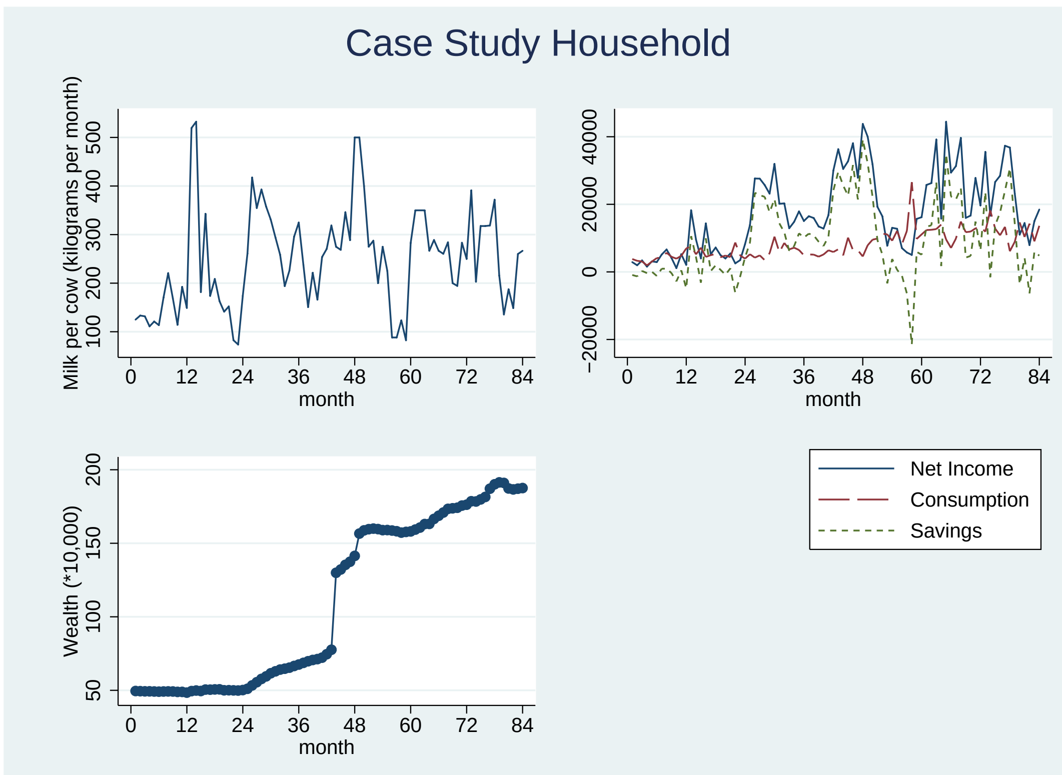

Case Study Household
Milk per cow (kilograms per month)
100
200
300
400
500
0
12
24
36
48
60
72
84
month
−20000
0
20000
40000
Wealth (*10,000)
50
100
150
200
Net Income
Consumption
Savings

Figure 16: