The Impact of Regional Isolationism: Disentangling Real and Financial Factors

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Abstract

Recently, there is a pressure for isolation policies both within the United States and among the EU members. The pressure arises due not only to the difference between regions in the U.S. and/or countries in the EU, but also to the difference across their population which affect the gains and losses from economic integration, both real as from trade in a common market and financial as in a monetary financial union. To get a better understanding of this pressure, one would need a model of trade and capital flows that takes into account the difference between individuals in a region and differences across regions. There is also a need for detail data at the individual and aggregated level, which often are not available. In this paper, we use unique long-panel data of households in Thailand, and from these data, we construct the household financial accounts, the village economic accounts, and the village balance of payments account. We also provide stylized facts on factor prices, factor intensities, financial obstacles, and village openness document differences across regions. Finally at the national level it is clear there is co-mingled variation in trade via devaluations and in finance via policies toward off shore bank and within-country financial infrastructure.

We develop a heterogeneous-agent/occupational-choices/trade model with financial frictions carefully built up and calibrated around micro and regional facts, that is, at both the individual level and the aggregate level. Then, we conduct two counterfactual policy experiments. In the first counterfactual experiment, we distinguish the effects of trade from the effects of capital flows. More specifically, we determine what would happen if we allow the prices of goods to change as in baseline scenario while keep borrowing limits and interest rates constant, and vice versa. In the second counterfactual experiment, we determine the effect of isolation policies that impede trade and/or capital flows across regions. We find through these counterfactual experiments that both real and financial factors are at play, that there are differences across regions in impact even when (policy) movements in variables such as interest rates and relative prices, which are exogenous to the regions, are common; impacts can be large, and vary with policy; and impacts are significant heterogeneous with both gains and losses and non-monotone movement across wealth classes and occupations, even allowing for occupation shifts which apriori might have mitigated impact.

1. Introduction

The contemporary rise of populist pressures leading movement away from trade and financial liberalization hardly needs elaboration. The US has renegotiated NAFTA with quotas and mention a concern with exchange rate manipulation. The US has pulled out of the Trans-Pacific Partnership (TPP), and in the midst of sanctions on China. The EU works at maintaining the monetary union while debating financial integration across countries, while Britain is pulling out of the trade union, Brexit. Within countries, Spain deals with regional pressures, especially Catalan pressures for separation. It is easy to imagine that concerns about increasing inequality can lead to internal within countries policies, some of which in the US target individual states. What impact would these have?

Ironically developing countries, at least until recently, were more prone toward liberalization than restrictions and one can see countries become more open in trade and financial flows, both externally and internally. Still the same question is raised. One seeks to disentangle the impact of real factors (movement in sectoral relative prices which determine production and trade) and financial factors (lower interest rates, more liberal credit/asset ratios) on households running farm/business projects or providing wage labor in diverse heterogeneous, small village economies that in turn are somewhat open to trade and capital flows. Likewise what if these had not been allowed to happen, if internal domestic restrictions on trade and financial flows had been imposed.

In this paper, we proceed in steps taking advantage of unusual data for Thailand: use the pre-existing complete financial accounts from a comprehensive, integrated survey for the surveyed households (income, balance sheet, and cash flow statement); create the village economic SNA and balance of payments accounts from detailed balance sheets and income statements available; generate stylized facts on within village heterogeneity in wealth and productivity; generate stylized facts on cross region variation in factor prices, factor intensities, financial obstacles, and openness; compare these to national events and numbers; construct a two-sector occupation-choice/trade/financially-constrained open economy model for each of the regions, ground carefully around the observed micro and regional heterogeneity, estimate/calibrate key parameters and unobserved variables, different across the diverse regions; simulate and judge model performance against the data; disentangle the contribution of real or financial factors by freezing one group or the other at their initial values and

comparing to the baseline simulations; and imposing real and financial frictions, wedges, one at a time. We find through these counterfactual model-based exercises that the impact of real and financial factors can be heterogeneous and large, generating both gains and losses and non-monotone impact across wealth classes and occupations even allowing for occupation shifts. We are able to map and quantify impacts back on to featured case study households.

In more detail, the Townsend Thai surveys are stratified random samples covering rural and semi-urban areas of the Kingdom. We use the monthly data from January l999 to December 2005, annualized, so 6 years in total. We have a reasonably large sample of households for each village, and we aggregate up to the county level (the four randomly selected villages for each county). Two counties are in the agrarian northeast and two others relatively near Bangkok and the industrialized central core. These economies reflect the diversity within the country, e.g., the Northeast not only specializes in agriculture but also has relative less real capital. Likewise, the Northeast tends to be less open to trade flows. The country as a whole has experienced a recovery from the financial crisis, falling real interest rates, rising wages, movement in relative prices, balance of payments deficits and surplus, and financial institution innovation include the establishment of the world's largest micro financial intervention.

From these data, we utilize Samphantharak and Townsend (2009) who created the balance sheet, income statement, and statement of cash flows for each of the households/businesses and follow the steps of the Bureau of Economic Analysis, U.S. Department of Commerce, to create the village economic accounts. In particular, we create the production account, appropriation account, savings-investment account, and balance of payments accounts. We are mindful that our data are not perfect, in particular, there can be sampling error and we cannot distinguish the source (village production or import) of all consumption data. We also need to decide in the end which variables to feature and use in the model, that is, real capital vs. financial assets such as cash, what to do with land, etc. Still, all in all, we are not aware of comparable panel data sets at this level of disaggregation.

In terms of stylized facts, we look at the value of outstanding loans and the loan/wealth ratios, which as anticipated have been increasing, especially in the Northeast, the declining price of manufactured goods relative to agriculture, declining and converging real interest rates, rising and

diverging real wages especially in the Central region, rising wage to interest rates, labor-intensive agricultural production and capital-intensive manufacturing production, evidence of credit constraints in terms of divergence of the marginal product of capital (high for low wealth households) and varying degrees of openness.

Next, we follow much of the literature and create an occupational choice, wage-earner vs. enterprise model (see for example, Lloyd-Ellis and Bernhardt, 2000; and its empirical implementation in Giné and Townsend, 2004; Jeong and Townsend, 2008; as well as a growing influential literature such as Buera, Kaboski, and Shin, 2011; Buera and Kaboski, 2012; and Song, Storesletten, and Zilibotti, 2011) but with two sectors, for production of the labor-intensive good and the capital-intensive good, respectively. In this model, wealth distribution plays a key role, not only in the determination of interest income but also through household-varying borrowing limits (the usual indebtedness or collateral ratios). Wealth evolution is determined by within-period earnings savings rates in cash and capital taken from the data. Labor endowments are fixed and common over households and time, and the wage rate is determined by the local demand and supply for labor. Local economies are entirely open to capital and can borrow and lend at outside-determined interest rates. In sum, in this model, borrowing limits and relative prices determine jointly the occupational choices and equilibrium wage rates.

To calibrate the model, we act as if interest rates are accurately measured and taken as given (small open economy). We do not believe we see accurate measures of either local relative prices or borrowing limits. The relative prices are determined at sector-level, but the goods in the capital-intensive and labor-intensive sectors vary by region and the available price indices are not sufficiently disaggregated and so do not reflect local variation nor shipping costs. Borrowing limits are an approximation to implicit and formal credit contracts which are not modeled in detail here. Thus, these two variables are calibrated, to match the sectoral profit shares and the wage rate, respectively. We are able to match perfectly the wage rate and profit shares.

To judge the performance of the model, we compare the model's predictions on occupations, income, and wealth with those of the actual households in Townsend Thai data. We do a reasonable

job predicting the occupational choices and the levels of total income and fixed assets of our sampled households.

We run some counterfactual exercises, namely, freezing real (relative prices) and then financial factors (interest rates and borrowing limits) at their initial values, with the other variables (financial and then real, respectively) free, comparing in turn to the baseline simulations where both real and financial factors are allowed to vary to match the wage and profit shares we see in the data. When only financial factors are allowed to vary in Lop Buri, for example, the profit share of the capital-intensive sector is higher, whereas when we vary only relative prices the profit share is lower. Under either scenario of these counterfactual, the wage rate is higher than what we observe in the data.

In a more austere counterfactual, we impose trade frictions or financial frictions on the economy, one at a time. When trade frictions are imposed, the price of imported goods must increase in relative to that of exported goods. So, it matters if the economy was initially importing labor-intensive (or capital-intensive goods), raising the price of the factor which is used relatively intensively in that good. The counterfactual with trade frictions can thus cause the wage to drop (increase), if for example, the price of the labor-intensive good is lowered (raised), with the lost demand for exports. Of course, similar arguments can be made for capital-intensive goods. When financial frictions are imposed, the interest rate will decrease (increase) if the economy had been exporting savings/lending (or borrowing from abroad), so to speak. Thus, owners of capital suffer large losses (or gains).

Finally, our model shows the heterogeneous effects on the households' welfare. In these exercises, whether the households are better off or worse off also depend on where they are in terms of ability and wealth. For example, if trade frictions increase the price of capital-intensive goods relative to the price of labor-intensive goods. This will, in turn, lower the wage rate. Then, the high-ability high-wealth households, who were entrepreneurs in the capital-intensive sector, will benefit from trade frictions. On the other hand, both the low-ability households, who were wage-earners, and the very-high-ability households, who were entrepreneurs in the labor-intensive sector, will be worse off.

A related point an interest rate increase can have different effects by occupation, in particular capital intensive entrepreneurs will be negatively affects more than labor intensive entrepreneurs. We do see variation across provinces in the number of capital intensive entrepreneurs so the impact will of the rate rise will be different.

2. Literature Review

We have a lot in common with the widely cited, seminal review of Goldberg and Pavcnik (2007), not only in the topic we study but also in the overall conclusions. Goldberg and Pavcnik study the impact of reductions in tariff barriers, arguing for a causal link between trade openness and changes in inequality. But they also believe that by the l990's increased capital flows from financial liberalization were playing a co-determining role. They found this worrisome for research purposes, as one is no longer look at the impact of trade alone. We thus emphasize our attempt to disentangle (through measurement and the model) real trade factors from financial factors. We also study the impact on particular regional economies over a period of time, one region at a time, rather than cross sectional comparisons. We do have the panel data from a continuously implemented survey to do this. Goldberg and Pavcnik also abstract from the growth channel and macro dynamics. We in contrast do have some endogenous wealth dynamics and hence time-varying impacts, but on the other hand, we abstract from TFP growth; however, we do have variation in TFP across firms and regions, and this plays a leading role in our model. Finally, we do identify several, diverse channels through which trade and financial openness can have impact. As Goldberg and Pavcnik (2007) and Feenstra (2008) emphasize the popular notion that relatively abundant factors in a country would be aided by exports and the consequent increase in factor prices turned out to be naïve; the standard Heckscher–Ohlin predictions turn out to be naïve in the context of our model, and data, as well. Their conclusion, and ours, is that attempts to understand, anticipate or alleviate the distributional effects of within-country openness need to be grounded in a careful study of regional circumstances. We document this extensively.

More recent papers continue to try to exploit exogenous policy variation in conjunction with theory. Brambilla, Lederman, and Porto (2012) study exports, export destinations, and skill utilization

by firms. Using the exogenous changes in exports and export destinations brought about by an Argentine l999 devaluation, they find that Argentine firms exporting to high-income countries hired a higher proportion of skilled workers and paid higher average wages than other exporters (to non-high-income countries) and domestic firms. We too are using exogenous policy variation, in particular, variation in credit in the data associated with a government financial intervention (though other things were happening at the same time – we use our model to sort this out).

On the other hand, unlike Brambilla, Lederman, and Porto (2012) we do not focus at all on skills variation within the labor sector, nor the source of demand for those exports. We do have heterogeneity among firms in a given sector in terms of productivity, but not on exporting or not per se. There is of course a large and growing literature emphasizing this kind of heterogeneity, for example, Bustos (2011), Melitz (2003), and Verhoogen (2008). Indeed, as reviewed by Harrison, McLaren, and McMillan (2011), the poor performance of the Stolper–Samuelson mechanism, has led Feenstra and Hanson (1996), Helpman, Itskhoki, and Redding (2011), Frías, Kaplan, and Verhoogen (2012), and Burstein, Morales, and Vogel (2015) to study different channels through which trade effects the distribution of earnings: outsourcing, labor market frictions, quality upgrading, or capital-skill complementarity. Here we take a different tact and incorporate financing frictions into a 2x2 HO model. This is another way to overturns the Stolper–Samuelson mechanism, a point made rather dramatically in Antràs and Caballero (2009) in their model of North-South trade and globalization, though their study was not empirical.

As in the recent paper Fajgelbaum and Khandelwal (2016), we complement a literature which views the distributional impact of international trade as one of the central tasks to be pursued by international economists. Fajgelbaum and Khandelwal (2016) find that trade has relatively adverse effects for low-income consumers in more than half of the countries that they consider and that the distributional effects of trade are often large relative to the aggregate effects. They focus on the demand side and heterogeneity in demand elasticities. We shut down that mechanism entirely and focus instead on the cross-sectional distribution of welfare gains and losses associated with varying factor endowments, varying factor intensities across sectors, and household-specific credit constraints related to wealth. As with a labor mobility literature, we find that occupation shifts can play a role in

mitigating adverse impact, or facilitating gains, but the distribution of gains and losses even with this mechanism in place can also be heterogeneous and large.

In emphasizing local within-country impacts associated with initial conditions, our paper shares much in common with Autor, Dorn, and Hanson (2013). They find impacts on local labor markets from rising Chinese import substitutes (unemployment, lower labor force participation, and reduced wages), and account for up to one quarter of declines in manufacturing employment. We too find impacts on factor prices and occupation, for us from changes in relative prices arguably associated with international and interregional trade. We show in fact relative prices of manufacturing and agricultural goods do move considerably in the time period we study. Related is Hakobyan and McLaren (2016), who find using US Census data for 1990–2000 at a quite disaggregated level the NAFTA-induced effects on US wages by industry and by geography, measuring each industry's vulnerability to Mexican imports and each locality's dependence on vulnerable industries. They find large distributional effects (larger than aggregate welfare effects estimated by other authors). Related in turn is the earlier paper of Topalova (2007), who constructed an employment-weighted average tariff for each Indian district to identify the differential effects of local labor-market shocks on different locations. Kovak (2013) uses a similar technique for Brazil. These studies indicate significant location-specific effects of trade shocks on wages, which of course implies mobility costs of some sort for workers that prevent them from arbitraging wage differences across locations. We too make these explicit assumptions about the local labor market, and we too document effects on wages. We go beyond these papers in taking an explicitly structural approach, which in turn allows us to conduct a number of counterfactual exercises. Though we stop short of introducing heterogeneity in labor skills, the matching of labor to task and worker-specific capital, we do allow heterogeneity across those running firms. Though we do not have direct costs of adjustment, we do have credit constraints that can prevent expansion in scale. We do find already with what in the model now enormous heterogeneity in impact.

There is of course increasing interest in using structural models to understand the impacts of policy shocks. Donaldson and Hornbeck (2016) study the impact of railroads in American growth using a "market access" approach based on Eaton and Kortum (2002). Morten and Oliveira (2018)

uses the same approach to study economic integration in Brazil with new roads connecting to the new capital city, and Bryan and Morten (2018) study aggregate productivity effects of migration in Indonesia. Allen and Arkolakis (2014) feature a versatile general equilibrium framework to study the spatial distribution of economic activity.

Other studies incorporate dynamics and study the impact of trade shocks on labor markets, such as reductions in tariffs associated with NAFTA or the China import shock. Caliendo and Parro (2015) study a multi-sector multi-country model of the impact of NAFTA. Lyon and Waugh (2018) study the impact of the China shock in the US, motivated by Autor, Dorn, and Hanson (2013) study mentioned earlier. There are tradeoffs in modeling and techniques in solving for the general equilibrium that have a lot to do with how the heterogeneity is allowed to enter the problem.

Caliendo and Parro (2015) use the Dekle-Eaton-Kortum dynamic technique with perfect foresight that allows a certain kind of aggregation – shares remain constant across equilibria with a measured counterfactual policy variable changes the levels. Lyon and Waugh (2018) feature discrete choice across value functions and differ from the former literature by studying an economy in which households face labor income shocks, incomplete markets, and partial self-insurance. The cost of this departure is that they are unable to incorporate the geographic and sectoral detail due to computational complexities. In this latter tradition, Itskhoki and Moll (2019) allow dynamic occupation choice of households running firms or providing labor, both with savings and borrowing, with credit constraints on firms as a linear function of wealth. If there is no persistence in randomly drawn productivities, this allows an aggregation in that macro variables are simple sums of the micro level variables. But if productivity shocks have some persistence, as in Moll (2014), then new techniques are needed. Though in Moll, the new state variables are the shares of wealth at various productivities. Pecuniary fixed costs subtracted from consumption can cause problems, as well. Sraer and Thesmar (2018) show that scaling up small scale experiments for an entire economy remains tractable if and only if the revenue to capital ratio is independent of general equilibrium conditions, which happens if the sources of distortions are homogeneous of degree one and production functions are Cobb-Douglas. Otherwise the modeler as analyst has to keep track of the joint distributions of wealth and talent in solving for

the general equilibrium, which though doable in some contexts, as noted, can lead to computational hard if not infeasible problems in others.

In this paper, we take a different track. Rather than tie our hands and limit individual and regional heterogeneity so that we can solve for the general equilibrium of the entire economy, we free ourselves by considering counter factual experiments for small open regional economies. We calibrate local economies using data from the observed equilibrium path. Relative to this baseline, general equilibrium effects would show up as changing wedges on the relative price of goods and changing interest rates. We study the impact of such changes. These changes could be generated from these general equilibrium macro effects or from local restrictive policies. From the point of view of the local economy, it does not matter. We can thus feature substantial, realistic individual and local heterogeneity. This results in simultaneous gains and loses across groups, highly nonlinear and non-monotone impacts with sign changes, and orders of magnitude of which can be substantial.

What we are doing has an analogy to work in macro, in assessing the impact of monetary policy. For example, Auclert (2018) distinguishes an earnings heterogeneity channel from unequal income gains, a Fisher channel from unexpected inflation, and an interest rate exposure channel from real interest rate changes. The inflation channel is explored by Doepke and Schneider (2006), who measure the balance sheet exposures of various sectors and groups of households in the United States to different inflation scenarios. Auclert (2018) uses 2010 Italian survey containing a self-reported measure of MPC (Jappelli and Pistaferri, 2014); the 1999–2013 waves of the U.S. Panel Survey of Income Dynamics, (Blundell, Pistaferri, and Preston, 2008); and the 2001–2002 waves of the U.S. Consumer Expenditure Survey, together with a method that exploits the randomized timing of tax rebates as a source of identification for MPC (Johnson, Parker, and Souleles, 2006). Likewise, Kaplan and Violante (2014) focus on heterogeneity in MPC distinguishing liquid and illiquid assets in the Survey of Consumer Finances. We emphasize that all work is in partial equilibrium, as is our paper, providing key building blocks.

Likewise, in the US at the community level, there is increasing interest in and work on understanding local heterogeneity. This was given impetus by Mian and Sufi (2014), then followed by Hurst et al. (2016) and a literature trying to see if and how to distinguish local from macro shocks.

Autor, Dorn, and Hanson (2013) can be thought of in this way, too. Beraja et al. (2019) using detailed loan-level data shows that regional differences in housing equity affect refinancing and spending responses to interest rate cuts and also that these effects vary over time with changes in the regional distribution of house price growth.

Auclert (2018), Kaplan, Moll, and Violante (2018), and Beraja (2018), go on to write down equilibrium models of the entire economy to gauge impact of policy change. But of course this last step is layered on top of their micro findings. Our focus in this paper is on documenting analogue micro building blocks, allowing heterogeneous policy impacts across households. Subsequent work can build on the micro underpinnings we provide here.

3. Townsend Thai Data

The data used in this paper comes from the monthly household-level panel survey, which is a part of the larger Townsend Thai project. The monthly survey was conducted in two provinces in the Central region, Chachoengsao and Lop Buri, and in two provinces in the Northeast region, Buri Ram and Si Sa Ket. In each province, counties (tambons) are randomly picked, and then four villages in each county were chosen at random, as well. For the chosen county of the monthly survey, approximately 45 households per each of the four villages of the county are sampled at random. The survey began in August 1998 with the baseline survey, which collects the data on the status of the sampled household, including household's composition, wealth, and the occupations of its members. Then, in the monthly resurvey, the same households are being interviewed for any activities within the household, including changes in its wealth, inputs, outputs, and any income received during the past month. The resurvey was started in September 1998. The results reported in this paper are drawn from an 84-month period (months 5-88). This period covers from January 1999 to December 2005.

At the beginning of the survey, there are, again, approximately 45 households per village. However, during the 88-month period covered in our survey, the migration of village resident is

unavoidable.[1] For every household in our survey that moves out of the village, a replacement household is added. However, for the purpose of constructing the village accounts, we decide to use the balanced panel data and consider only households that stay for the entire 88-month period.

Villages in the Central provinces are relatively richer than villages in the Northeast provinces. The average net worth of households in Chachoengsao and Lop Buri in 1999 are approximately $112,000 and $46,000, respectively, while the average net worth of households in Buri Ram and Si Sa Ket are approximately $22,600 and $18,600, respectively. Villages in the Central also participate more in the capital-intensive production activities (e.g., operating fish and/or shrimp ponds, raising livestock, etc.), while villages in the Northeast focus on the labor-intensive activities (e.g., being rice farmers or wage workers).

4. Financial Statements of Individual Households

Samphantharak and Townsend (2009) propose a framework to create balance sheets, income statements, and statements of cash flow for households in developing countries. As they point out, many households in developing countries not only behave as consumers, supplying factors of production and consuming output, but also as firms in production activities. Conceptualizing a household as an analogue to a corporate firm, they use and modify the standards of corporate financial accounting to create household financial statements. We base what we do on these financial accounts, and so summarize briefly here.

4.1 Constructing Household Financial Statements

Even though we view a household as analogous to a corporate firm, various issues need to be considered when constructing the household financial statements from a household survey. These issues arise mainly because of the differences in the characteristics of a household versus a corporate firm. Modifications of the financial accounts are needed. The issues include in-kind finance, multi-period production, storage and inventory, livestock, depreciation, insurance embedded in loans, gift

[1] We do observe the migration at individual and household levels. However, as will be shown below, there are persistent differences in wage rates across regions. According to the data from the Community Development Department (CDD), the fraction of households with migrants during 1988–1999 was between 22–32%.

and transfer, and home-produced consumption. Covering each of these in detail would take us astray so we simply reference Samphantharak and Townsend (2009) and also Pawasutipaisit et al. (2010) for these details.

4.2 Balance Sheet

The balance sheet provides the information on a household's wealth at any point in time. On one side is the composition of the household's assets which equal to the household's liabilities and net wealth on the other side. The household's assets include current assets, such as cash, inventory, or deposits at financial institutions, and fixed assets, including land.

4.3 Statement of Income and Retained Earnings

The statement of income and retained earnings provides information about a household's income over a period of time. The right column lists the sources of household's revenues. The left column shows how the household's revenues are distributed. The household's net income equals the difference between total revenues and total expenses.

4.4 Statement of Cash Flow

The difference between cash flow and income as above is the accrual method. In the latter expenses are booked at the time of sale of output, for example. In the cash flow statement, one simply has inflows and outflows of cash associated with expenses and income. The two methods are close, though not identical when annualizing the data, as we do here.

4.5 Financial Statements of Example Households

Here in this section we both illustrate the financial statements by looking at particular example households. We will also come back to these particular households when we look at the impact of the trade and financial counterfactuals we consider.

4.5.1 Household A

For the first example, we consider a typical working household in Lop Buri. In 1999, this household consisted of a male household head, his wife, and a four-years-old daughter. The household head was 38 years old, while his wife was 34 years old. Both the household head and his wife only have the primary-level education (4 years and 6 years, respectively). In 2000, this household has another daughter.

In 1999, both adult members worked at a shoe-making factory. Later that year, the household head switched to work as a construction worker. In the next year, the wife moved to work at a garment company making knitted dresses. Since 2001, both adult members have changed their jobs several times. This pattern is quite common in Thai rural villages and suggests high job mobility among Thai wage workers. This household also raised a small flock of chickens and ducks. In 2001, this household branched out to cultivation activity and grew chili. And in 2005, this household invested in a friend's cantaloupe farm. However, labor income is always the main source of this household income. Table 1 reports the statement of income and retained earnings of this household in 1999. Figure 1 shows the composition of household A's income over time.

In 1999, the average value of fixed assets of this household is 159,251 Baht (69,251 Baht excluding land). Household A is ranked at the 24th percentile by the value of fixed assets (the 33rd percentile if land is excluded). Therefore, household A has relatively low wealth by the Lop Buri's standard. Table 2 reports the average balance sheet of this household in 1999. Household A held most of its wealth in land and household assets.

Figure 2 shows the composition of household A's wealth level over time. In early years (1999–2002), household A's liability level is quite stable, and the increase in household A's asset level comes from the increase in household A's savings. From 2003, on the other hand, household A also uses loans to finance its asset accumulation. Table 3 reports the statement of cash flow of household A.

Table 1 – Statement of income and retained earnings of household A

Uses		Sources	
Expenses from production		Revenues from production	
Cultivation	0	Cultivation	0
Livestock	181	Livestock	340
Fish and shrimp	0	Fish and shrimp	0
Business	0	Business	0
Labor	0	Labor	91,150
Other	730	Other	260
Interest expense	10,000	Interest revenue	0
Depreciation	3,435	Capital gains	0
Insurance premium	0	Less: Capital losses	0
Property tax	0	Insurance indemnity	0
Net income before tax			
Income tax	0		
Consumption	54,076		
Savings	23,329		
Charges against total revenue	91,750	Total Revenue	91,750

Figure 1 – The composition of household A's income over time

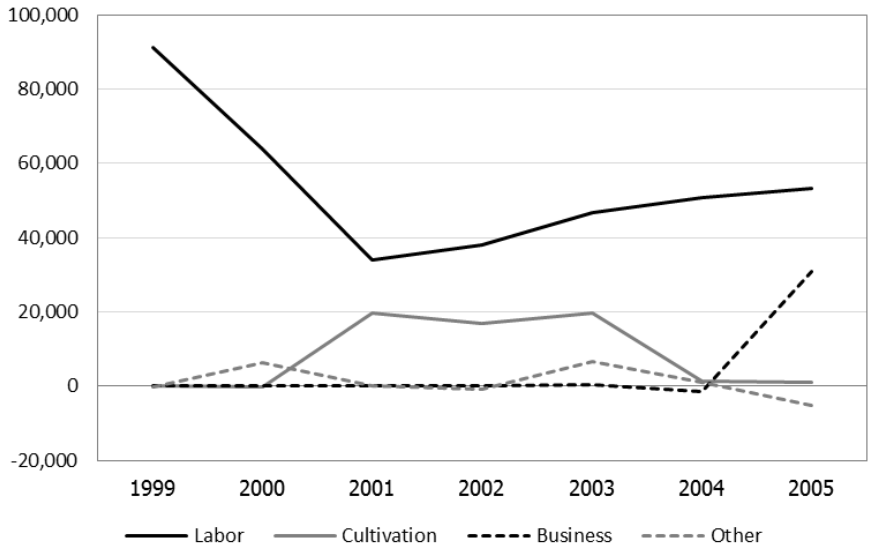


Table 2 – Balance sheet of household A

Assets		Liabilities and net wealth	
Current assets		Current liabilities	
Financial assets		Account payable	0
Cash	22,992	Other borrowing	37,417
Account receivable	0	Household's net wealth	
Other lending	0	Contributed capital	118,192
Deposits	5,560	Current retained earnings	50,779
ROSCA (net position)	14,125	Gifts (net transfer)	–1,602
Inventories	1,777		
Prepaid insurance	0		
Livestock	1,081		
Fixed assets			
Household assets	69,251		
Agricultural assets	0		
Business assets	0		
Land and other fixed assets	90,000		
Total assets	204,786	Total liabilities and net wealth	204,786

Figure 2 – The composition of household A's wealth

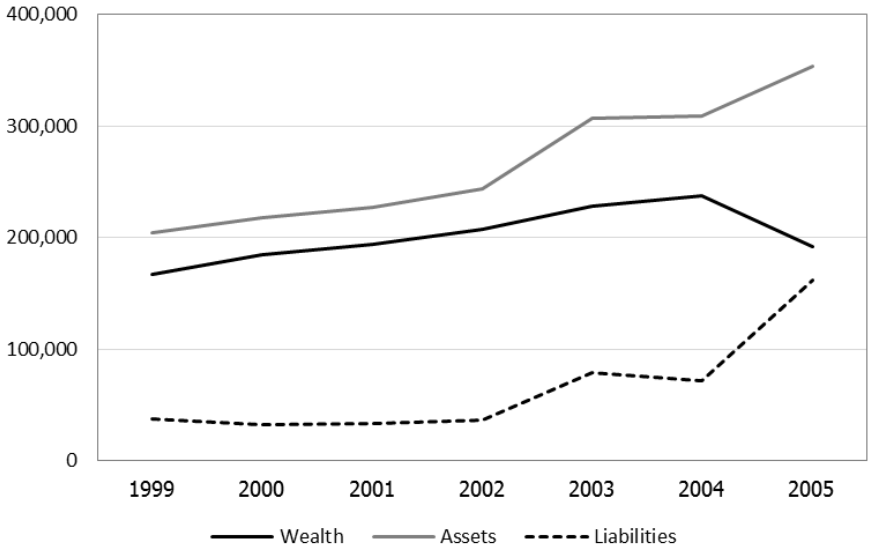


Table 3 – Statement of cash flow of household A

Change in cash holding	**–11,479**
Cash flow from production	**84,096**
(+) Income from production	87,447
(+) Depreciation of assets	3,435
(+) Change in account payable	0
(–) Change in account receivable	0
(–) Change in inventory	–40
(–) Consumption of household production	–6,746
(–) Net capital gains from production	–90
Cash flow from financing, investment, & consumption	**–95,575**
(+) Net capital gains from financial assets	0
(–) Capital expenditure on fixed assets	–10,795
(+) Net interest income	–10,000
(–) Tax expenditure	0
(–) Consumption expenditure	–47,330
(–) Insurance premium	0
(–) Capital expenditure on livestock	250
(–) Change in deposit at financial institutions	–940
(–) Change in ROSCA position	–10,750
(–) Lending	0
(+) Borrowing	–14,000
(+) Net gifts and transfer	–2,010
(+) Change in contributed capital	0
(+) Insurance indemnity	0
Statistical discrepancy	**0**
Change in cash holding from balance sheet	**–11,479**

4.5.2 Household B

Next, we consider another household in Lop Buri. The members of this household are a male household head, his wife, a seven-years-old daughter, and a two-years-old son. Both the household head and his wife are relatively young (30 years old and 26 years old, respectively). The household

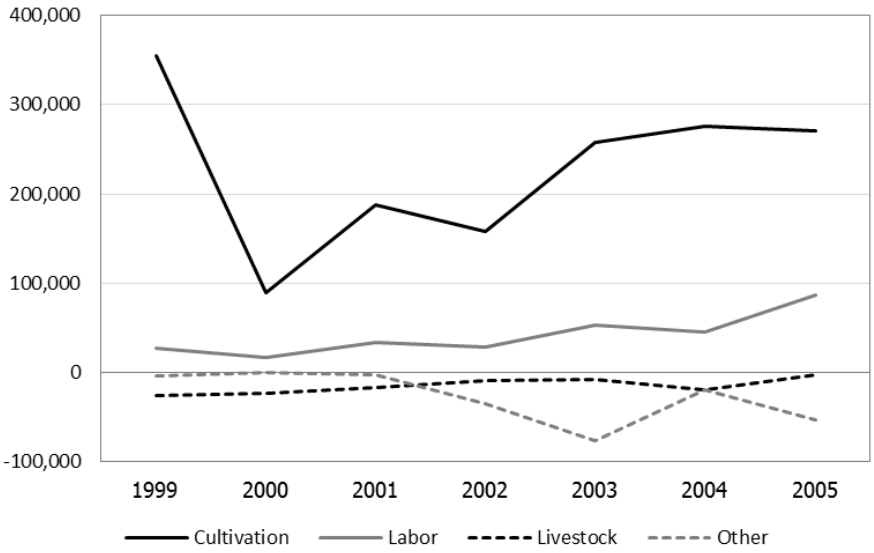
head has a lower-secondary education (9 years), while his wife has a primary education. The daughter is in the kindergarten, while the son is not in school yet.

The main source of income of this household is the cultivation activity. In early years, the crops grew by this household include corn, sunflower, and peanut. In later years, this household also diversify its crops to include chili and cotton. Both adult members also work occasionally as wage workers in their neighbors' farms. Moreover, this household also raised cattle (i.e., beef cows) but faced losses in most years. Table 4 reports the statement of income and retained earnings of household B in 1999. Figure 3 shows the composition of household B's income over time.

Table 4 – Statement of income and retained earnings of household B

Uses		Sources	
Expenses from production		Revenues from production	
Cultivation	14,717	Cultivation	370,000
Livestock	25,898	Livestock	0
Fish and shrimp	0	Fish and shrimp	0
Business	0	Business	0
Labor	1,000	Labor	28,540
Other	4,070	Other	50
Interest expense	47,627	Interest revenue	0
Depreciation	9,535	Capital gains	0
Insurance premium	700	Less: Capital losses	0
Property tax	0	Insurance indemnity	0
Net income before tax			
Income tax	0		
Consumption	65,301		
Savings	229,742		
Charges against total revenue	398,590	Total Revenue	398,590

Figure 3 – The composition of household B's income over time



In 1999, the average value of this household's fixed assets is 486,067 Baht (191,150 Baht excluding land), and household B is ranked at the 40th percentile by the value of fixed assets (the 64th percentile if land is excluded). Therefore, household B has medium wealth by the Lop Buri's standard. Table 5 shows the average balance sheet of this household in 1999. Household B holds most of its wealth in land, livestock, and agricultural assets, respectively.

Figure 4 shows the composition of household B's wealth level over time. Similar to that of household A, the liability level of household B is quite constant from 1999 to 2004, and the increase in household B's asset level comes from the increase in household B's savings. Also, household B uses loans to finance its investment in 2005. The statement of cash flow of household B is shown in Table 6.

Table 5 – Balance sheet of household B

Assets		Liabilities and net wealth	
Current assets		Current liabilities	
Financial assets		Account payable	0
Cash	70,936	Other borrowing	185,550
Account receivable	0	Household's net wealth	
Other lending	0	Contributed capital	840,679
Deposits	6,266	Current retained earnings	–68,660
ROSCA (net position)	89,480	Gifts (net transfer)	–1,249
Inventories	90,677		
Prepaid insurance	0		
Livestock	212,893		
Fixed assets			
Household assets	68,239		
Agricultural assets	122,911		
Business assets	0		
Land and other fixed assets	294,917		
Total assets	956,319	Total liabilities and net wealth	956,319

Figure 4 – The composition of household B's wealth

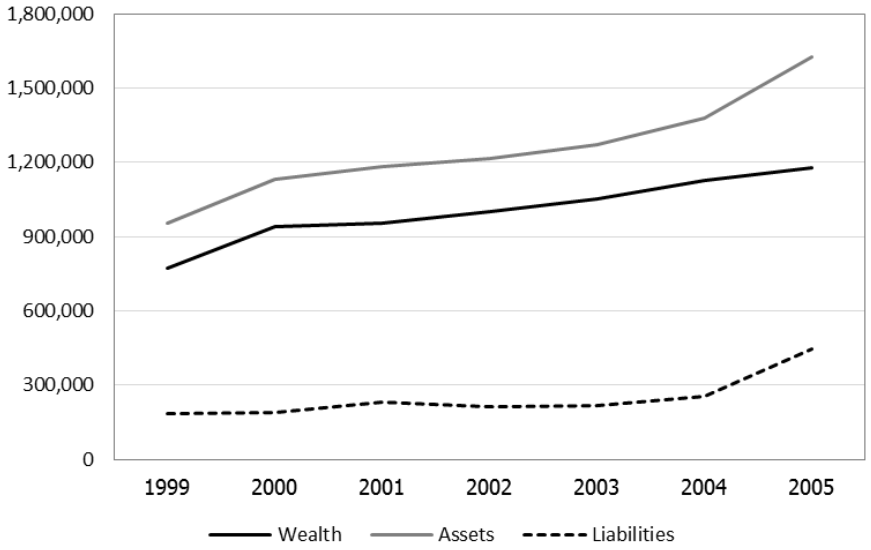


Table 6 – Statement of cash flow of household B

Change in cash holding	**–76,344**
Cash flow from production	**–26,034**
(+) Income from production	369,269
(+) Depreciation of assets	9,535
(+) Change in account payable	0
(–) Change in account receivable	0
(–) Change in inventory	–401,328
(–) Consumption of household production	–3,509
(–) Net capital gains from production	0
Cash flow from financing, investment, & consumption	**–50,310**
(+) Net capital gains from financial assets	0
(–) Capital expenditure on fixed assets	–42,670
(+) Net interest income	–47,627
(–) Tax expenditure	0
(–) Consumption expenditure	–61,792
(–) Insurance premium	–700
(–) Capital expenditure on livestock	9,200
(–) Change in deposit at financial institutions	189
(–) Change in ROSCA position	–12,000
(–) Lending	0
(+) Borrowing	107,400
(+) Net gifts and transfer	–2,310
(+) Change in contributed capital	0
(+) Insurance indemnity	0
Statistical discrepancy	**0**
Change in cash holding from balance sheet	**–76,344**

4.5.3 Household C

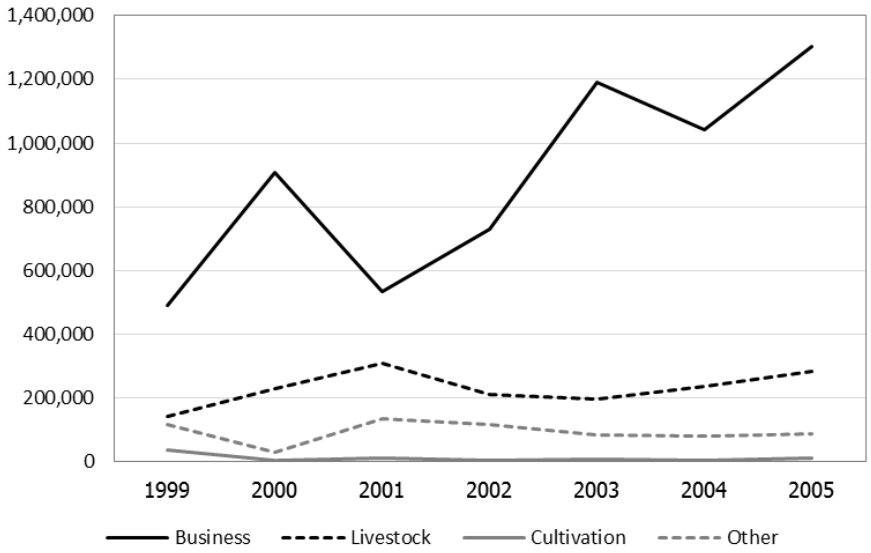
As the last example, we consider another entrepreneurial household in Lop Buri. In 1999, this household consists of a male household head, his wife, a fourteen-years-old son, a ten-years-old son, and a three-years-old daughter. Both the household head and his wife are 36 years old and have 8 years of education. In 1999, the elder son is in grade 8, while the younger son is in grade 3. In 2001, the elder son moves to a school in another province for three years before coming back in 2004.

This household receive income from several activities. The primary source of income of this household is its business, which is making compressed straw. The secondary source of this household's income is livestock (i.e., dairy cows and chickens). Household C also received a small amount of income from boarders and from cultivation (i.e., growing grass). Table 7 reports the statement of income and retained earnings of household C in 1999. Figure 5 shows the composition of household C's income over time.

Table 7 – Statement of income and retained earnings of household C

Uses		Sources	
Expenses from production		Revenues from production	
Cultivation	5,928	Cultivation	41,600
Livestock	406,591	Livestock	548,772
Fish and shrimp	0	Fish and shrimp	0
Business	310,149	Business	801,120
Labor	70	Labor	12,000
Other	710	Other	105,200
Interest expense	4,500	Interest revenue	19,550
Depreciation	53,841	Capital gains	0
Insurance premium	0	Less: Capital losses	0
Property tax	0	Insurance indemnity	0
Net income before tax			
Income tax	0		
Consumption	142,170		
Savings	604,284		
Charges against total revenue	1,528,242	Total Revenue	1,528,242

Figure 5 – The composition of household C's income over time



In 1999, the average value of household C's fixed assets is 5,519,800 Baht (1,094,300 Baht excluding land), and household C is ranked at the 98th percentile by the value of fixed assets by both measures (including and excluding land). Therefore, household C has very high wealth. Table 8 reports the average balance sheet of this household in 1999. Household C holds most of its wealth in land, followed by livestock, agricultural assets, and household assets. The level of household C's liabilities is insignificant relative to its wealth (see figure 6), suggesting that household C finances most of its investment using savings. Table 9 reports the statement of cash flow of household C.

Table 8 – Balance sheet of household C

Assets		Liabilities and net wealth	
Current assets		Current liabilities	
Financial assets		Account payable	0
Cash	365,886	Other borrowing	150,000
Account receivable	0	Household's net wealth	
Other lending	40,833	Contributed capital	6,467,045
Deposits	99,385	Current retained earnings	345,964
ROSCA (net position)	29,483	Gifts (net transfer)	–11,908
Inventories	20,382		
Prepaid insurance	0		
Livestock	875,330		
Fixed assets			
Household assets	520,380		
Agricultural assets	573,920		
Business assets	0		
Land and other fixed assets	4,425,500		
Total assets	6,951,101	Total liabilities and net wealth	6,951,101

Figure 6 – The composition of household C's wealth

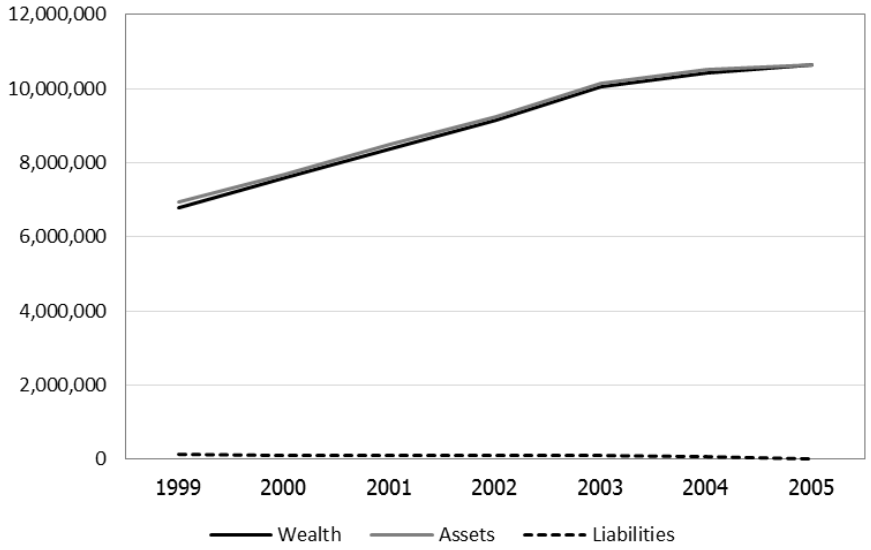


Table 9 – Statement of cash flow of household C

Change in cash holding	**447,068**
Cash flow from production	**990,154**
(+) Income from production	859,393
(+) Depreciation of assets	53,841
(+) Change in account payable	0
(–) Change in account receivable	0
(–) Change in inventory	81,804
(–) Consumption of household production	–4,884
(–) Net capital gains from production	0
Cash flow from financing, investment, & consumption	**–543,086**
(+) Net capital gains from financial assets	0
(–) Capital expenditure on fixed assets	–273,900
(+) Net interest income	15,050
(–) Tax expenditure	0
(–) Consumption expenditure	–137,286
(–) Insurance premium	0
(–) Capital expenditure on livestock	117,000
(–) Change in deposit at financial institutions	6,450
(–) Change in ROSCA position	800
(–) Lending	–60,000
(+) Borrowing	–200,000
(+) Net gifts and transfer	–11,200
(+) Change in contributed capital	0
(+) Insurance indemnity	0
Statistical discrepancy	**0**
Change in cash holding from balance sheet	**447,068**

4.6 Technology

In Townsend Thai data, households' production activities can be classified as one of the four sectors; business, cultivation, fish and shrimp, or livestock. The revenues and expenses of these activities, plus the labor revenue and expense, are recorded in the financial accounts introduced earlier in this section.

The production activities are also different across provinces. Villages in Chachoengsao have diverse sources of income, including operating fish and shrimp ponds, livestock, cultivation, and labor income. Cultivation, livestock, and labor income are the main sources of income for villages in Lop Buri. Labor income is the main source of income for villages in Buri Ram until 2002, when the income from businesses becomes equally large. For Si Sa Ket, the main sources of income are cultivation, labor income, and businesses.

Even within the activities defined above, there are differences in household activities across provinces, especially for cultivation and business activities. For example, many households in Lop Buri grew corn, while those in Buri Ram grew rice. Household businesses could also range from operating a food stall or a small grocery store to selling trucks and tractors. All these differences could lead to the productivity difference across provinces. However, when we estimate the production function, we decide to group household's production activities into four broadly-defined activities (i.e., business, cultivation, fish and shrimps, and livestock) for the purpose of fitting into the model. And we pick the two most-common activities, namely business and cultivation, to represent the two sectors in our model.

We estimate the production function of each activity using the following specification:

$$\ln(Y_{it}) = \delta_K \ln(K_{it}) + \delta_L \ln(L_{it}) + \varepsilon_{it} \quad (1)$$

where Y_{it} denotes the output of household i in period t, and K_{it} and L_{it} denote the capital and the labor used by household i in period t. The error term ε_{it} captures the household i-specific productivity in period t. We allow the household's production function to have decreasing returns to scale (DRS), and therefore, there are positive entrepreneurial rents.[2]

If the households in our data expand their production size when they observe positive productivity shocks, the levels of capital and labor might be correlated with the error term and the OLS estimators could be biased. Therefore, we use the estimation method in Levinsohn and Petrin (2003) to obtain the consistent estimators and use the level of intermediate input as a proxy variable.

[2] On the other hand, if we impose the constant-returns-to-scale technological constraint, then only the most productive producers will produce, until they reach their borrowing limits. Then, the second most productive producers will take over, and so on. Although, in this case, the more productive producers could also have positive profits.

Table 10 reports the estimation results. Cultivation activity is the most labor-intensive, while fish and shrimp activity is the least labor-intensive.

Table 10 – Estimation of production functions

	Cultivation	Business	Livestock	Fish & Shrimp
δ_K	0.2313	0.3061	0.3099	0.5306
	(0.0390)	(0.0975)	(0.1967)	(0.1892)
δ_L	0.4564	0.3922	0.2260	0.0660
	(0.0375)	(0.0873)	(0.1052)	(0.0963)

Note: Standard errors are in parentheses.

To estimate sector-average TFP and household's entrepreneurial ability, we start by estimating household-specific TFP from the regression residual as follows:

$$a_i = \frac{1}{T}\sum_{t=1}^{T} \varepsilon_{it} \tag{2}$$

where a_i denotes the log TFP of household i. Then, we decompose the household-specific TFP into the sector-average TFP and the household's entrepreneurial ability, i.e.,

$$a_i = \bar{a} + z_i \tag{3}$$

where z_i is assume to have a normal distribution with mean zero and standard deviation σ_z.[3] Table 11 reports the sector-average TFP and σ_z for each activity.

Table 11 – Estimated sector-average TFP and ability dispersion

	Cultivation	Business	Livestock	Fish & Shrimp
$\bar{a}$	4.1244	3.7464	4.6071	3.1648
σ_z	0.8409	0.9644	1.4057	1.8448

[3] We assume that a household's entrepreneurial ability, z_i, is common to all production activities. In our case studies, if a household participates in more than one activities and have multiple estimated z_i, we pick the highest one. Of course, the multiple z_i suggest that we should have used Roy's model. However, we cannot estimate productivities for sectors a household was never in.

4.7 Household Wealth

In the model, the distribution of capital endowment is assumed to follow the distribution of fixed assets excluding land in the data. If we don't take out land, the wealth level of households will be too high, and most of the household's capital will be lent out (in the model). This is partly because according to the estimated production function, the marginal product of capital is quite low, and the villages face high interest rates in early years. So, it's better to just lend capital to someone else than using them in production activity.

The initial distribution of household's capital is assumed to follow Gamma distribution:

$$f(x;k,\theta) = x^{k-1}\frac{e^{-x/\theta}}{\theta^k G(k)} \tag{4}$$

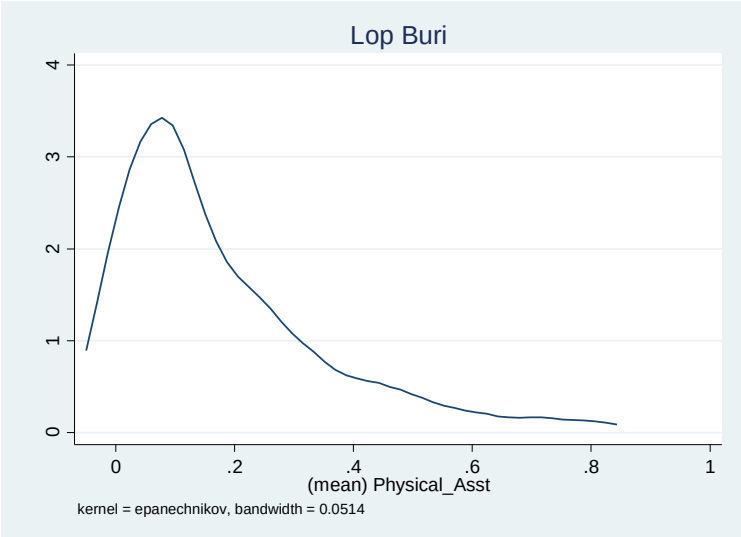
where $G(\cdot)$ is Gamma function. We calibrate the distribution parameters, k and θ, to match the distribution of household's fixed assets in 1999. The calibrated values for k and θ are 2.6205 and 0.08267, respectively. Figure 7 compares the actual initial distribution of household's fixed assets in Lop Buri data and the calibrated distribution in the model.

To put our case-study households in the Lop Buri context, household A is an average-ability household ($z_i = 0$) with very low initial capital level (i.e., at the l0th percentile of the distribution). Household B is a high-ability household ($z_i = 1.58\sigma$) with intermediate initial capital level (i.e., at the 50th percentile of the wealth distribution). And household C is a very high ability household ($z_i = 2.07\sigma$) with very high wealth (i.e., at the 99th percentile of the wealth distribution). [4]

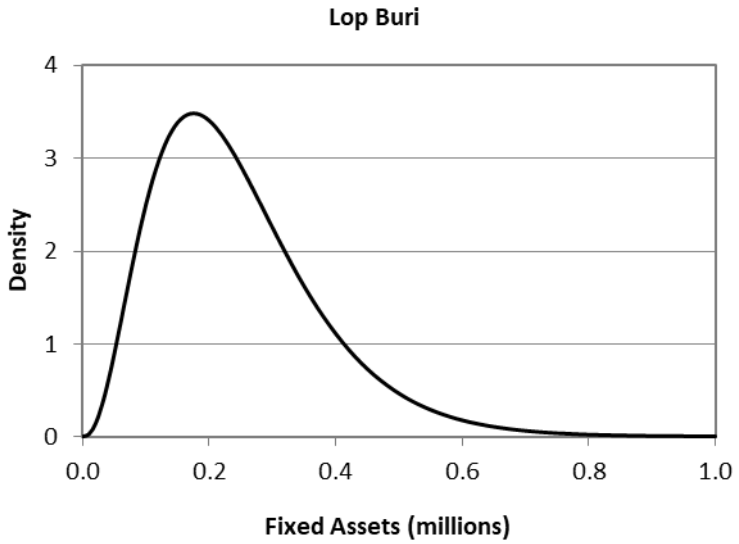
[4] We have tested and found that, in the Townsend Thai data, the initial level of household's wealth or household's fixed assets are mostly uncorrelated with the level of household's ability.

Figure 7 – The distributions of household's fixed asset in Lop Buri in 1999

(a) Actual distribution



(b) Calibrated distribution



4.8 Financial Frictions and Borrowing Limits

Pawasutipaisit and Townsend (2011) find the strong differences in marginal products across households in the Townsend Thai data, high for low wealth households, which points toward the existence of financial frictions. Due to an imperfect financial market, the amount of capital than an entrepreneur can utilize depend on the level of his own capital. We will assume that an entrepreneur i whose capital level is W_{it} cannot use the capital in his production activity during period t more than

$\eta_t W_{it}$. In other words, we assume that an entrepreneur i can borrow at most $(\eta_t - 1)$ times of his capital level.

Suppose in each period, households consume according to the following consumption function

$$C_{it} = C^* + \gamma(\pi_{it} - C^*).$$

where C_{it} denotes the consumption of household i in period t, π_{it} denotes the net income (profit) of household i in period t, and C^* denotes the subsistent level of consumption. Household i then put a fraction ω of its savings in cash and invest the rest in fixed assets.[5] The values of C^*, γ, and ω are estimated to match the patterns of consumption, cash holding, and investment at the provincial level. More specifically, we first estimate the consumption function above using the provincial-level income and consumption over 7-year period. Then, we calculate ω from the ratio of savings in cash to investment in fixed assets at the provincial level. The estimated values of C^*, γ, and ω for Lop Buri are 54,099, 0.1989, and 0.6462, respectively. The numbers suggest that, on average, the subsistent consumption level of households in Lop Buri is 54,099 baht per year, the marginal propensity to consume is approximately 20%, and the average household in Lop Buri saves approximately 65% of its unconsumed income in cash as oppose to in fixed assets.

Figure 8 compares the predicted level of consumption based on the estimated consumption function above with the actual consumption level of the households in our case studies. The results suggest that the case-study households tend to save more (consume less) that the provincial-average household.

[5] This allocation would be optimal for a household maximizing the within-period utility function, $U = (C_{it} - C^*)^{\gamma}\left(i_{it}^{K}\right)^{\alpha}\left(i_{it}^{Cash}\right)^{\beta}$, where i_{it}^{K} denotes the household's investment in fixed assets, i_{it}^{Cash} denotes the household's savings in cash, and $\omega = \frac{\beta}{\alpha+\beta}$, assuming that $\pi_{it} > C^*$.

Figure 8 – Actual and predicted consumption levels of case-study households

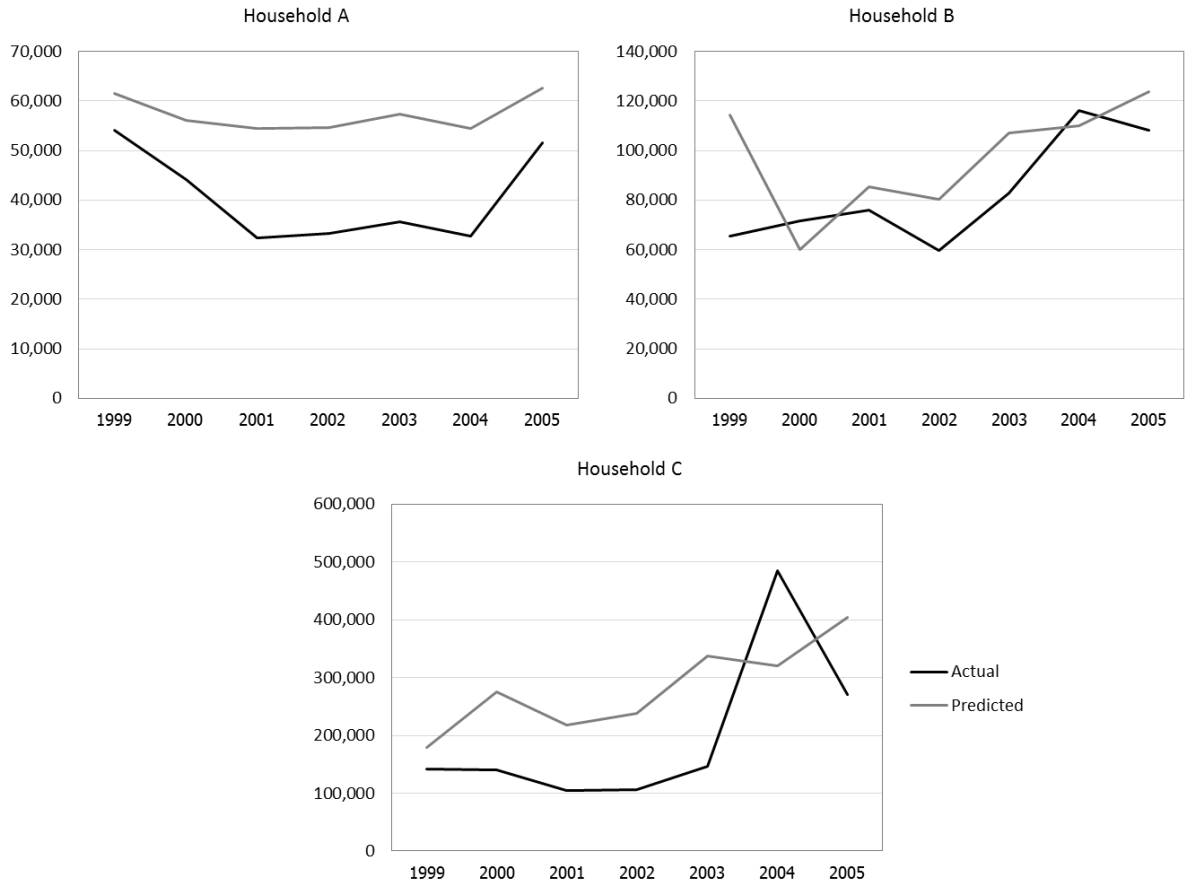


Figure 9 shows the average value of outstanding loans at village level in each province. Figure 10 shows the average value of loan-to-wealth ratios at village level in each province. The values of outstanding loans have been increasing, including, the year of the million-baht fund intervention. Indeed, the loan-to-wealth ratios have been increasing in Northeast provinces. This pattern suggests that the households in Buri Ram and Si Sa Ket have indeed gained better access to credit market over time. On the other hand, the loan-to-wealth ratios in Central provinces are relatively flat. We thus treat loan to wealth ratios as something we try to explain rather than as an exogenous policy shock.

Figure 9 – Average liabilities per household

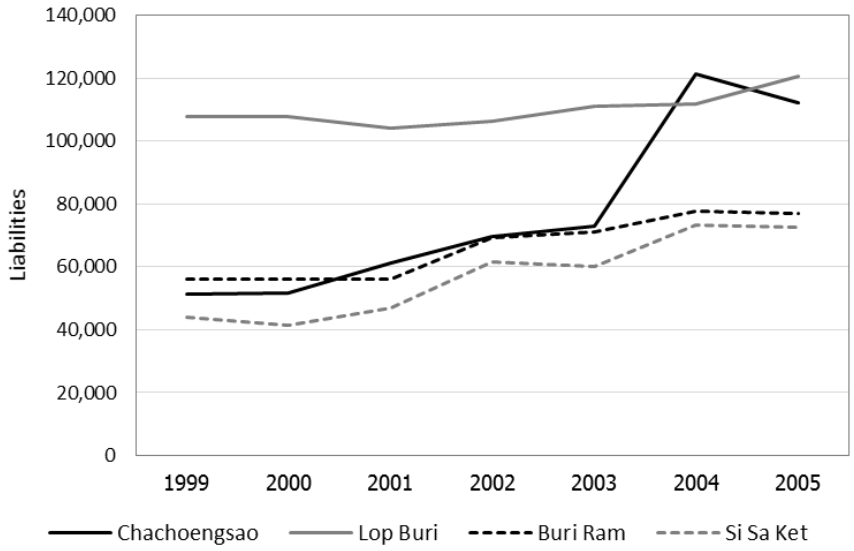


Figure 10 – Loans-to-wealth ratio at the provincial level

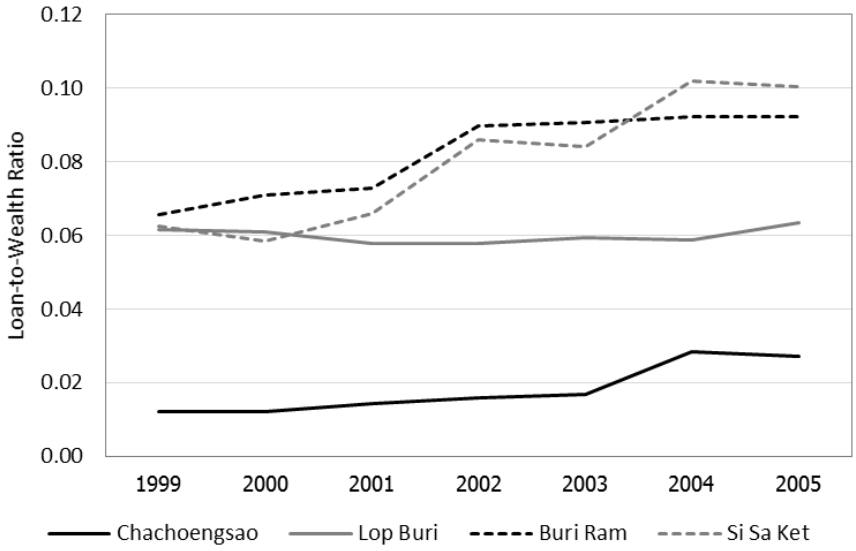


Figure 11 shows the loan-to-wealth ratios of the case-study households. The loan-to-wealth ratios of household A and household B are much higher than the provincial-average level, except for those in 2005. On the other hand, household C who has higher wealth has lower loan-to-wealth ratio than the provincial average.

Figure 11 – Loan-to-wealth ratios of the case-study households

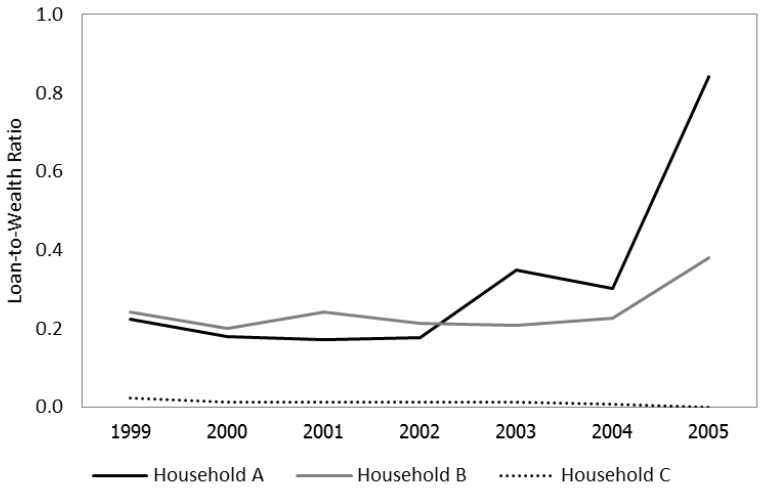
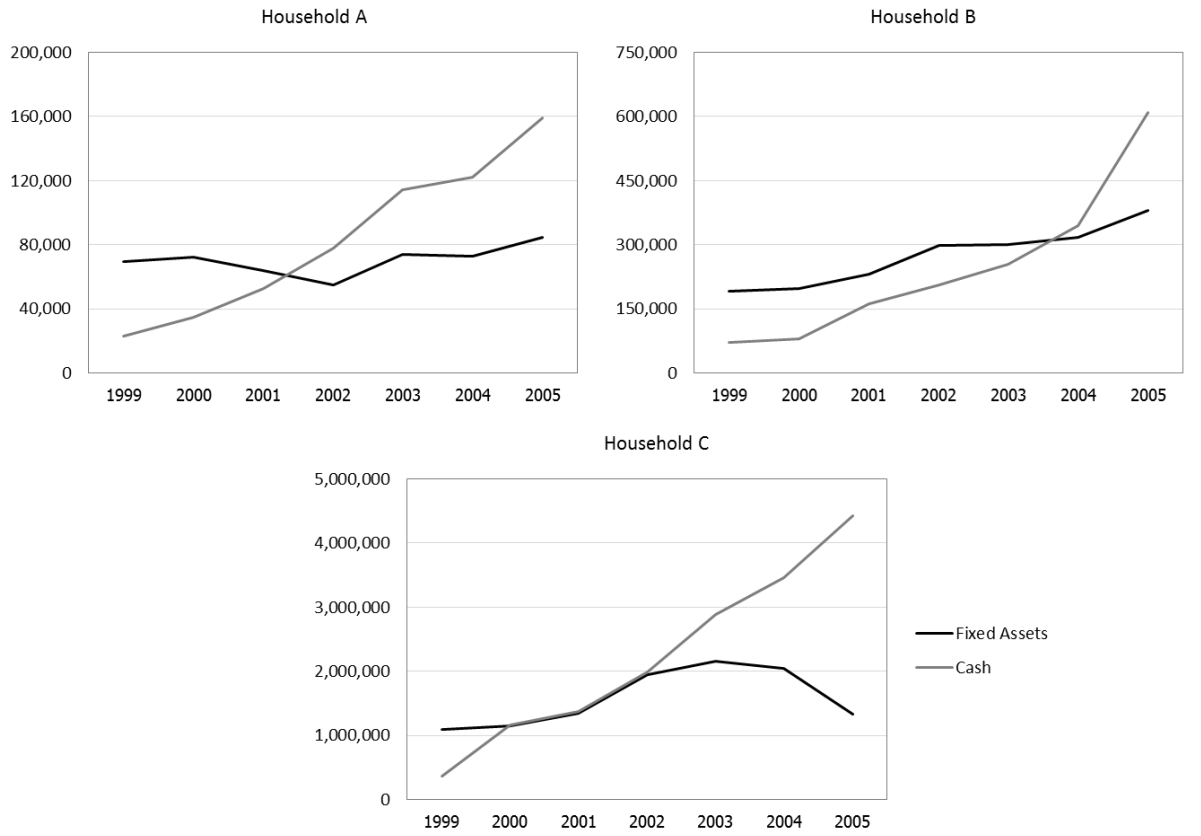


Figure 12 shows the movements in fixed assets and cash holdings of the case-study households over time. The results confirm the provincial pattern that cash holdings grow faster than fixed assets.

Figure 12 – Fixed assets and cash holdings of the case-study households



5. Constructing Village Economic Accounts

Here in this section, we show how to create village level income and product accounts. This will serve the dual purpose of understanding what is happening at the village aggregated level (i.e., where the data come from) and also assessing the impact of counterfactuals at the village aggregated level.

To create the village economic accounts, we follow the method described in US Department of Commerce (1985) for constructing the national economic accounts. Each village is considered as a nation. And, as in Samphantharak and Townsend (2009), each household is considered as a business firm. Therefore, to create economic accounts of a household that will be used in the accounts for a village, we follow the steps in creating economic accounts of a business firm from the firm's financial statements. First, we create these economic accounts for each household, one at a time. Then, we create village economic accounts by consolidating all the (sampled) household economic accounts together.

In our survey, when a household reports a transaction, it also reports the name and the village of the person/institution with whom/which it made the transaction. Therefore, we can categorize the transactions as intra-village and inter-village transactions and distinguish these when we aggregate.

5.1 Some Special Issues for Village Economic Accounts

In the case of national economic accounts, after the accounts of all business firms have been created, one can aggregate them up to get the accounts of the business sector. Since the output of one firm is usually used as the input of other firms, the entries for a net transaction between two business firms cancel. Therefore, only investments in business sector and transactions between business sector and other sectors remain.

Similarly, village economic accounts can be created by adding the accounts for all households together. However, not all intra-village transactions will cancel. The residual in intra-village transaction stems from at least three sources. First, in village accounting, households play two roles, as producers and as consumers. In the production account, only the transactions related to products sold by one household in the village and used as inputs by other households in the village would cancel. If the products sold by one household in the village are consumed or used as investments by

other households in the village, their transactions will remain in the production account. Second, sampling error can also create the residual in intra-village transaction. One might miss a pivotal or large household; say one playing the role of intermediary or so substantial that its (unmeasured) transactions are a big part of the village average.[6] Finally, there is conventional measurement error, though if this is i.i.d. over households and the number of sampled households is large, this latter part would be small.

5.1.1 Issue Concerning Consumption

Even though we can categorize most transactions in our survey into intra-village and inter-village, this is not the case for consumption since unfortunately the survey instruments do not ask about trading partners in consumption transactions. Hence, and it's quite unfortunate, we cannot distinguish directly between consumption of village products and consumption of imported goods. However, we can indirectly estimate the consumption of village products by assuming that households in our survey are perfectly representative, as if either we had a representative subsample or we sampled all of them. Since the village's products sold within the village must be either consumed or invested, and since we know the value of village's products sold within the village and the value of investment of village's products, we can estimate the value of consumption of village's products as:

Consumption of village's products = Village's products sold within the village – investment of village's product.

5.1.2 Issue Concerning Labor Income

In national economic accounts, wages and salaries that households receive from business firms are not considered as households' production but as business firms' production.[7] Again, business firms are envisioned as the main producers in the economy, while households provide the factors of production (such as labor, but also capital via lending, and so on) and buy produced goods for consumption. The only production within the household sector is when a household provides services directly to other

[6] We searched for such households and could not find one.
[7] There are some exceptions though. For example, households paid as consultants are treated as businesses.

households such as child care and cleaning. This is counted as consumption of the recipient household and income of the producing/supplying household.

In Thai villages, most households also play the role of business firms and engage in production activity as single proprietors. And the distinction between household and firm accounts is difficult to make even for narrower wage-earning households. Consider the case in which household A receives a wage payment from household B. If the labor service provided by household A is used in the production activity of household B, this wage payment should in principle be considered as household B's production. On the other hand, if the labor service provided by household A is for household B's consumption or investment, e.g., a carpenter repairing a house or a mechanics repairing an equipment, this wage payment should be considered as household A's production.

In the survey, when a household member receives labor income, the counterparty (employer's) name and location are recorded. However, sometimes, we do not have information on what is the activity. Therefore, we cannot distinguish between two cases discussed above.

Consequently, we consider all labor income as the income from household production as if the household were a proprietor supplying labor services. Indeed, all households are regarded as business firms, and their products include labor services. In sum, when household A receives labor income from household B, we consider as household A supplies its product (labor service) to household B, and the transaction is recorded as household A's production.

5.1.3 Owner-Occupied Housing

In national economic accounts, the service flow from owned-housing is also recorded as household's consumption and income, usually measured at an implicit market rental rate. Thus, the service that a household in our survey receives from its own house should ideally be included in consumption and income. However, the estimation of a market rental rate cannot be straight-forwardly obtained from the household survey. Consequently, the current village accounts do not yet include the value of owner-occupied housing.

5.2 Creating Economic Accounts of a Typical Household

5.2.1 Production Account

First, we construct the production account, which is related to the statement of income (see Table 12). To create the production account from the statement of income, we first subtract the cost of materials and services used in production from both sides. Note this expense includes wages paid (to service contractors). Then, we also subtract the non-production revenue (i.e., interest revenue, capital gains net of capital losses, or insurance indemnity) from both sides. In this account, we introduce a term called "profits", which is defined as net income before tax less net capital gains and less insurance indemnity. In other words, "profit" is the household's earnings from production.

Table 12 – Creating production account from statement of income

Statement of income	
Uses	Sources
Expenses from production	Revenues from production
Interest expense	Interest revenue
Depreciation	Capital gains
Insurance premium	*Less:* Capital losses
Property tax	Insurance indemnity
Net income before tax	
Charge against revenue	Total revenue

Production account	
Uses	Sources
Interest expense	Revenues from production
Less: Interest revenue	Less: Expenses from production
Insurance premium	
Property tax	
Profit	
Net income before tax	
Less: Capital gains	
Plus: Capital losses	
Less: Insurance indemnity	
Charge against output	Output

The sum of terms on the sources side equals to the output, which is the value added from production activities (but again for us value added does not include paid labor expenses). The terms on the uses side are charges against output, which show where the output goes (disposition into factor payments).

In the model, entrepreneurial profit will be net of capital cost (including own capital), but the agent will also get capital compensation from the capital he owns. In the data, we did not subtract off the cost of own capital from entrepreneurial profit. So, we will over-estimate the profit from entrepreneurial activity, though the total income for the household is the same. This is also true for unpaid labor from household members, overestimating profit but underestimating labor income.

5.2.2 Appropriation Account

The appropriation account shows how a household distributes its profits. As in Table 13, we can create the appropriation account from the statement of retained earnings. The statement of retained earnings has the net income before tax as the source of funds and has corporate income tax, dividend paid, and addition to retained earnings as the uses of funds. From the net income before tax, we can create profit, which are earnings from production, by subtracting of capital gains (net of capital losses) and insurance indemnity from both sides.

On the uses side, we define the term "undistributed profit" to be equal to retained earnings less net capital gains and less insurance indemnity.

Table 13 – Creating appropriation account from statement of retained earnings

Statement of retained earnings	
Uses	Sources
Income tax Consumption Current retained earnings	Net income before tax
Distribution of net income	Net income before tax

Appropriation account	
Uses	Sources
Income tax Consumption Undistributed profit Current retained earnings *Less:* Capital gains *Plus:* Capital losses *Less:* Insurance indemnity	Profit Net income before tax *Less:* Capital gains *Plus:* Capital losses *Less:* Insurance indemnity
Distribution of profit and savings	Profit

5.2.3 Saving-Investment Account

Table 14 shows the construction of the saving-investment account, which considers the changes in household's assets and liabilities. To create the saving-investment account, we start from the changes of items in the balance sheet. Then, we add the depreciation of fixed assets (from the statement of income) to both sides and subtract the change in current liabilities from both sides.

On the left side of the saving-investment account is gross investment, which is the change in current assets plus the change in fixed assets (before depreciation) less the change in liabilities. On the right side is gross saving, which equals to the change in household's net wealth (before depreciation).

Table 14 – Creating saving-investment account from changes in balance sheet

Change in balance sheet	
Uses	Sources
Change in financial assets	Change in current liabilities
Cash	Account payable
Deposits	Other borrowing
Account receivable	Change in household's net wealth
ROSCA (net position)	Contributed capital
Other lending	Gifts
Change in prepaid insurance	Current retained earning
Change in inventories	
Change in livestock	
Change in fixed assets	
Distribution of net income	Change in liabilities and net wealth

Saving-investment account	
Uses	Sources
Change in financial assets	Change in household's net wealth
Change in prepaid insurance	Contributed capital
Change in inventories	Gifts
Change in livestock	Current retained earning
Change in fixed assets	
Plus: Depreciation	
Less: Change in current liabilities	
Gross investment	Gross savings

5.3 Village Economic Accounts

Next, we create village economic accounts by aggregating the economic accounts of every household in the village. Tables 15–17 and Tables 18–20 show the economic accounts of representative villages in Lop Buri and in Buri Ram, respectively. The numbers shown are per-household, averaged over 7-year period.

Table 15 – Production account of a village in Lop Buri

Production account			
Uses		Sources	
Depreciation	12,714	Revenues from production	192,923
Net interest		*Less:* Expenses from production	82,330
Interest expense			
To within village	776		
To other villages	6,542		
Less: Interest revenue			
From within village	1,455		
From other villages	732		
Insurance premium	241		
Property tax	136		
Profit			
Net income before tax	93,223		
Less: Capital gains	1,043		
Plus: Capital losses	191		
Less: Insurance indemnity	0		
Charge against output	110,593	Output	110,593

Table 16 - Appropriation account of a village in Lop Buri

Appropriation account			
Uses		Sources	
Income tax	127	Profit	
Consumption	54,848	Net income before tax	93,223
Undistributed profit		*Less:* Capital gains	1,043
Current retained earnings	38,248	*Plus:* Capital losses	191
Less: Capital gains	1,043		
Plus: Capital losses	191		
Distribution of profit	92,371	Profit	92,371

Table 17 – Saving-investment account of a village in Lop Buri

Saving-investment account			
Uses		Sources	
Change in financial assets		Change in village net worth	
Within village	–14,873	Change in contributed capital	
With other villages	55,150	Within village	–347
Change in inventories		With other villages	–835
Within village	33,730	Net transfer	
With other villages	–36,804	Within village	–2,843
Change in livestock		With other villages	24,435
Within village	2,195	Current retained earnings	38,248
With other villages	2,546	Depreciation	12,714
Change in fixed assets			
Within village	610		
With other villages	26,502		
Plus: Depreciation	12,714		
Less: Change in liabilities			
Within village	1,238		
With other villages	–353		
Gross investment	71,373	Gross savings	71,373

Table 18 – Production account of a village in Buri Ram

Production account			
Uses		Sources	
Depreciation	5,822	Revenues from production	229,115
Net interest		*Less:* Expenses from production	168,239
Interest expense			
To within village	2,502		
To other villages	4,271		
Less: Interest revenue			
From within village	1,397		
From other villages	173		
Insurance premium	317		
Property tax	9		
Profit			
Net income before tax	54,280		
Less: Capital gains	5,024		
Plus: Capital losses	269		
Less: Insurance indemnity	0		
Charge against output	60,876	Output	60,876

Table 19 - Appropriation account of a village in Buri Ram

Appropriation account			
Uses		Sources	
Income tax	0	Profit	
Consumption	46,551	Net income before tax	54,280
Undistributed profit		*Less:* Capital gains	5,024
Current retained earnings	7,729	*Plus:* Capital losses	269
Less: Capital gains	5,024		
Plus: Capital losses	269		
Distribution of profit	49,525	Profit	49,525

Table 17 – Saving-investment account of a village in Buri Ram

Saving-investment account			
Uses		Sources	
Change in financial assets		Change in village net worth	
Within village	924	Change in contributed capital	
With other villages	25,639	Within village	–128
Change in inventories		With other villages	239
Within village	–5,019	Net transfer	
With other villages	1,852	Within village	6,226
Change in livestock		With other villages	13,148
Within village	–2,117	Current retained earnings	7,729
With other villages	–3,207	Depreciation	5,822
Change in fixed assets			
Within village	5,824		
With other villages	7,409		
Plus: Depreciation	5,822		
Less: Change in liabilities			
Within village	1,631		
With other villages	2,461		
Gross investment	33,036	Gross savings	33,036

Figure 13 shows the dynamic movements of villages' output over time. Each line represents the output from each village. The outputs of villages in Chachoengsao have been decreasing over time, while the outputs of the villages in the three other provinces have been increasing. Figure 14 plots the average share of village's income in each province. Based on the estimated factor intensity as above, and to review, we classified cultivation as labor-intensive and classify running business, operating fish and shrimp ponds, and livestock as capital-intensive. The results suggest that, in Chachoengsao, the share of income from capital-intensive sector decreases over time, while the share of labor income increases over time. In Buri Ram, the share of income from capital-intensive sector increases over time and the share of income from labor-intensive sector decreases over time. In Lop Buri and Si Sa Ket, the shares of incomes are flat.

Figure 13 – Villages' output (scale varies by provinces)

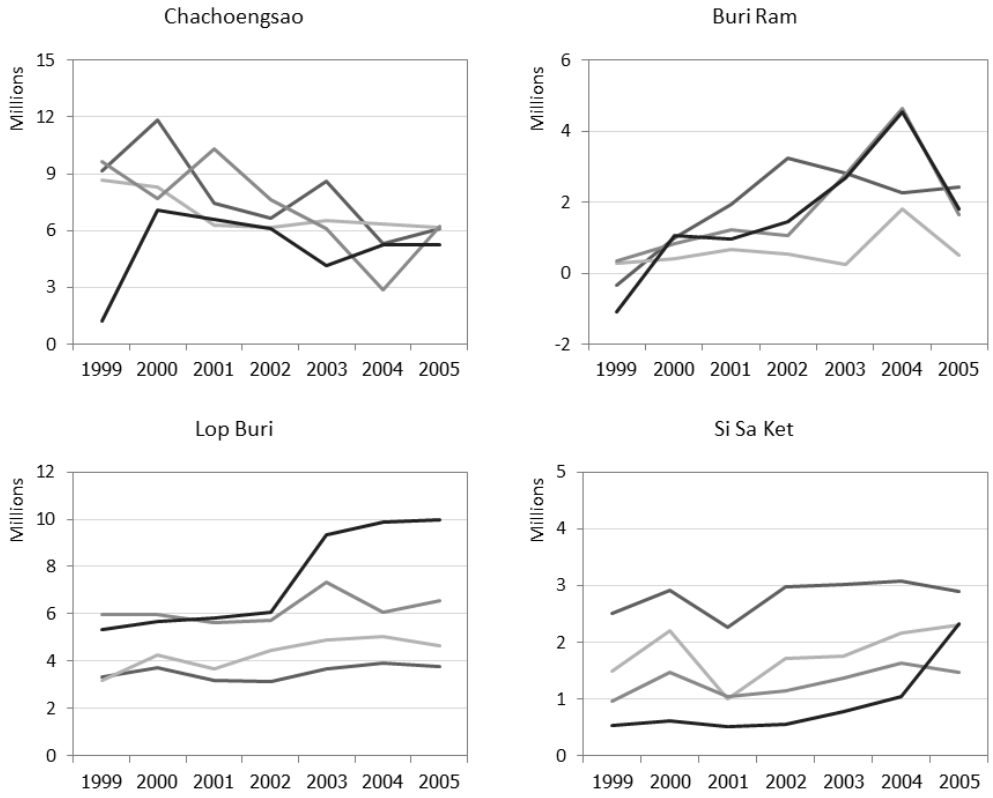
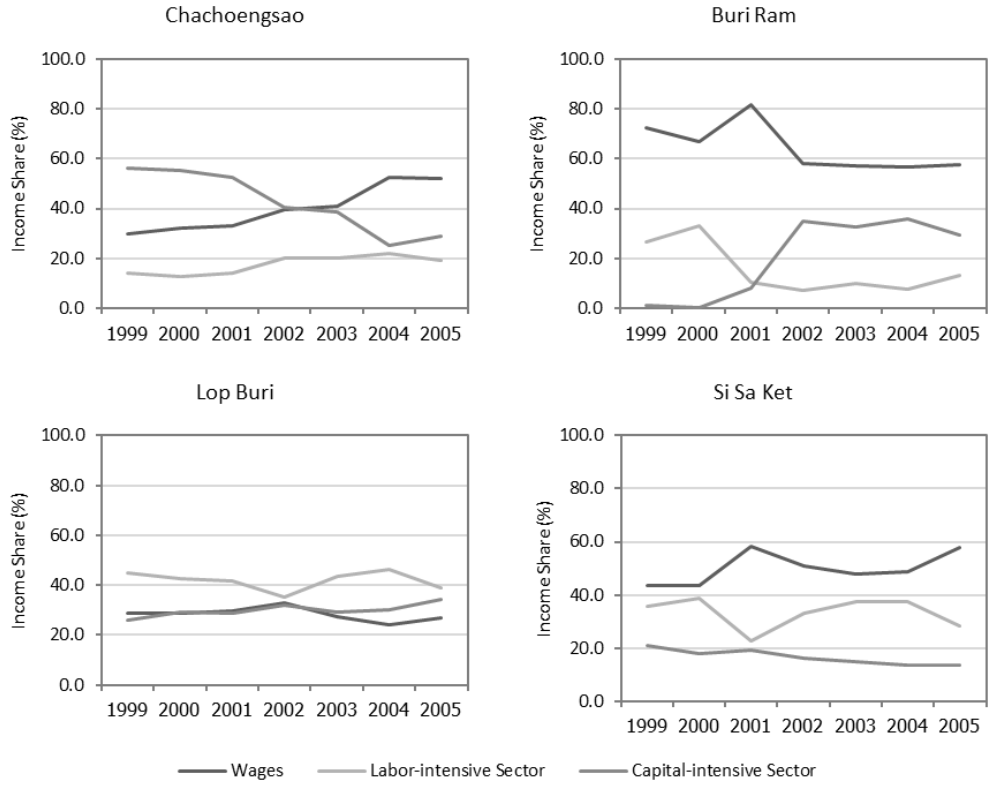


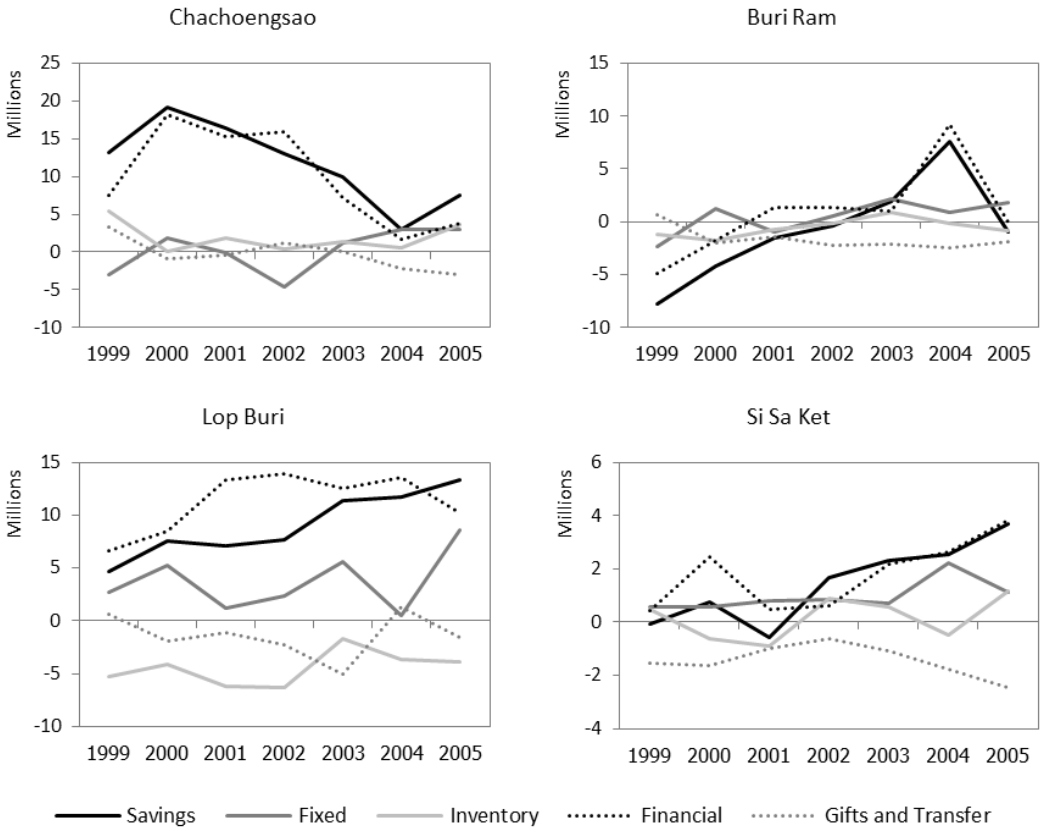
Figure 14 – Share of village's income



The village's saving-investment account tells us how the village allocates its wealth. When a village has positive savings (i.e., it consumes less than its income), its wealth increases. As mentioned at the individual level, a village can allocate its savings in inventories (including livestock), financial assets (cash, deposits, lending, etc.), fixed assets, or giving as gifts (and other contributed capital).[8] We construct the gifts such that the positive sign means the village gives out gifts.

Figure 15 shows how each village allocates its savings (plus gifts) annually. The line representing financial assets moves closely with the line representing village's savings. This pattern appears in every village, suggesting that, at a high frequency, the village keeps its wealth in the form of financial assets. But capital is also co-moving.

Figure 15 – Allocation of village's savings (scale varies by provinces)



[8] In the saving-investment account, we separate gifts from other contributed capital. Gifts represent the transfers from one household to another household. Contributed capital represents the situation when a member of a household moves out and takes some assets with him. However, in this presentation, we group them together.

6. Village Balance of Payments Accounts

Village balance of payments accounts can be constructed from village economic accounts. As discussed earlier, we are able to separate the transactions into two different groups; within-village and across-village. A within-village transaction is the transaction between two village residents. An across-village transaction is the transaction between a village resident and a non-resident.

To illustrate the within- vs. across-village transactions, we use the following examples. Suppose a household buys 500-baht worth of fertilizer from a store located within the village. This transaction will enter that particular household's financial statement as a within-village 500-baht increase in inventory of input and a within-village 500-baht decrease in cash. Similarly, suppose a household sells 1,000-baht worth of rice to someone residing in another village. This transaction will enter that household's financial statement as an across-village 1,000-baht increase in cash and an across-village 1,000-baht decrease in finished-goods inventory.

An across-village increase in fixed assets could be (i) an import of fixed assets, (ii) a re-acquisition of claims on village fixed assets previously held by a village non-resident, or (iii) an acquisition of claims on a fixed asset located in another village. An example of the first case is an import of machine used in production. An example of the second case is a purchase of land located within the village from a village non-resident. An example of the third case is a purchase of land located in another village from a village non-resident. We use the residential status of the trading partner to distinguish the type of transaction. Also, as discussed above, labor earnings of village residents are considered village production even when employment is outside the village.

Similar to those of the nation, village balance of payments consists of the trade balance, current account, capital account, financial account, and cash reserve. The trade balance records the exports net of the imports of goods (including the ownerships of fixed assets) and services between village residents and nonresidents. The current account measures the transactions of goods, services and transfers between village residents and nonresidents. In other words, the current account equals the trade balance plus net factor income (interest earned abroad) and transfers to village residents.

The financial account[9] measures the transactions of financial assets between village residents and nonresidents (though for this cash is treated as a residual and measured separately). Financial assets include bank deposits, accounts payable, accounts receivables, lending, and borrowing. The capital account measures the changes in ownerships of assets due to the migration of household members.

The balance of payments identity is

$$\textit{Current Account} + \textit{Capital Account} + \textit{Financial Account} + \textit{Change in Cash Reserve} = 0.$$

Note, as is standard, that a current account surplus is associated with a capital+financial account deficit.

Figure 16 shows the balance of payments, accumulated to the provincial level, in four provinces. The current account surplus of villages in Chachoengsao is decreasing, while the current account surpluses of villages in Lop Buri and Si Sa Ket are increasing. The current account balance of villages in Buri Ram increases in every year except for 2005.

The scale of balance of payments accounts in village economies is large, compared to the scale of international economic accounts. . For example, a village in Chachoengsao has current account surplus 66% of its gross village product on average. In comparison, Thailand has current account deficits around 6.7% of its GDP in the pre-1997 crisis and has current account surplus around 4.5% of its GDP in the post-crisis period. The United States has run current account deficits at 4.6% of its GDP on average during the last 10 years. There are international norms for reasonable balance of payment deficits, presumably based on cumulative experience.

[9] By the current standard for national balance of payments accounts, the capital account includes both the capital account and the financial account in our framework.

Figure 16 – Village balance of payments

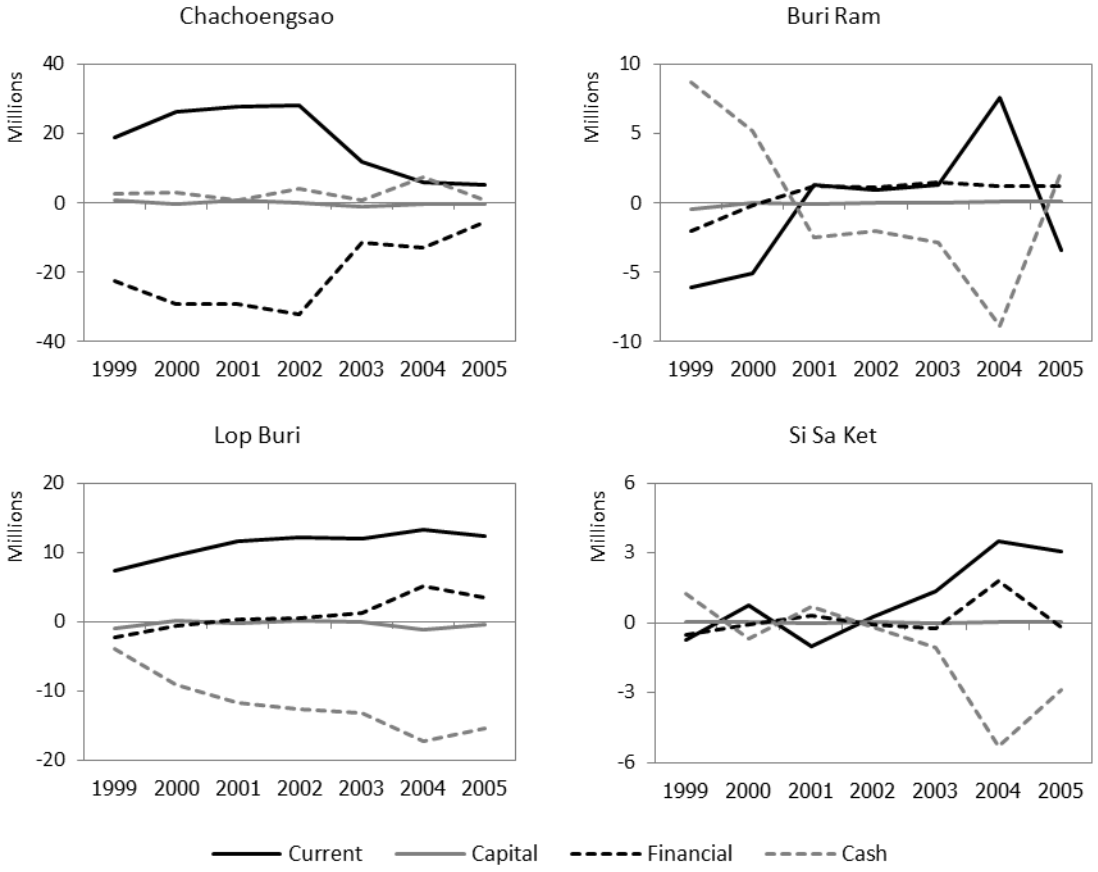
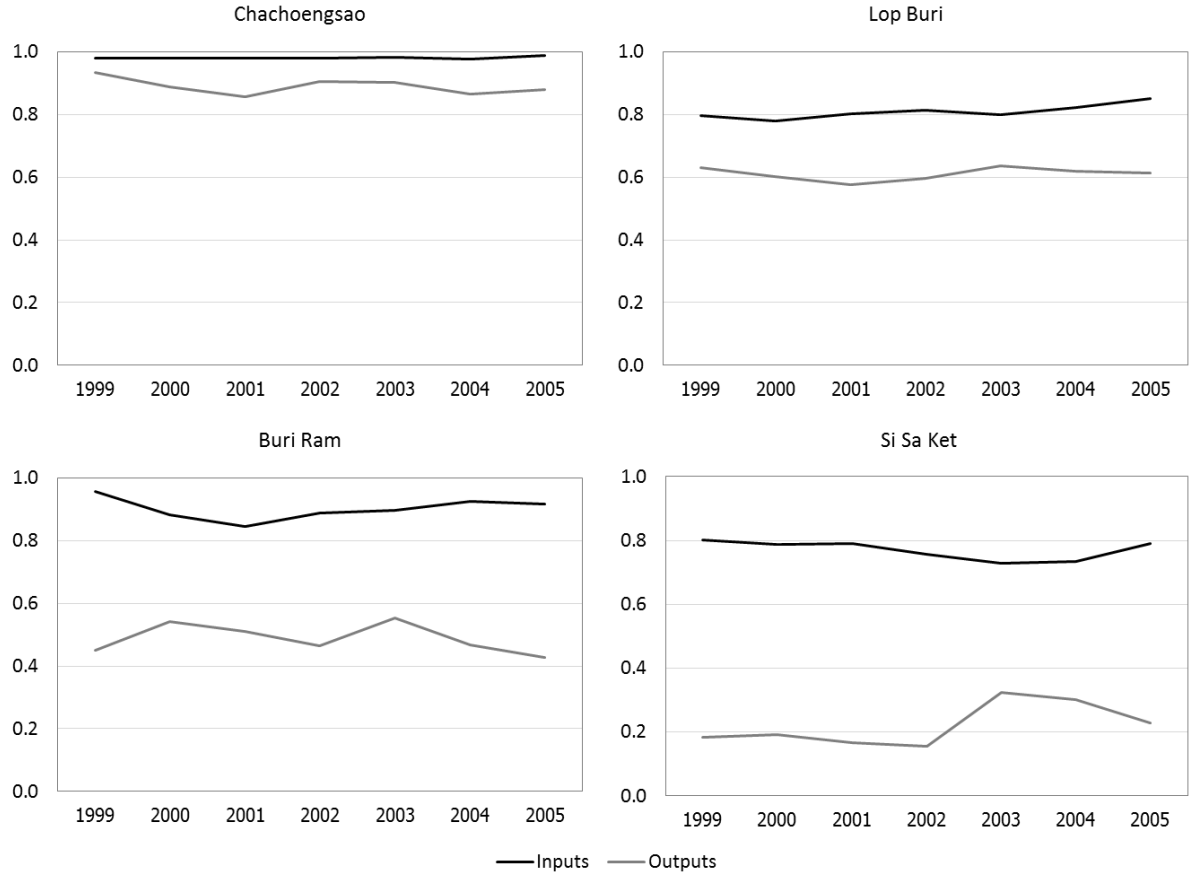


Figure 17 shows the average village openness levels within each province. The black line represents the share of inputs purchased from outside the village, and the grey line represents the share of outputs sold to other villages. Overall, the Central villages are more open than the Northeast villages.

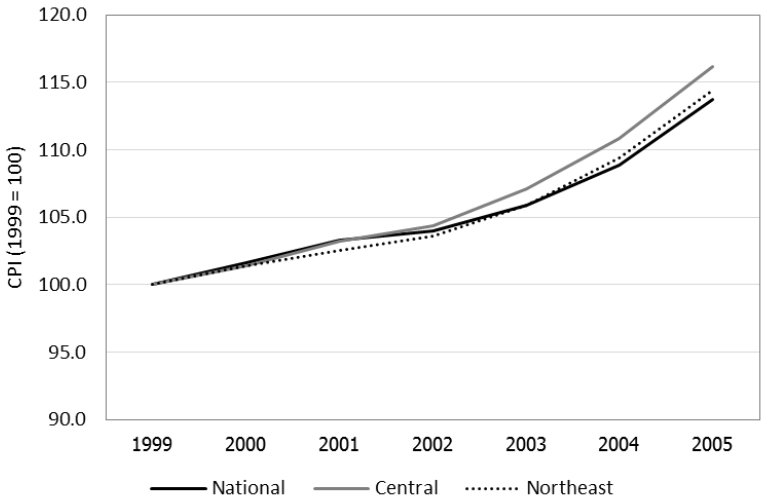
Figure 17 – Village openness levels



6.1 Price Indices, Inflations, and Relative Prices

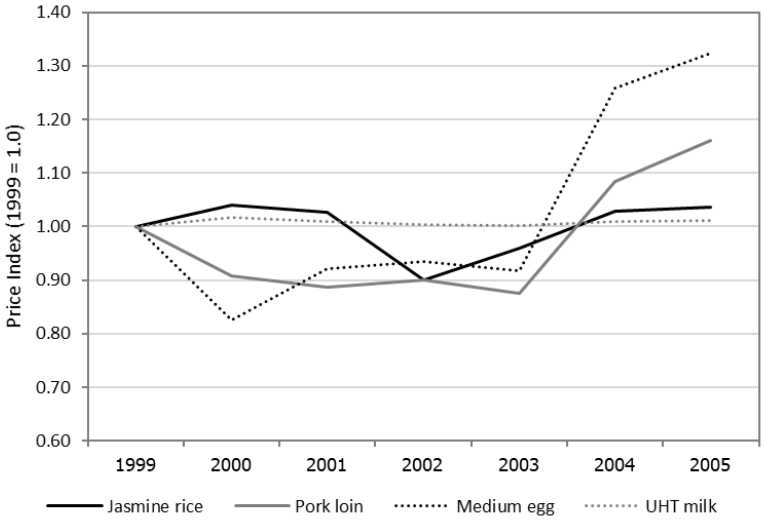
The national and regional consumer price indices are shown in Figure 18. All price indices increase over time. The price level in the Northeast region increases faster than the price level in the Central region. The model will be in real terms so we use the inflation data to adjust interest rates and make nominal values real.

Figure 18 – National and regional consumer price indices



Source: Ministry of Commerce; Authors' calculation

Figure 19 – Price indices of labor-intensive and capital-intensive goods

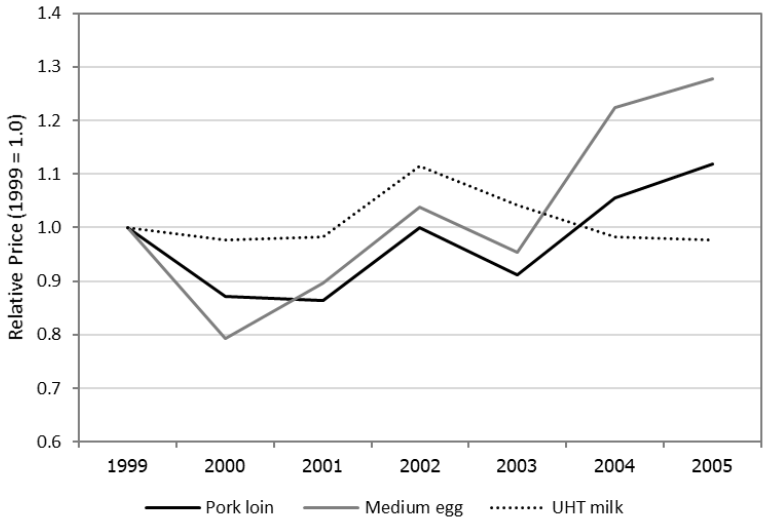


Source: Ministry of Commerce; Authors' calculation

Figure 19 shows the retail price indices of the product from cultivation (Jasmine rice) and the products from livestock (pork loins, eggs, and milk). We use the price index of cultivation product to represent the price of labor-intensive goods in our model and use the price index of the products from

livestock to represent the price of capital-intensive goods.[10] Figure 20 shows the relative price (i.e., the ratio of the price of livestock to the price of crops). We find that the relative price of capital intensive goods is increasing.

Figure 20 – Prices of capital-intensive goods relative to the price of Jasmine rice



Source: Ministry of Commerce; Authors' calculation

We are however unable to show province level figures given the great heterogeneity across provinces already documented. So, we treat the relative price of capital to labor intensive goods as something we try to infer though the lens of other observables.

6.2 Factor Prices

Figures 21 and 22 show the median real wage rates and the median real interest rates in four provinces in the Townsend Thai survey. To get the real interest rate, we subtract off the expected (realized) regional inflation from the nominal interest rate. To get the real wage rate, we normalize the nominal wage rate with the regional price index.

[10] In the data, the income sources for "capital-intensive" sector are fish and shrimp ponds, livestock, and businesses. Certainly, none of them involve the traditional manufacturing sector. We don't think fish and shrimp ponds are good representative since they are active in only one province and declining. For business, most of household businesses are either in service sector (e.g., barber shop) or small-scale production (e.g., food stroll), or local grocery shop. Therefore, it is hard to choose the price index that represents goods from business sector. Livestock is the only activity that we can find the related price index.

Figure 21 – Median real wage rates

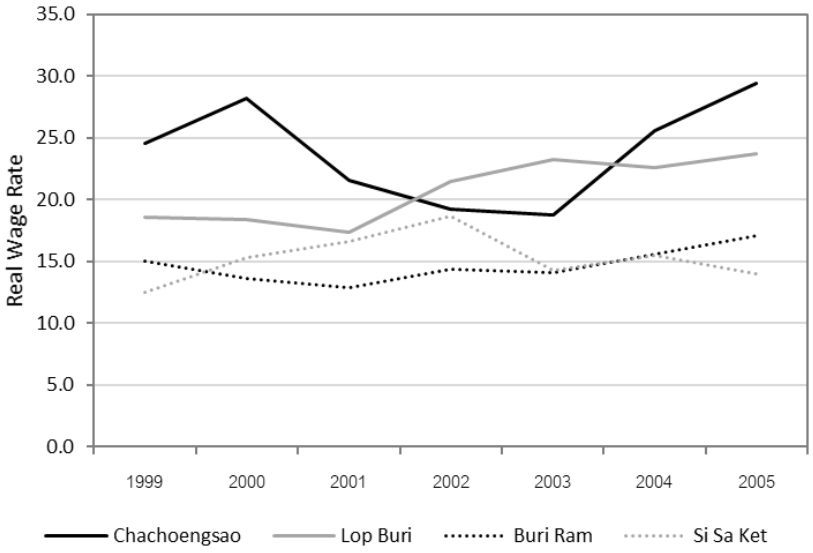
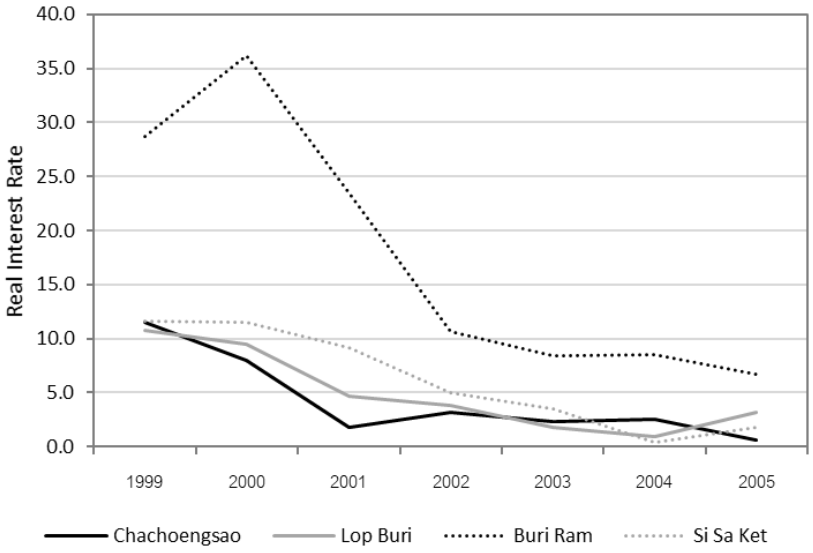


Figure 22 – Median real interest rates

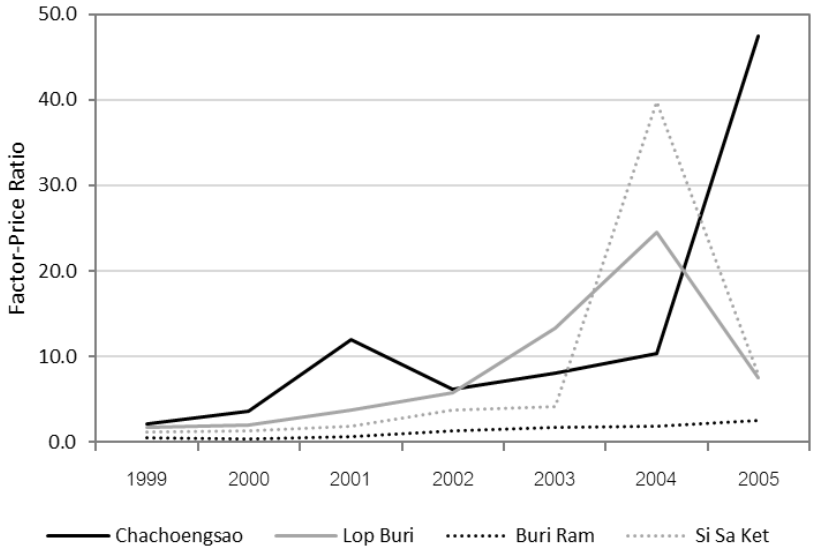


First, consider the levels of factor prices. The real interest rates are lower in the Central provinces and the wage rates are lower in the Northeast provinces. We now turn to the movements of factor prices over time. Real wage rates in the Central provinces have been increasing, while real wage rates in the

Northeast provinces remain constant. On the other hand, real interest rates in the Northeast provinces have converged to those in the Central provinces in recent years.

Figure 23 shows the ratios of factor prices in four provinces. The wage-interest ratio increases fastest in Chachoengsao, due mainly to the increasing wage rate in the last two years. Lop Buri also experience the increasing factor-price ratio due to the increasing wage rate. While the change in the factor price ratio in Si Sa Ket is about the same size as Lop Buri, it is driven by the lower interest rate. Buri Ram has the smallest change in the factor price ratio. These lead to the divergence of factor price ratio across provinces.

Figure 23 – Ratio of factor prices

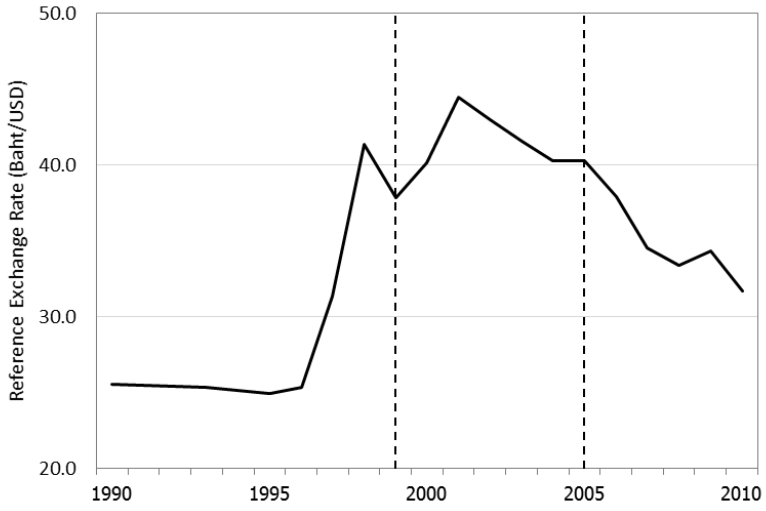


7. Thai National Economy

Since the financial crisis in 1997, Thailand went through a considerable change in its financial environment, from the devaluation of Thai baht in 1997, to the decision to change from the Monetary Targeting framework to the Inflation Targeting framework in 2000, to the introduction of one-million-baht village funds in 2001, which is one of the largest microfinance program in the world.[11]

In July 1997, the Thai government decided to change its exchange rate policy from fixed to a managed float. The exchange rate then increased from the pre-float level at 25 baht per US dollar to more than 50 baht per US dollar in January 1998. The reference exchange rate is shown in Figure 24. Two vertical dash lines indicate the period consider in this paper (1999–2005). The crisis hit Thailand the hardest in 1998, when Thai gross domestic product dropped 10.51% from the previous year. The movement of the Thai GDP over time is shown in Figure 25. The unemployment rate rose to the level of 4.35% in 1998, before it continuously declined (see Figure 26).

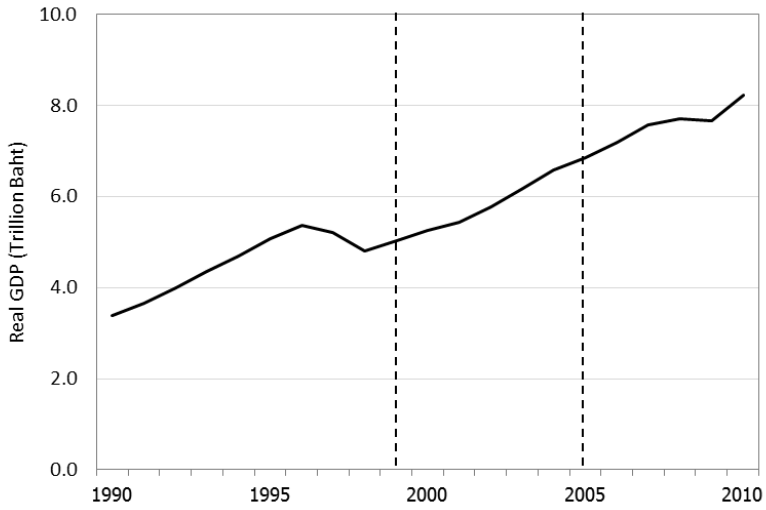
Figure 24 – Reference exchange rates



Source: Bank of Thailand

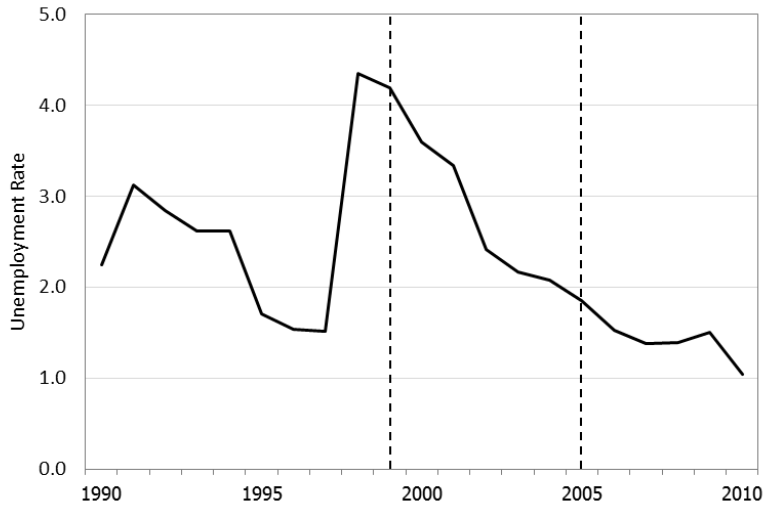
[11] As reported in Kaboski and Townsend (2011), the size of the initial funds of this program is about 1.5 percent of the Thai GDP in 2001.

Figure 25 – Thai quarterly GDP



Source: National Economic and Social Development Board

Figure 26 – Unemployment rate

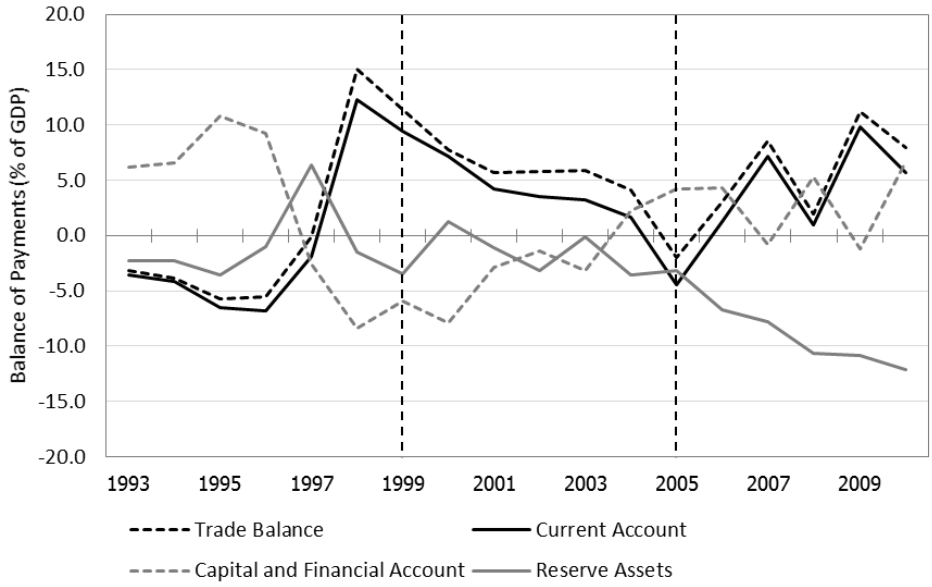


Source: National Statistical Office of Thailand

The balance of payments of Thailand is shown in Figure 27. Before the crisis, Thailand consistently ran a trade deficit financed by foreign capital inflows. After the crisis, it faced a sharp reversal of foreign capital inflows. The exporting sectors have been benefited from the depreciation of Thai baht, and Thailand has run a trade surplus since 1998. In addition to the trade balance, we also look at Thailand's level of openness to trade. We use the standard openness measure, namely the ratio of

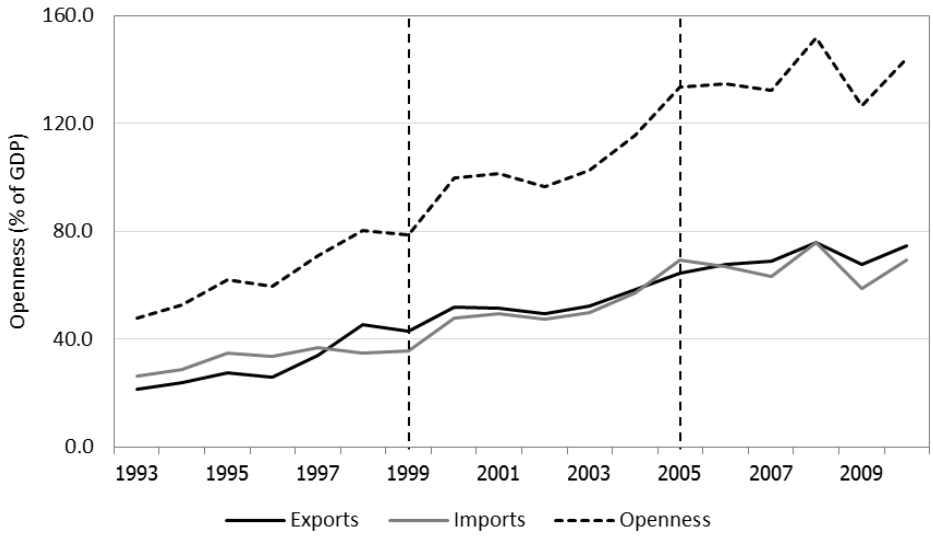
exports and imports to GDP. The openness level has been increasing over time, driven by the increases in both export and import shares (see Figure 28).

Figure 27 – Balance of payments accounts



Source: Bank of Thailand

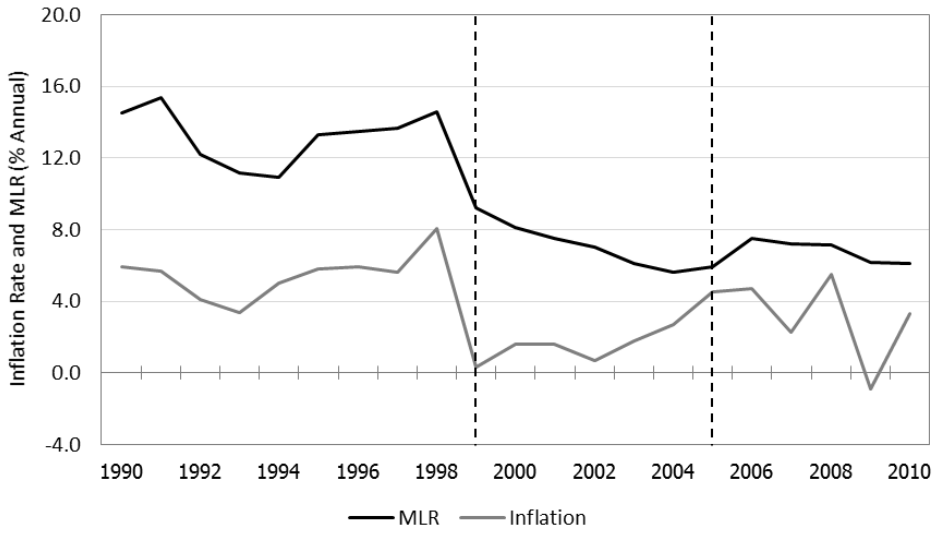
Figure 28 – Openness level



Source: Bank of Thailand

Under the Inflation Targeting framework, the Bank of Thailand has managed to keep the inflation rate well below the level under the previous regime. As a result, the interest rate has also come down during the same period (as in and consistent with the rest of the world). Figure 29 shows the headline inflation and the interest rate in Thailand from 1990 to 2011.

Figure 29 – Headline inflation and interest rate



Source: Bank of Thailand

8. The Model

Consider a two-good two-factor trade model with financial friction. The two factors of production are labor and capital. And there are two production sectors, which differ in their factor intensity. Let a denote the labor-intensive sector and let m denote the capital-intensive sector. In this economy, there is a continuum of infinitesimal agents who are different in their wealth level and in their "entrepreneurial ability". In each period, agents choose to be a wage worker or choose to run a business as an entrepreneur in one of the two sectors. An entrepreneur utilizes the factors of production and produces consumption goods. A worker provides inelastic labor supply[12] $\bar{L}$ at the market wage rate w_t. We assume that workers can move freely across sectors but cannot move across

[12] The estimated wage elasticities in the data are quite low (see Bonhomme et al., 2012).

regions. There is in fact nontrivial migration but on the other hand real wages do not converge in the data. Interest rates do

8.1 Preference, Entrepreneurial Ability, and Technology

To review, agent i consumes according to the following consumption function

$$C_{it} = C^* + \gamma(\pi_{it} - C^*)$$

where C_{it} is the total consumption of agent i in period t, C^* is the subsistent level of consumption, and π_{it} is the total income of agent i in period t. The total consumption of agent i is the combination of consumption of goods a and m according to the following function

$$C_{it} = \left(\frac{C_{it}^a}{\mu}\right)^{\mu} \left(\frac{C_{it}^m}{1-\mu}\right)^{1-\mu}$$

where C_{it}^a is agent i's consumption of goods a in period t, C_{it}^m is agent i's consumption of goods m in period t, and μ is the parameter capturing the share of spending on goods from sector a. We currently assume that μ = 0.5.[13] Since we model our village as small-open economies, the supply of goods from each sector is determined by the global relative price and not by the local demand for each good. Therefore, the equilibrium outcomes of our model are not sensitive to this parameter. The exceptions are the counterfactual example and the autarkic counterfactual example, in which the supply of each goods must equal its local demand. And since the consumption share affects the local demand for each good, it also affects the equilibrium outcomes in these counterfactual exercises.

Agents accumulate their wealth by holding a fraction ω of their savings in cash and investing the rest in capital, which is produced by combining goods a and m according to the production function

$$\Delta K_{it} = \left(\frac{I_{it}^a}{\mu}\right)^{\mu} \left(\frac{I_{it}^m}{1-\mu}\right)^{1-\mu}$$

[13] While we could use the detailed information about the composition of household consumption in the data to determine consumption shares, but this remains to be completed. In the model, we use cultivation for labor-intensive sector and we use for livestock, fish and shrimp, and business for capital-intensive sector. When we look at consumption data, we have the consumption of food and non-food, which includes the spending on gas, electricity, clothing, etc. Therefore, we need to decide what to do with the consumption of goods which are not related to the village's production.

where ΔK_{it} is the new capital produced, I_{it}^{a} is agent i's investment of goods a in period t, and I_{it}^{m} is agent i's investment of goods m in period t. The price of capital q is therefore equal to

$$q = (p_a)^{\mu}(p_m)^{1-\mu}$$

where p_a is the price of goods a and p_m is the price of goods m. The capital will be use as the numéraire and, therefore, $q = 1$.

8.2 Occupational Choice

An entrepreneur i in sector a with owned capital W_{it} and ability z_i solves the following maximization problem:[14]

$$\max_{(K_{it},L_{it})} p_a A_i K_{it}^{\alpha_K} L_{it}^{\alpha_L} - r_t K_{it} - w_t L_{it}$$

subject to the borrowing constraint

$$K_{it} \leq \eta_t W_{it}.$$

Let $\pi_t^a(W_{it}, z_i)$ denote the net profit of an entrepreneur i in sector a with owned capital W_{it} and ability z_i in period t. Similarly, an entrepreneur i in sector m with owned capital W_{it} and ability z_i solves the following maximization problem:

$$\max_{(K_{it},L_{it})} p_m B_i K_{it}^{\beta_K} L_{it}^{\beta_L} - r_t K_{it} - w_t L_{it}$$

subject to the borrowing constraint

$$K_{it} \leq \eta_t W_{it}.$$

And let $\pi_t^m(W_{it}, z_i)$ denote the net profit of an entrepreneur i in sector m with owned capital W_{it} and ability z_i in period t.

As discussed in section 4, with the DRS production function, there exists an optimal business size for each entrepreneur. On the other hand, if the production function has a constant return to scale, only the most productive producers will produce until they reach their borrowing limit. Then, the second-most productive producers will take over, and so on.

Therefore, we can summarize the within-period income of agents in each group as follows:

[14] As discussed in section 4, we assume that a household's entrepreneurial ability is common across all production activities.

$$\pi_t(W_{it}, z_i) = \begin{cases} w_t\bar{L} + r_t W_{it} & \text{for a worker} \\ \pi_t^a(W_{it}, z_i) + r_t W_{it} & \text{for an entrepreneur in sector } a \\ \pi_t^m(W_{it}, z_i) + r_t W_{it} & \text{for an entrepreneur in sector } m \end{cases} \quad (8.1)$$

The models with occupational choice and borrowing constraints, like this one, are quite standard in development economic literature (see, for example, Lloyd-Ellis and Bernhardt, 2000, or Buera, Kaboski, and Shin, 2011).

8.3 Markets for Capital and Labor

In this model, we assume that the market for capital is completely open and the market for labor is completely closed. In equilibrium, the wage rate w_t adjusts so that the local demand for labor equals the local supply of labor. This assumption might seem extreme at first. However, it is not unreasonable in practice. As supporting evidence, Figures 17 and 18 show that the differences in interest rates across provinces become smaller over time, while the differences in wage rates do not.

We assume that each household is endowed with 3,461 units of labor per year. This number comes from the Townsend Thai data, in which the median number of household members whose age above 15 is 2.4, and from Thai macro data, in which 69.34% of population aged 15 or above work full-time.[15]

We calibrate the capital endowment across households to match the distribution of household's fixed assets in 1999. Then, we use the cash-to-fixed-asset ratio in 1999 to approximate the initial cash holding in the model. We also assume that the initial distribution of household's capital is uncorrelated with household's ability.

8.4 Mechanics of the Model

Borrowing limits and relative prices will jointly determine the occupational choices and the equilibrium wage rate. An increase in borrowing limit will increase the demand for capital and labor for the constrained entrepreneur. This will, in turn, increase the real wage rate.

[15] There is very little difference in the demographics across provinces.

The effect of increasing the borrowing limit on the number of workers vs. entrepreneurs is less obvious. On the one hand, an increase in borrowing limit increases the size and the profits of the constrained entrepreneurs. On the other hand, increasing wage rate makes being a worker become more attractive. An increase in borrowing limit also benefits the entrepreneurs in sector m (capital-intensive) more than the entrepreneurs in sector a (labor-intensive).

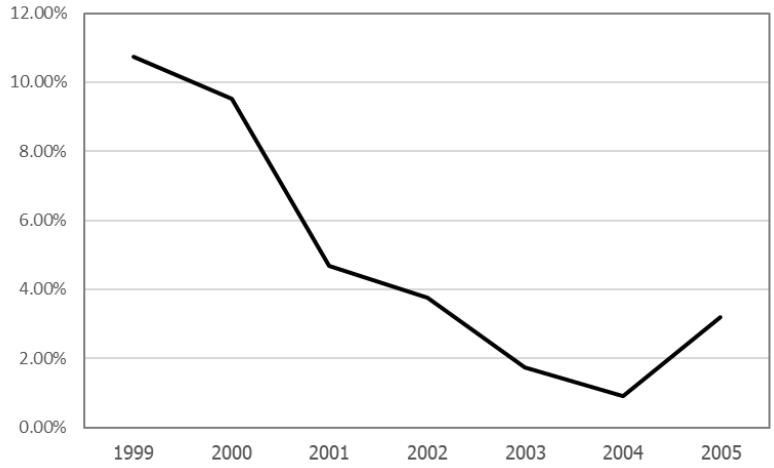
An increase in relative price, p_m/p_a will increase the benefit of entrepreneurs in sector m in relative to those in sector a. As entrepreneurs switch from sector a to sector m, the demand for labor will decrease. This is because sector a is labor-intensive, while sector m is capital-intensive. Finally, the decreased demand for labor will lower the real wage rate.

9. Calibration

9.1 Calibration Exercises

As we envisioned this model as a trade model with occupational choice subject to financial constraints, the obvious exogenous variables are the interest rate, the relative price of goods, and the borrowing limit. To summarize what we have mentioned in the introduction and along the way, for the interest rate, we believe we have a good measure of the interest rate in the data, the observed value. Figure 30 shows the real interest rates in Lop Buri, which we will use as the model's parameters.

Figure 30 – Real interest rates in Lop Buri



For the relative price and the borrowing limit, we don't think we have very good measures of them. The relative prices are determined at sector-level, but the goods in the capital-intensive and labor-intensive sectors vary by region and the available price indices are not sufficiently disaggregated and so do not reflect local variation nor shipping costs. Borrowing limits are approximation to implicit and formal credit contracts which are not modeled in detail here. Therefore, we calibrate the relative price against the profit share from each sector and the borrowing limit against the wage rate.

9.1.1 Calibration Procedure for the Dynamics

In each year, we then adjust the borrowing limit and the relative price jointly to match (i) the real wage rate observed in the data, and (ii) the share of entrepreneurial profits from sector a and sector m.

Figure 31 compares the calibrated borrowing limit from the model with the loan-to-wealth ratio of the median household in Lop Buri. The result suggest that the borrowing limit moves closely with the loan-to-wealth ratio with an exception in years 1999-2000, which is right after the Asian Financial Crisis. Figure 32 shows the calibrated relative prices in Lop Buri. The price of the capital-intensive goods increases, in relative to the price of the labor-intensive goods, during 1999–2001 and decreases since 2002. The calibrated relative price in this baseline scenario could also include trade costs and other frictions. However, neither the results in this baseline scenario nor those in subsequent counterfactual exercises are affected by these unobserved initial trade frictions. We will discuss more about this in section 10.

Figures 33 and 34 compare the actual and the calibrated real wage rates and the actual and the calibrated shares of profits from the capital-intensive sector, respectively. With two calibrated variables (i.e., borrowing limit and relative price), we can exactly match the two target variables (i.e., wage rate and share of profits).

Figure 31 – Calibrated borrowing limits and loan-to-wealth ratios

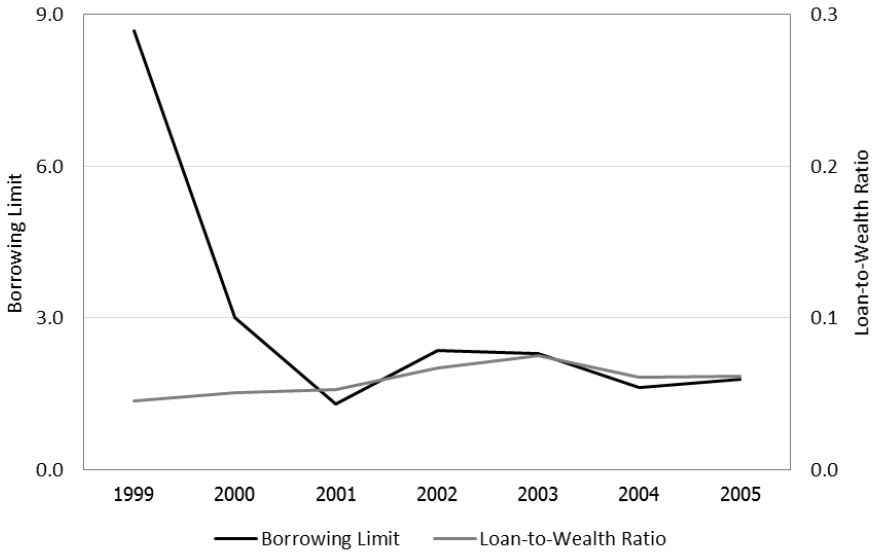


Figure 32 – Calibrated relative prices

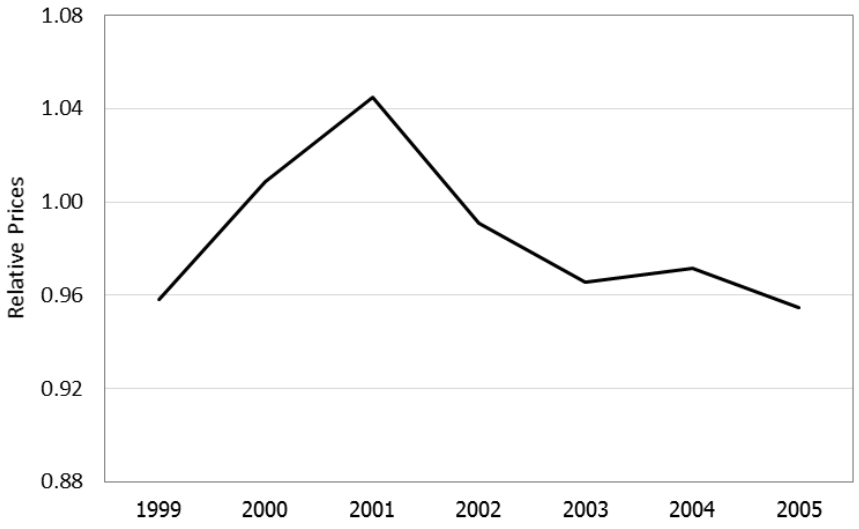


Figure 33 – Real wage rates

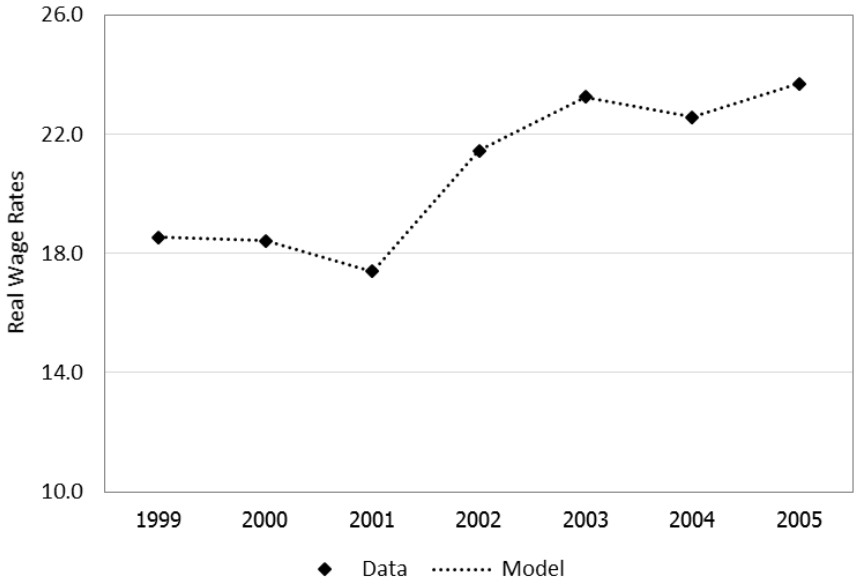
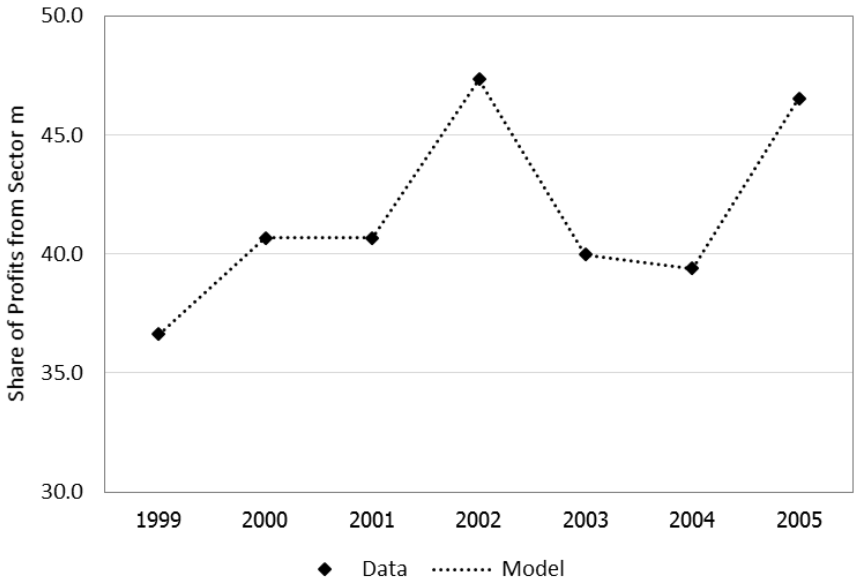


Figure 34 – Shares of profits from sector m



9.1.2 Calibration Result

Figure 35 shows the occupational choices from the calibrated model in Lop Buri in 1999. The horizontal axis represents the initial wealth of the household, while the vertical axis represents the household's entrepreneurial ability. The lines in the figures are the boundaries of the sets of

households who choose certain occupations. A household can choose to become a worker, an entrepreneur in the labor-intensive sector a, or an entrepreneur in the capital-intensive sector m. We also distinguish a financially-constrained entrepreneur, whose business could benefit from expansion, from an unconstrained entrepreneur, whose business is at the optimal size. For example, a financially-constrained entrepreneur in the labor-intensive sector will be labeled as "constrained a". The model predicts that the households with medium-to-low ability will choose to be workers regardless of their wealth level. The households with high ability will be entrepreneurs. The household's choice on sector is determined by the household's ability rather than the household's wealth level.

Figure 35 – Occupational choices in Lop Buri in year 1999

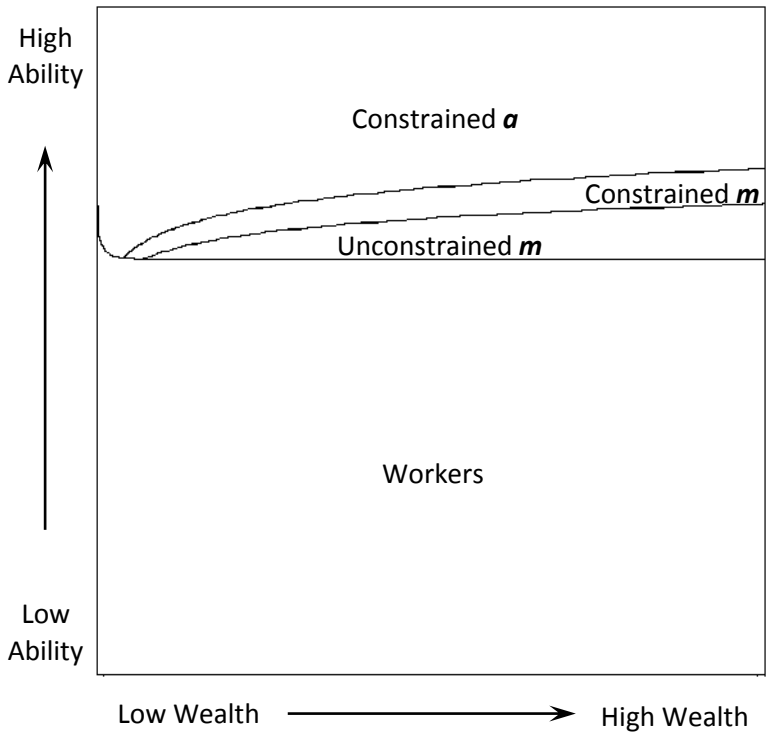
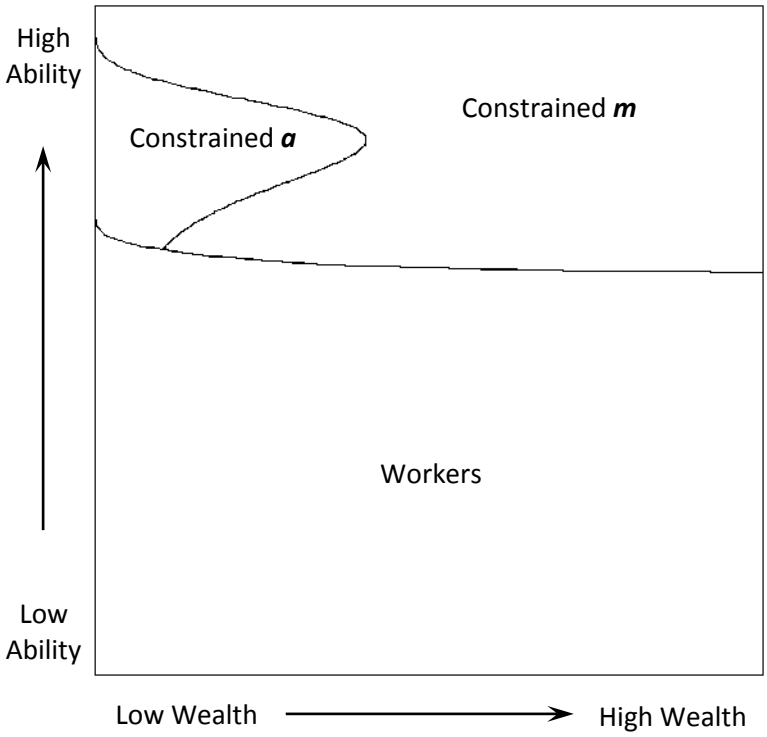


Figure 36 shows the occupational choices from the calibrated model in Lop Buri in 2005. Again, the households with medium-to-low ability will choose to be workers regardless of their wealth level. However, for the households with high ability, their wealth will determine the sector in which they choose to be entrepreneurs. The households with low wealth will choose the labor-intensive sector$a$, while the households with high wealth will choose the capital-intensive sector m.

Figure 36 – Occupational choices in Lop Buri in year 2005



9.1.3 Evaluating the Performance of the Model

In this section, we evaluate the performance of the calibrated model by comparing the predicted values of income, consumption, fixed assets, and cash holdings with those in the data. Figure 37 compares the predicted and the actual values of output per households of villages in Lop Buri. The model can predict the levels reasonably well; the average outputs per households in the data over the 7-years period is 146,140 Baht vs. the predicted value of 146,031 Baht. Figure 38 compares the actual and the predicted values of consumption per household in Lop Buri. The model can also predict the level reasonably well (average 66,472 Baht actual vs. 73,462 Baht predicted).

Figure 37 – The comparison of the actual and the predicted values of output

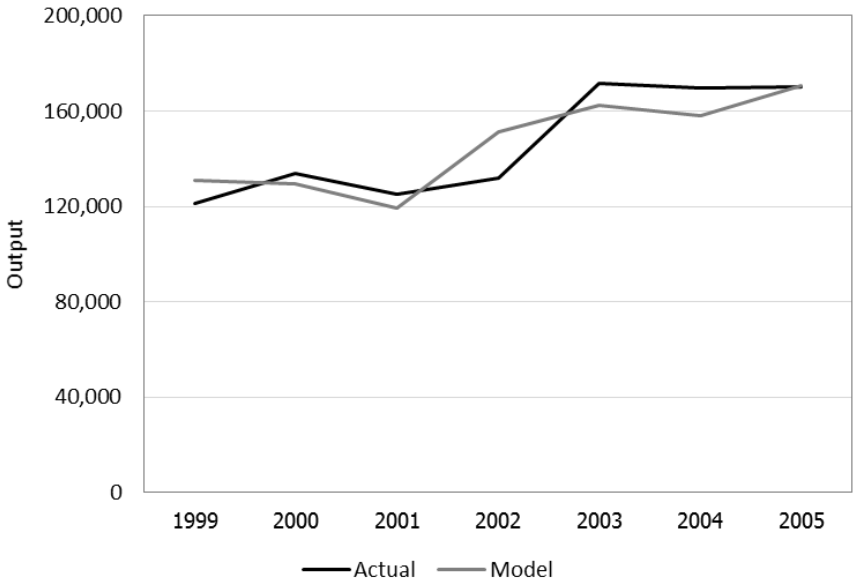
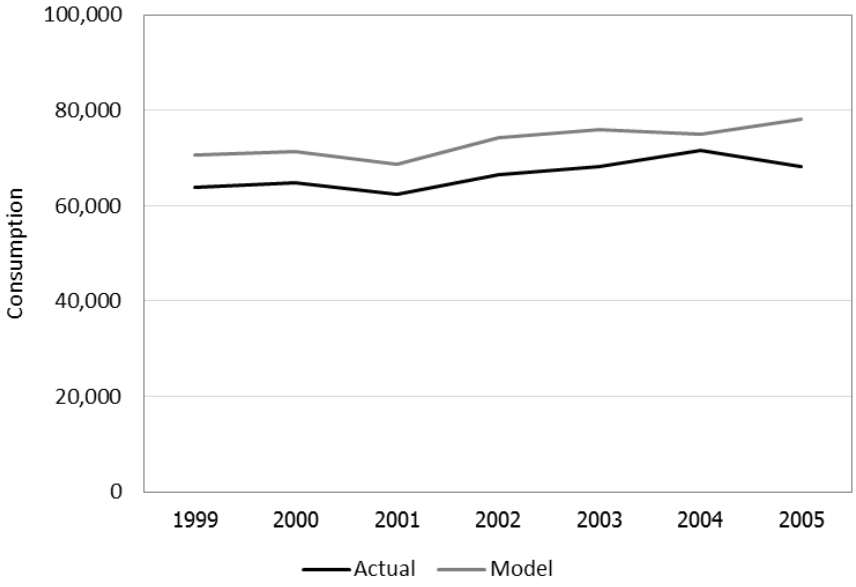


Figure 38 – The comparison of the actual and the predicted values of consumption



The comparison of the actual and the predicted values of fixed assets per household in Lop Buri is shown in Figure 39. Again, the model can capture both the level (average 270,030 Baht actual vs. 263,826 Baht predicted) and the growth of fixed assets remarkably well. Lastly, figure 40 compare the

actual and the predicted values of cash holding per household in Lop Buri. The model slightly underestimates the change in cash holding.

Figure 39 – The comparison of the actual and the predicted values of fixed assets

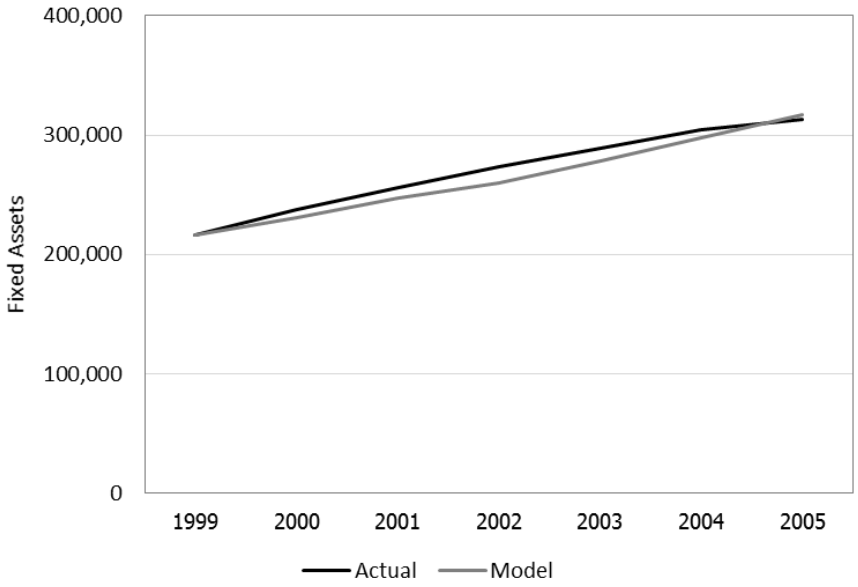


Figure 40 – The comparison of the actual and the predicted values of cash holdings

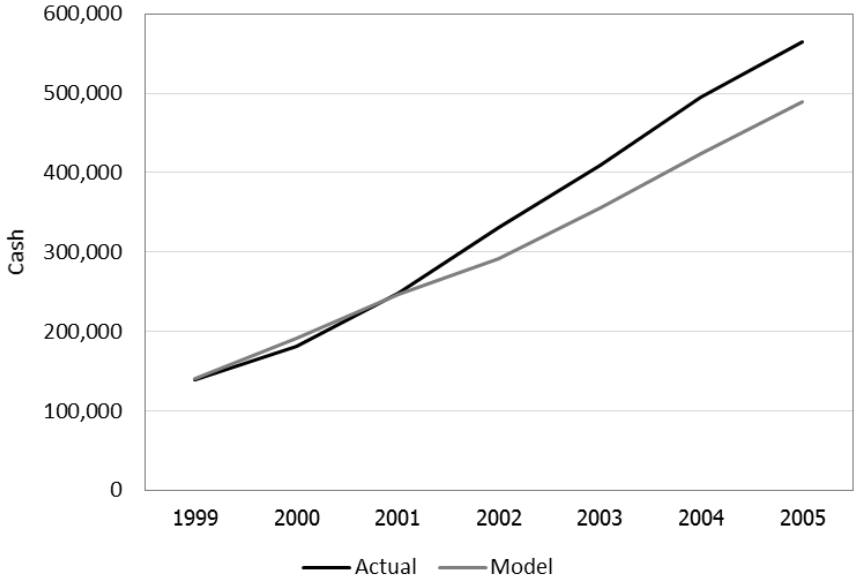
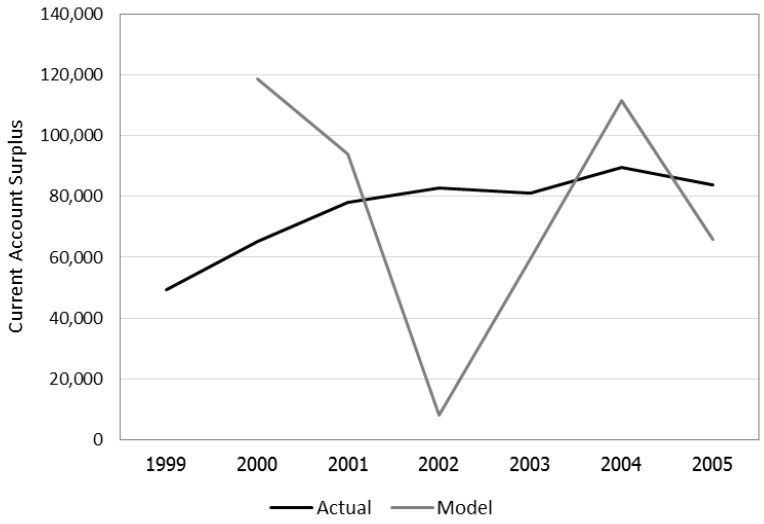


Figure 41 compares the actual and the predicted current account balances in Lop Buri. Again, the model can capture the average level of current account surplus reasonably well (80,206 actual vs.

76,273 predicted). However, the model predicts that the current account surplus fluctuates much more than what we observe in the data.

Figure 41 – The comparison of the actual and the predicted current account balances



9.2 The Model through the Lens of Illustrative Micro Data – Our Case Studies

We compare the model's prediction on households' occupation, income, and wealth with those in the data for our case-study households.

9.2.1 Household A

Recall that household A is an average-ability household with very low initial capital level. As a result, the model's prediction is that this household would always be a worker, which is confirmed in the data (see Table 21). Figures 42 and 43 compare the actual income and consumption of household A with those predicted by the model. The model can predict the average income of household A reasonably well (75,568 predicted vs. 70,188 actual) but over-predicts the average consumption level (58,369 predicted vs. 40,528 actual).

Table 21 – Household A's main source of income and the predicted occupation

Year	Data	Model
1999	Worker	Worker
2000	Worker	Worker
2001	Worker	Worker
2002	Worker	Worker
2003	Worker	Worker
2004	Worker	Worker
2005	Worker	Worker

Figure 42 – Actual income and predicted income of household A

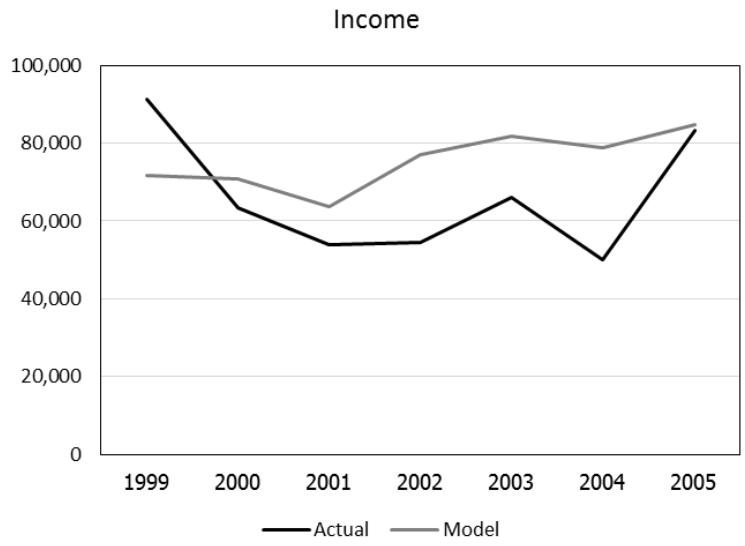
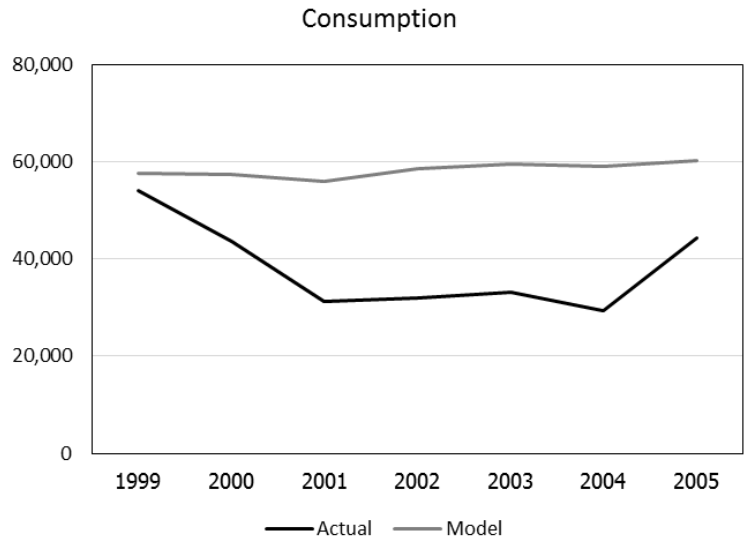


Figure 43 - Actual consumption and predicted consumption of household A



Figures 44 and 45 compare the actual value of fixed assets and cash holding of household A with those predicted by the model. The model can capture the overall growth rate of fixed assets reasonably well, while it under predicts the growth rate of cash holding.

Figure 44 – Household A's actual value of fixed assets and the predicted value

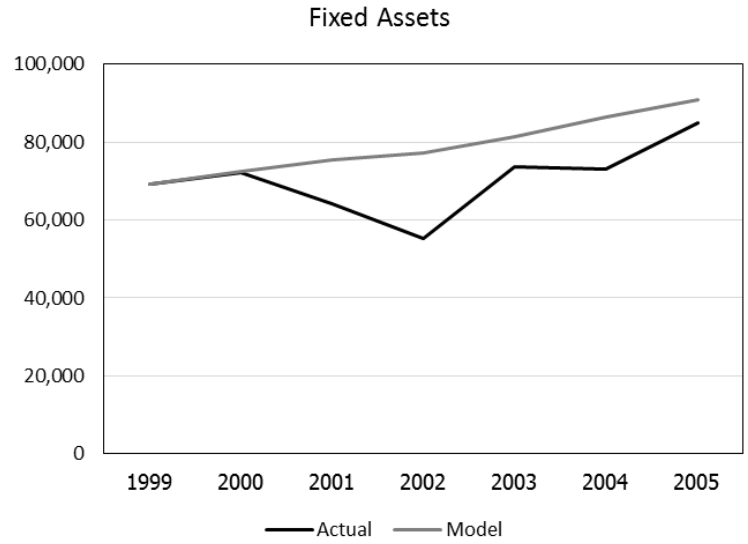
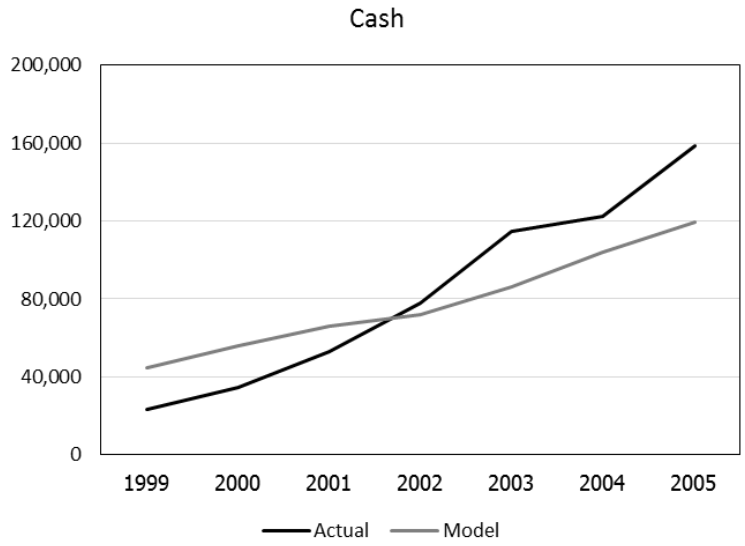


Figure 45 – Household A's actual value of cash holding and the predicted value



9.2.2 Household B

Household B is a high-ability household with intermediate initial capital level. In the data, the main source of income for this household is cultivation activity, which is labor intensive. However, the model predicts that this household would choose to be an entrepreneur in the capital-intensive sector.

Table 22 – Household B's main source of income and the predicted occupation

Year	Data	Model
1999	Cultivation	Capital-intensive
2000	Cultivation	Capital-intensive
2001	Cultivation	Capital-intensive
2002	Cultivation	Capital-intensive
2003	Cultivation	Capital-intensive
2004	Cultivation	Capital-intensive
2005	Cultivation	Capital-intensive

Figures 46 and 47 compare the actual income and consumption of household B with those predicted by the model. The model can predict the average level of consumption reasonably well (83,542 predicted vs 82,763 actual), but under-predict the average level of income (202,126 predicted vs.

271,208 actual). Moreover, the model cannot capture the fluctuation in income and consumption level, possibly due to the lack of income shock in the model.

Figure 46 – Actual income and predicted income of household B

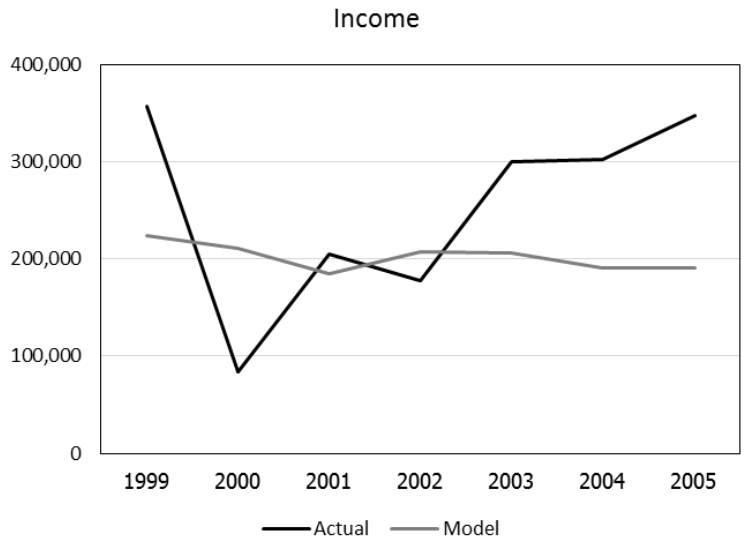
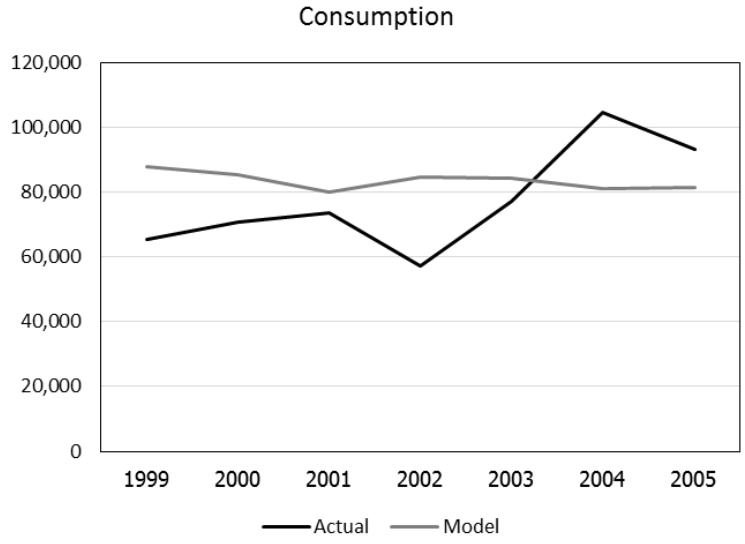


Figure 47 – Actual consumption and predicted consumption of household B



Figures 48 and 49 compare the values of household B's fixed assets and cash holding in the data with those predicted by the model. Similar to the case of household A, the model can capture the overall growth rate of fixed assets reasonably well, while it under predicts the growth rate of cash holding.

Figure 48 – Household B's actual value of fixed assets and the predicted value

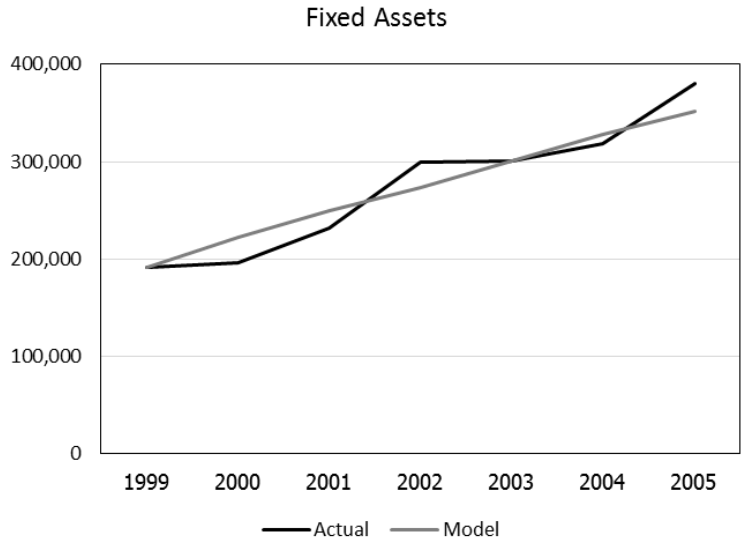
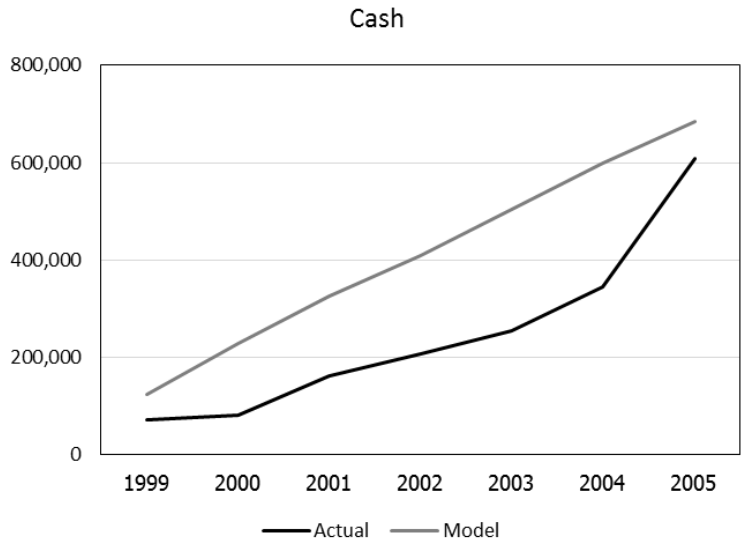


Figure 49 – Household B's actual value of cash and the predicted value



9.2.3 Household C

Household C is a very high ability household with very high wealth. In the data, the main source of income for this household is business activity, which is capital intensive. And, the model correctly predicts that this household would choose to be an entrepreneur in the capital-intensive sector.

Table 23 – Household C's main source of income and the predicted occupation

Year	Data	Model
1999	Business	Capital-intensive
2000	Business	Capital-intensive
2001	Business	Capital-intensive
2002	Business	Capital-intensive
2003	Business	Capital-intensive
2004	Business	Capital-intensive
2005	Business	Capital-intensive

Figures 50 and 51 compare the actual income and consumption of household C with those predicted by the model. The model can predict the average level of income reasonably well (1,055,052 predicted vs 1,117,568 actual), but over-predict the average level of consumption (253,189 predicted vs. 184,561 actual). Moreover, the model cannot capture the fluctuation in income and consumption level, possibly due to the lack of income shock in the model.

Figures 52 and 53 compare the values of household C's fixed assets and cash holding in the data with those predicted by the model. The model can capture the overall growth rate of cash holdings reasonably well, while it over predicts the growth rate of fixed assets.

Figure 50 – Actual income and predicted income of household C

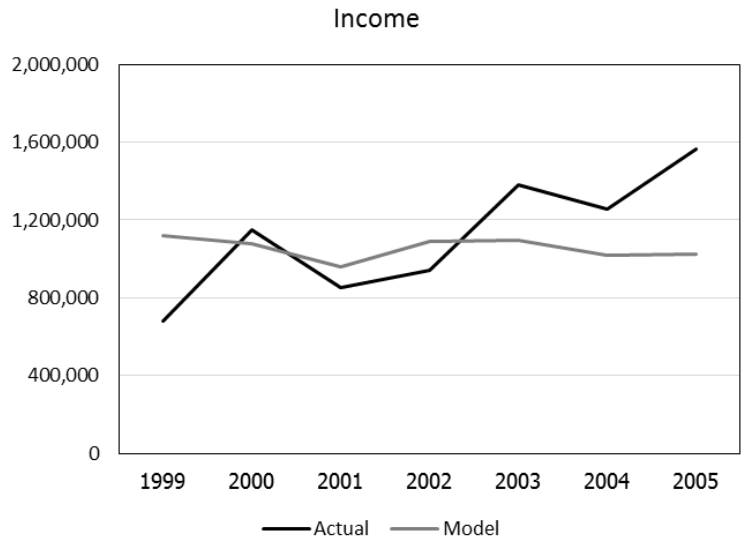


Figure 51 – Actual consumption and predicted consumption of household C

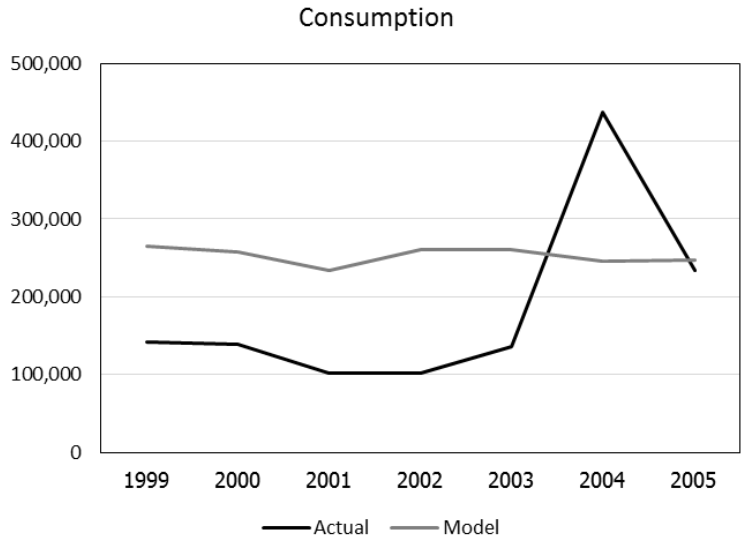


Figure 52 – Household C's actual value of fixed assets and the predicted value

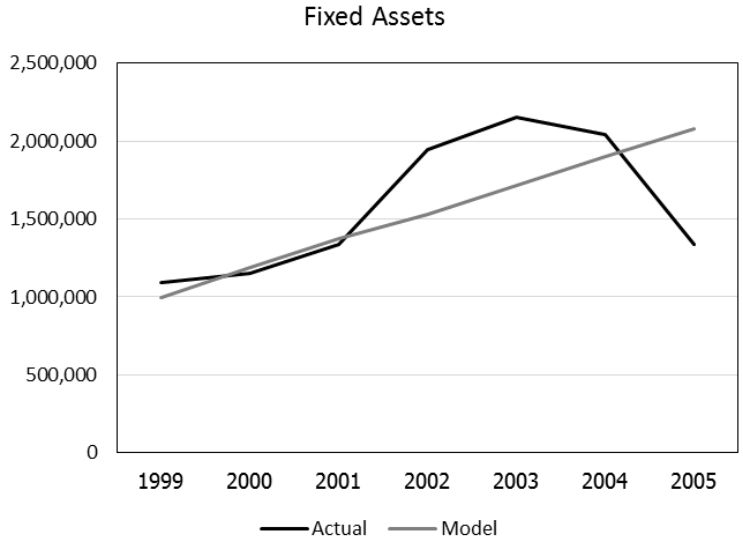
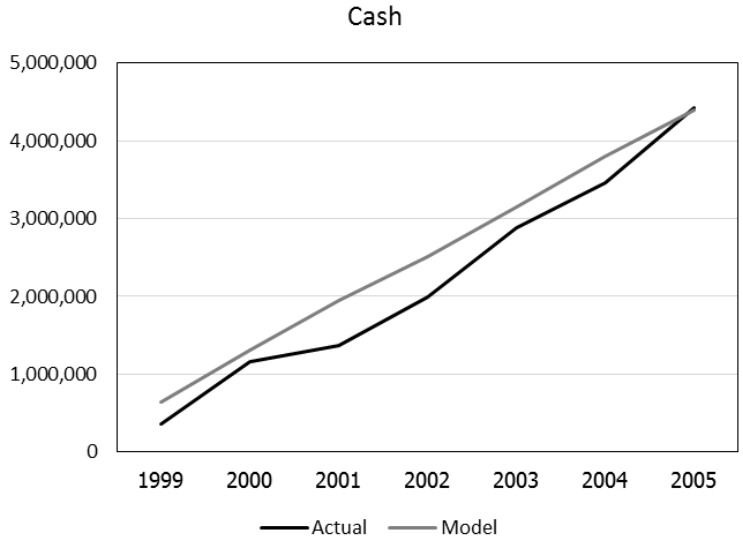


Figure 53 – Household C's actual value of cash and the predicted value



10. Counterfactual Exercise

10.1 Introduction

In this section we consider two counterfactual exercises. In the first exercise, we try to distinguish the effects of real and financial factors by keeping one factor at the initial level and varying another factor. In the second exercise, we consider the effects of shutting down the trade market, the financial

market, or both. Then, we predict what would happen to our case-study households in these counterfactual scenarios.

10.2 Disentangling Real and Financial Factors

In this exercise, we freeze the relative price at the initial 1999 level and vary the financial variables (i.e., the interest rate and the borrowing limit) using the calibrated values from the baseline scenario. Then, we freeze the financial variables at the initial 1999 levels and vary the relative price instead. Hence, we are disentangling real and financial forces behind the movement over time through the lens of the model.

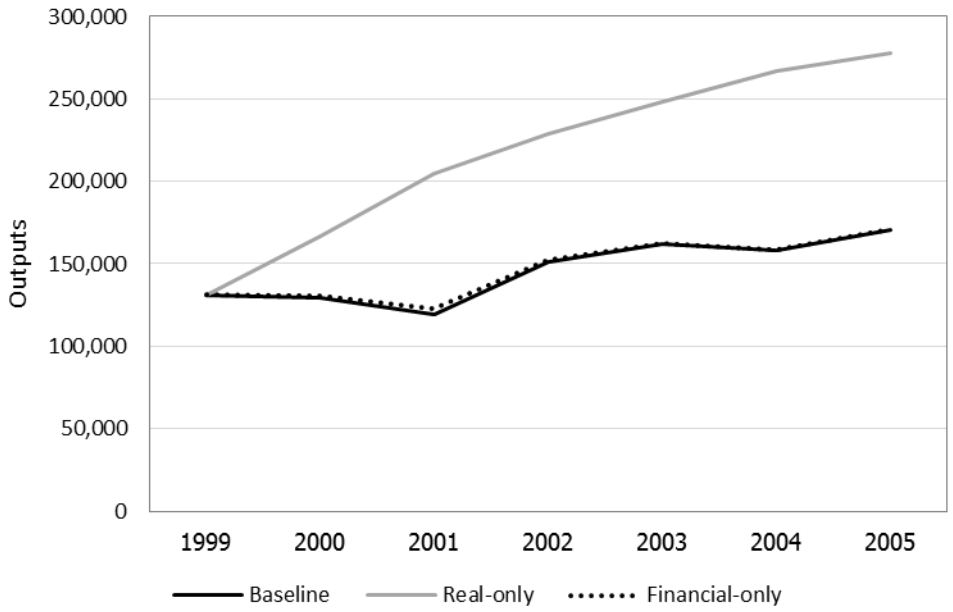
10.2.1 Lop Buri

Figure 54 compares the outputs in the baseline scenario with those in counterfactual scenarios. The black line shows the outputs in the baseline scenario, where both real and financial factors are in effect. The grey line shows the outputs in the counterfactual scenario where only the real factor (i.e., relative price) is considered. Thus, the difference between the black line and the grey line shows the effect of financial factors (i.e., interest rate and borrowing limit). The dotted line shows the outputs in the counterfactual scenario where only the financial factors (i.e., borrowing limit and interest rate) are considered, and the difference between the black line and the dotted line shows the effect of real factor.

In Lop Buri, both interest rates and borrowing limits decrease over time (see Figures 30 and 31). These changes have opposing effects on outputs. On the one hand, lower interest rates increase entrepreneurial profits and the optimal size of businesses. Therefore, outputs should be higher. On the other hand, lower borrowing limits decrease entrepreneur's' ability to borrow and the size of businesses of the constrained entrepreneurs. As a result, outputs should be lower. The results in Figure 54 suggest that the effect of borrowing limits dominates as the output is lower in the baseline scenario (which includes the effect of financial factors) than in the "Real-only" counterfactual exercise (which excludes the effect of financial factors).

The relative price in Lop Buri increases in the first three years and decreases in the last four years. Moreover, the changes in relative price are relatively small (i.e., within 5% range). The result suggests that the effect of relative prices is small since the dotted line lies almost on top of the black line.

Figure 54 – Outputs in baseline and counterfactual scenarios in Lop Buri

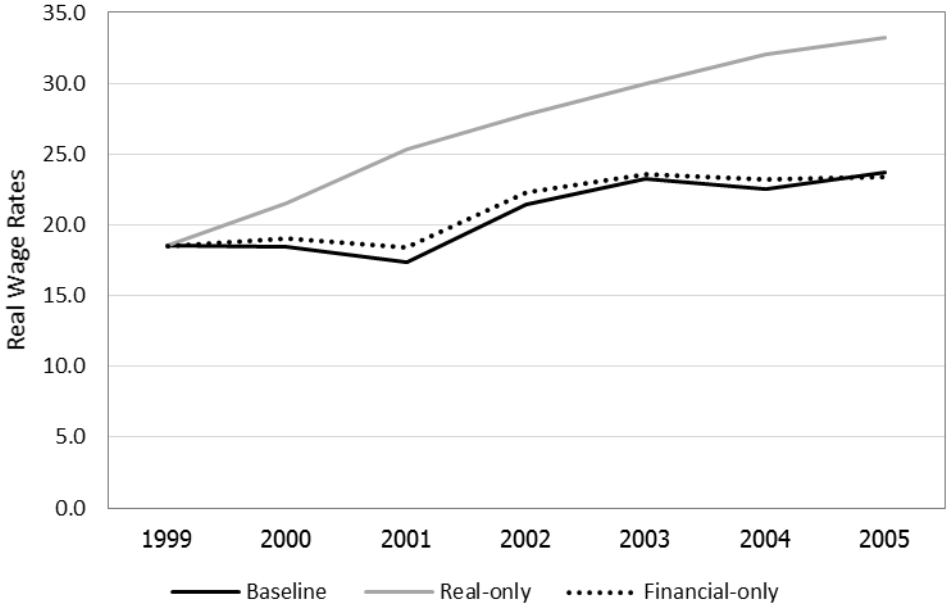


The changes in interest rates and borrowing limits also have opposing effects on wage rates. On the one hand, lower interest rates increase the amount of capital used and raises the marginal product of labor. Thus, wage rates should be higher. On the other hand, lower borrowing limits decrease economic activity which lowers the demand for labor, and wage rates as well. The result in Figure 55 suggests that, as in the case of outputs, the effect of borrowing limits dominates.

The level of relative prices in 2000–2004 are higher than the 1999-level. As a result, the change in relative prices should have a negative effect on wage rates. This is because the higher relative price will increase the profits of entrepreneurs in sector *m* in relative to the profits of entrepreneurs in sector *a*. As the entrepreneurs move from the labor-intensive sector *a* to the capital-intensive sector *m*, the aggregate demand for labor decreases, and so are the relative prices. The result

in Figure 55 confirms this prediction as the wage rates in the "financial-only" counterfactual scenario are higher than the wage rates in the baseline scenario between 2000 and 2004.

Figure 55 – Real wage rates in baseline and counterfactual scenarios in Lop Buri

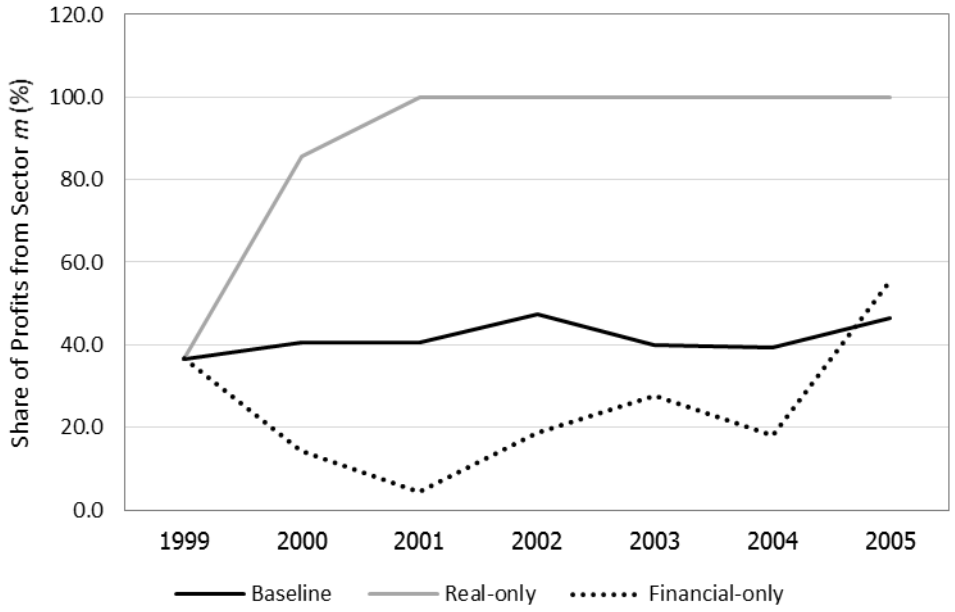


Changes in interest rates and borrowing limits also have opposing effects on the share of profits from each sector. On the one hand, decreasing interest rates benefit the capital-intensive sector m more than the labor-intensive sector a. Therefore, the shares of profits from sector m should increase. On the other hand, lowering borrowing limits affect the constrained entrepreneurs in sector m more than those in sector a, since sector m is more capital-intensive. As a result, the shares of profits from sector m should decrease. Figure 56 compares the shares of profits from sector m in Lop Buri in the baseline scenario with those in counterfactual scenarios. Again, the result suggests that the effect from lowering borrowing limits dominates since the shares of profits from sector m in the baseline scenario are lower than those in the "Real-only" counterfactual scenario.

The effect of the changes in relative prices on the shares of profits from sector m is straightforward. The relative prices in 2000–2004 are higher than the 1999-level. Therefore, the shares of profits from sector m should also be higher in this period. On the other hand, the relative

price in 2005 is lower than the 1999-level. Therefore, the share of profits from sector *m* should be lower in this year. The result in Figure 56 confirms this prediction.

Figure 56 – Shares of profits from sector m in baseline and counterfactual scenarios in Lop Buri



10.3 Trade and Financial Frictions

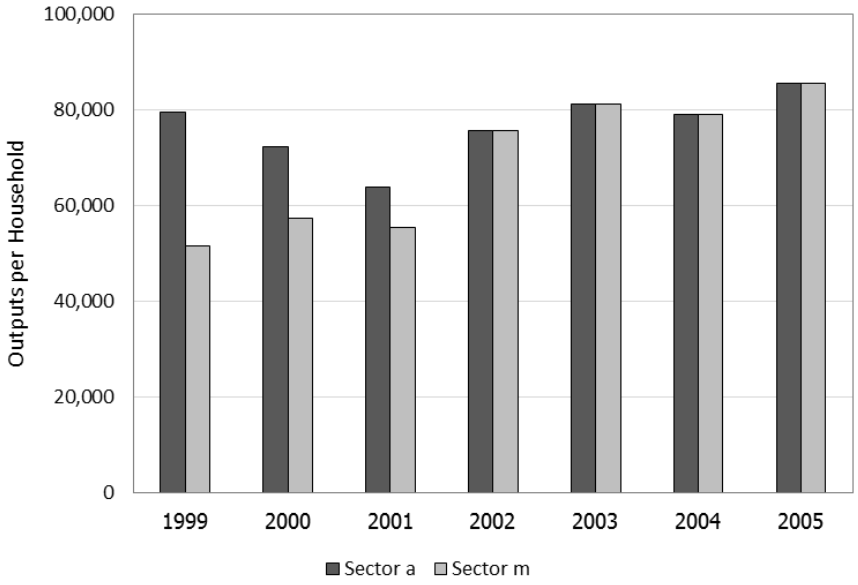
In the second counterfactual exercise, we consider the effects of frictions on trade and financial channels, one at a time. For trade frictions, we impose the iceberg-type trade costs on the imported goods. The effect of trade costs on relative prices will depend on the type of good that a village imports. For example, if a village imports goods *a* and exports goods *m*, we assume that trade frictions will lower the relative price by 1%. On the other hand, if a village exports goods *a* and imports goods *m*, we assume that trade frictions will increase the relative price by 1%.

For financial frictions, we assume that if a village resident lends to non-village resident, there is a 1% transaction tax. On the other hand, lending to another village resident is risk free. Therefore, financial frictions by keeping more funds at home will lower the local equilibrium interest rate if a village is a net lender.

10.3.1 Lop Buri

Since the village in Lop Buri always exports the labor-intensive goods *a* and imports the capital-intensive goods *m* under baseline scenario, trade friction will increase the price of goods *m* in relative to the price of goods *a*. Figure 57 shows the value for outputs from each sector in the counterfactual scenario with trade frictions. The level of output from labor-intensive sector *a* is higher than the level of output from capital-intensive sector *m* in the first three years. This results suggests that a village in Lop Buri can still export goods from sector *a* despite trade frictions in these years. On the other hand, imposing trade frictions totally shut down trade channel for this village in the last four years. Therefore, the equilibrium relative prices in the last four years are the one that equalize the local demand for and the local supply of goods from each sector. Figure 58 compares the equilibrium relative prices in the baseline scenario with those in the counterfactual scenario with trade frictions.[16]

Figure 57 – The value of outputs in the counterfactual scenario with trade frictions



[16] As discussed in section 9, the relative price under baseline scenario could already include existing trade costs and other frictions. However, these existing trade frictions will not qualitatively affect our counterfactual results. See, for example, suppose that the baseline price of 0.96 in 1999 is already include 2% trade costs. Since this village exports goods *a* in baseline 1999, the "world" relative price is likely to be 2% lower (i.e., $p_m/p_a = 0.94$). For the counterfactual exercise, in which we impose a 1% trade friction on top of the existing frictions, the village's relative price would be 0.97, which is similar to the level in our current counterfactual exercise. Thus, the counterfactual results remain unchanged.

Figure 58 – The equilibrium relative prices in the baseline scenario and in the counterfactual scenario with trade frictions

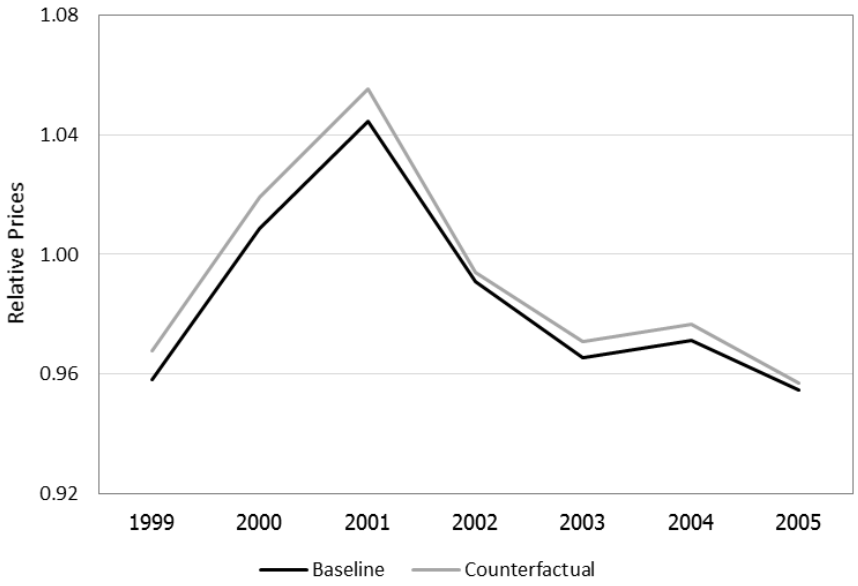


Figure 59 shows the local demand for and the local supply of capital in the counterfactual scenario with financial frictions. The local supply of capital exceeds the local demand for capital in all years. Therefore, the local interest rates will be lower than the global ones due to financial frictions. We compare the equilibrium interest rates in the baseline scenario and those in the counterfactual scenario with financial frictions in Figure 60.

Figure 59 – The local demand for and the local supply of capital in the counterfactual scenario with financial frictions

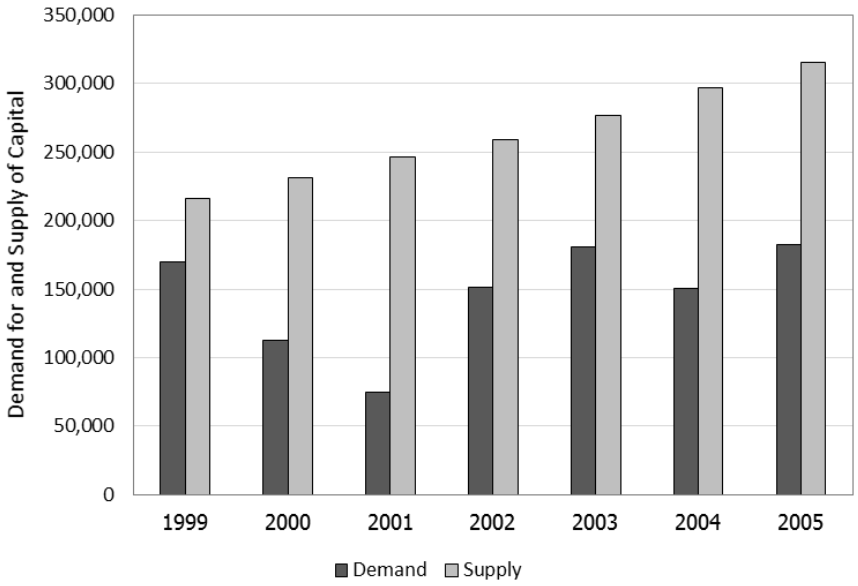


Figure 60 – The equilibrium interest rates in the baseline scenario and in the counterfactual scenario with financial frictions

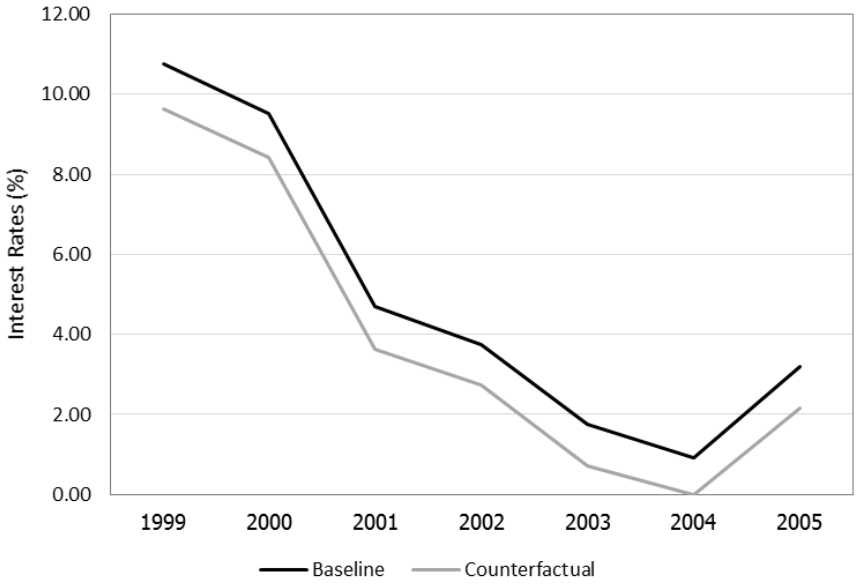
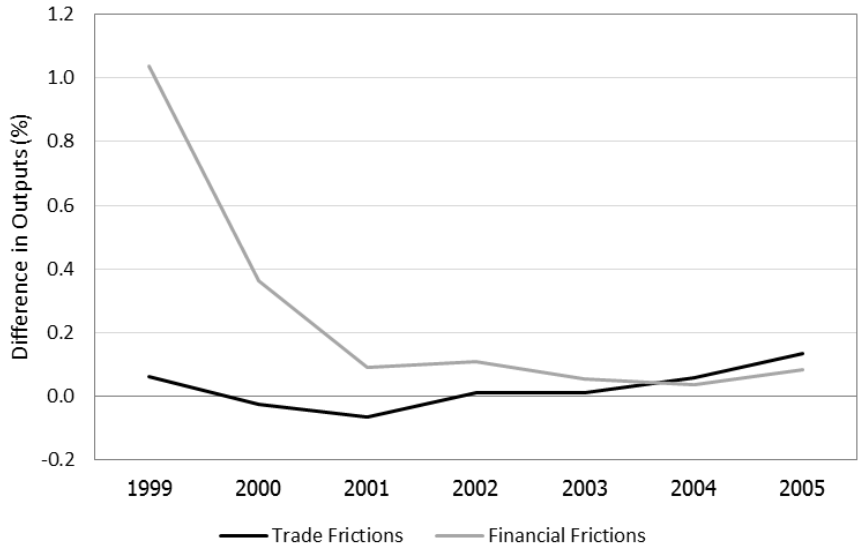


Figure 61 shows the differences between the levels of outputs in both counterfactual scenarios and those in the baseline scenario. While the 1% trade frictions are enough to drive the village into

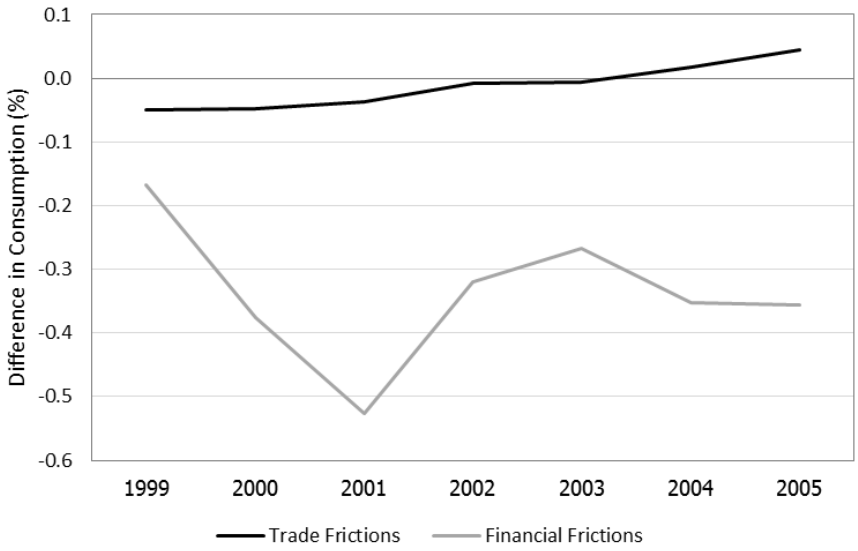
autarky, their effect on the level of outputs is quite small. In the counterfactual scenario with financial frictions, the levels of outputs are higher than those in the baseline scenario in all years and the difference pattern resembles the pattern of borrowing limits. This is because this village is the net lender in all years. Thus, financial frictions lower the local interest rates which, in turn, lead to entrepreneurs using more capital and producing more outputs. The size of the outputs increase will depend on how much more entrepreneurs can borrow, which is determined by the borrowing limits.

Figure 61 – Differences in output levels between counterfactual scenarios and the baseline scenario



The differences between the consumptions levels in counterfactual scenarios and those in the baseline scenario is reported in Figure 62. As in the case of outputs, trade frictions have small effect on the average consumption level. Financial frictions have negative effects on consumption levels through the lower interest income.

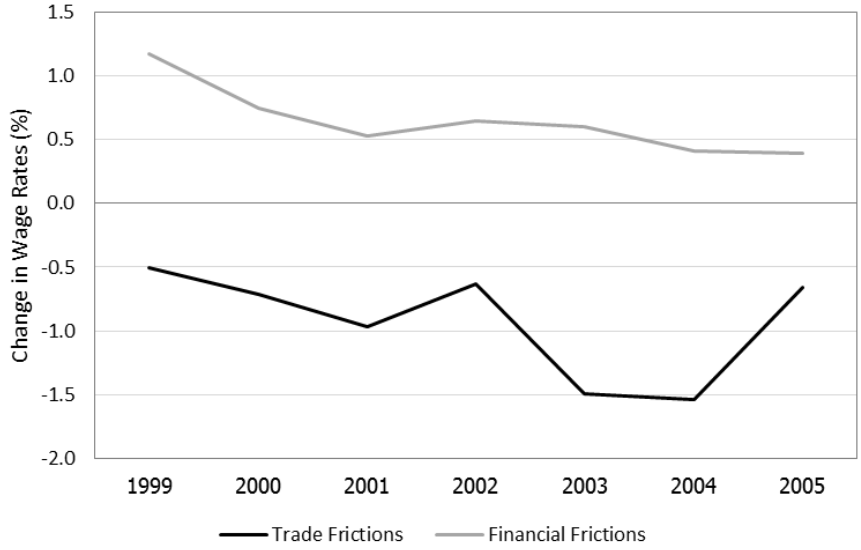
Figure 62 – Differences in consumption levels in counterfactual scenarios



Both frictions have considerable impacts on wage rates (Figure 63) but in the opposite directions. In the counterfactual scenario with trade frictions, wage rates are lower than those in the baseline scenario. Note that trade frictions increase relative prices in this village. As a result, the marginal entrepreneurs will move from the labor-intensive sector *a* to the capital-intensive sector *m*. Therefore, the local demand for labor decreases, and so do the wage rates.

In the counterfactual scenario with financial frictions, the lowered interest rates raise the marginal product of labor. Thus, the local demand for labor increases, and so do the wage rates.

Figure 63 – Differences in wage rates in counterfactual scenarios



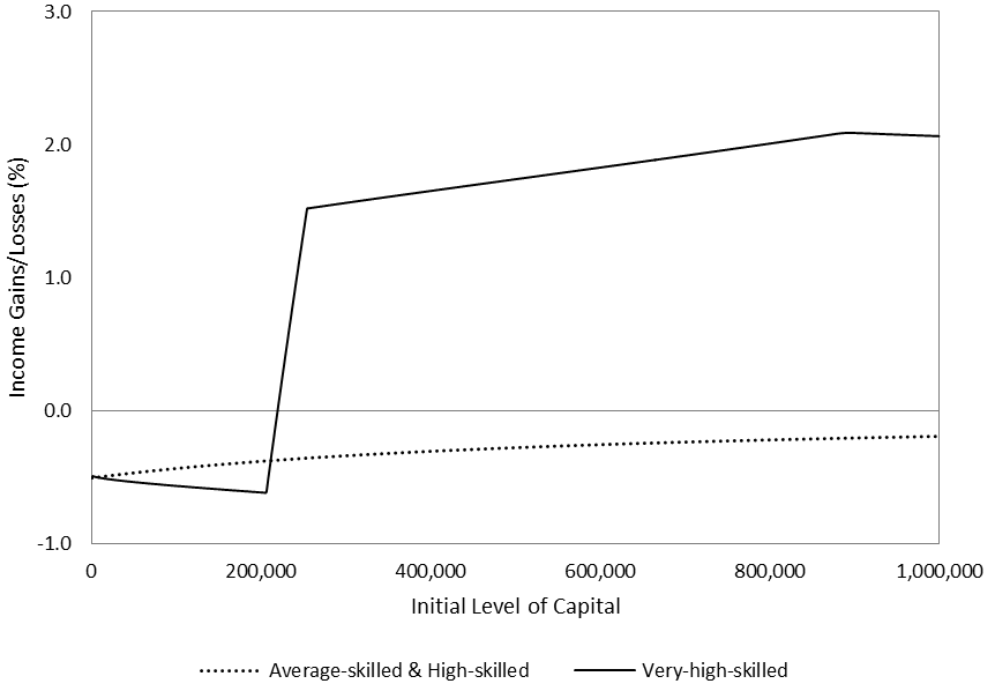
10.3.2 Effects on Households' Occupation and Income

(A) Counterfactual Exercise with Trade Frictions

Finally, we return to our main theme and consider the effects of the counterfactual exercise on the income of agents. Figure 64 shows the income difference between the baseline scenario and the counterfactual exercise with trade frictions in Lop Buri in year 1999. To show that the effect of trade frictions could be different across heterogeneous households, we compare three groups of households which have different ability levels; the average-skilled group ($z_i = 0$), the high-skilled group ($z_i = \sigma$), and the very-high-skilled group ($z_i = 2\sigma$). The vertical axis shows the welfare gains and losses measured as the changes in households' total income. The horizontal axis shows the value of households' capital in 1999.

The dotted line shows the change in income of average-skilled and high-skilled households. Since they choose to be wage-workers in both the baseline scenario and the counterfactual exercise, welfare loss reflects the change in wage income as a fraction of households' total income. For wealthier households, welfare loss becomes smaller since the fraction of interest income becomes bigger.

Figure 64 – Income gains and losses from trade frictions in Lop Buri in 1999



The solid line show the change in income of very-high-skilled households. For them, the effect of trade frictions on households' income is more non-monotonic. We can separate the very-high-skilled entrepreneurs into three groups. The first group consists of households with low wealth (i.e., those with initial capital less that 206,000 baht). The second group consists of households with medium wealth (i.e., those with initial capital between 206,000 and 254,000 baht). And households with high wealth (i.e., those with initial capital more than 254,000 baht) belong to the third group.

The first group of very-high-skilled households choose to be entrepreneurs in labor-intensive sector in both the baseline scenario and the counterfactual exercise. For this group, their total income decreases because trade frictions lower the price of labor-intensive goods.

The second group switch from being entrepreneurs in the labor-intensive sector in the baseline scenario to being entrepreneurs in the capital-intensive sector in the counterfactual exercise. We observe a positive relationship between the change in welfare and household's initial wealth for this group.

The third group of very-high-skilled households choose to be entrepreneurs in capital-intensive sector in both the baseline scenario and the counterfactual exercise. For this group, their total income increases because trade frictions raise the price of capital-intensive goods.

Figure 65 - Income gains and losses from trade frictions in Lop Buri in 2002

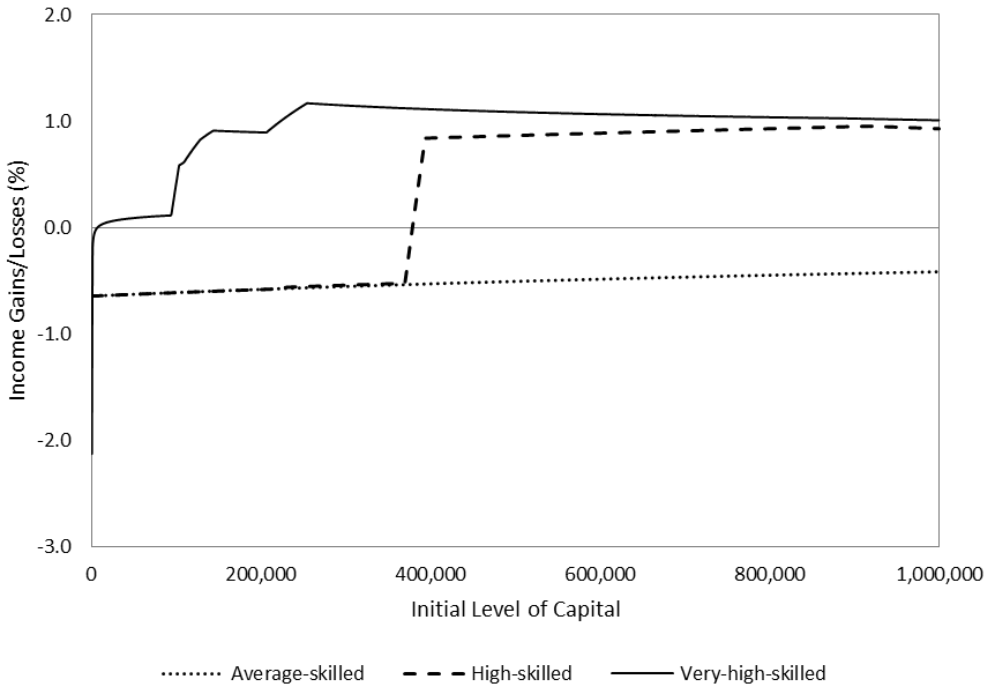


Figure 65 shows the income difference between the baseline scenario and the counterfactual exercise with trade frictions in Lop Buri in year 2002. Again, average-skilled households choose to be wage-workers in both the baseline scenario and the counterfactual exercise, and the welfare loss reflects the decrease in wage rate.

For high-skilled households, we can separate them into three groups. First, households with low initial wealth (with initial capital less than 370,000 baht) choose to be workers in both between the baseline scenario and the counterfactual exercise and have welfare loss from the lower wage rate. Second, households with medium initial wealth (with initial capital between 370,000 and 395,000 baht) switch from being wage-workers in the baseline scenario to being entrepreneurs in the capital-intensive sector. The welfare of household in this group increases in wealth level. Third, households

with high wealth (with initial capital more than 395,000 baht) choose to be entrepreneurs in capital-intensive sector in both the baseline scenario and the counterfactual exercise. Welfare gain of households in this group reflects the increase in the price of capital-intensive goods.

For very-high-skilled households, welfare change in 2002 reflects not only the occupational switch in 2002, but also the effects from previous years through the change in 2002 wealth level. This result in the highly non-linear pattern of welfare gains/losses.

(B) Counterfactual Exercise with Financial Frictions

Figure 66 shows the income difference between the baseline scenario and the counterfactual exercise with financial frictions in Lop Buri in year 1999. In the counterfactual exercise, the interest rate is lower than the baseline scenario, while the wage rate is higher. These changes in factor prices have opposing effect on the welfare of average-skilled and high-skilled households, who always choose to be wage-workers. On the one hand, higher wage rate raises their wage income. On the other hand, lower interest rate lowers their interest income. Therefore, households with very low initial wealth enjoy welfare gain since the effect from higher wage rate dominates, while households with higher initial wealth face welfare loss since the effect from lower interest rate dominates.

Very-high-skilled households always choose to be entrepreneurs (except for the poorest one, who chooses to be worker) in both the baseline scenario and the counterfactual exercise. Therefore, the effects from changing factor prices on their income are in the opposite directions from those on wage-workers, i.e., they enjoy lower interest rate but hurt from higher wage rate. The result in figure 48 suggests that the benefit from lower interest rate outweighs the cost of higher wage rate for most households. And those with higher wealth, who used more capital, benefit more from lower interest rate.

Figure 66 – Income gains and losses from financial frictions in Lop Buri in 1999

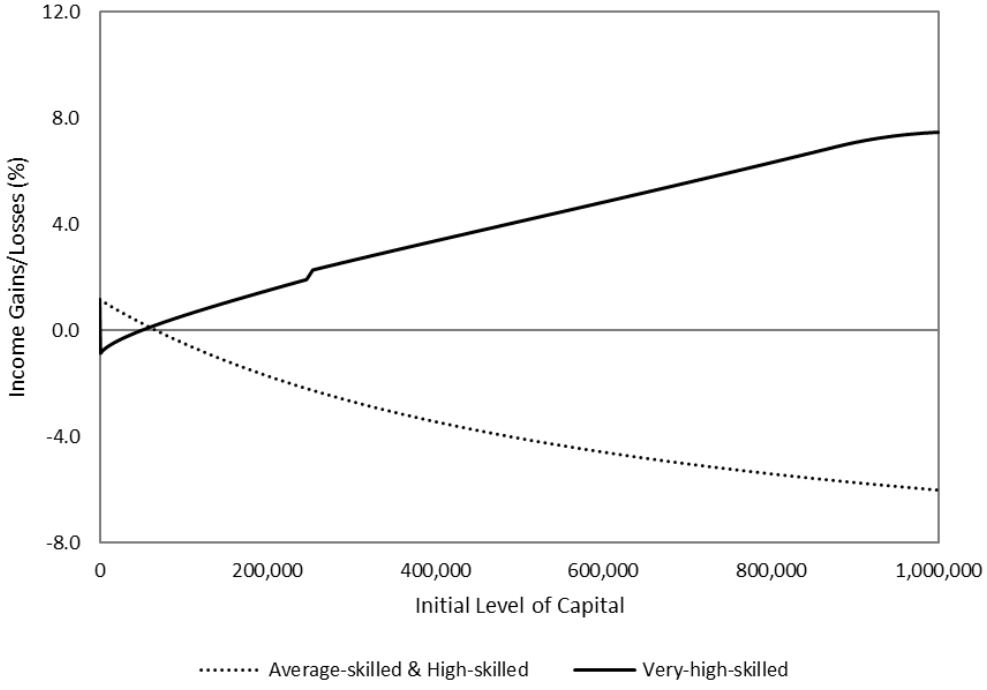
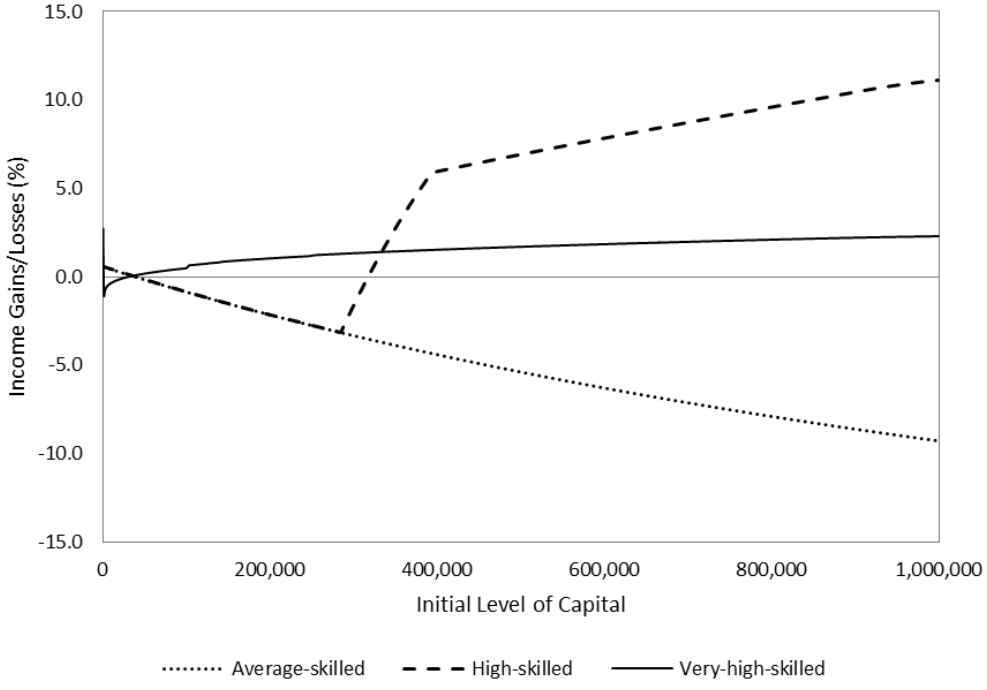


Figure 67 shows the income difference between the baseline scenario and the counterfactual exercise with financial frictions in Lop Buri in year 2002. Again, average-skilled households choose to be wage-workers in both the baseline scenario and the counterfactual exercise, and the welfare loss reflects the decrease in interest income.

For high-skilled households with low wealth, they also choose to be wage-workers in both the baseline scenario and the counterfactual exercise and, therefore, face the same welfare gain/loss as the average-skilled households. For those with medium wealth level (i.e., initial level of capital between 285,000 and 394,000 baht), they choose to switch from being workers in the baseline scenario to being entrepreneurs in the capital-intensive sector in the counterfactual exercise. For this group of households, welfare gain increases with their wealth level.

Again, for very-high-skilled households, they always choose to be entrepreneurs and the result suggests that the benefit from lower interest rate outweighs the cost of high wage rate for most households.

Figure 67 – Income gains and losses from financial frictions in Lop Buri in 2002



Besides the effects of shutting down trade channel and financial channel on income level, we also look at the effects on income inequality across households and find that the effects are small.

10.4 Case Studies

10.4.1 Household A

Table 24 reports the occupational choices of household A in baseline and counterfactual scenarios. In baseline scenario and all counterfactual scenarios, this household always chooses to be a worker.

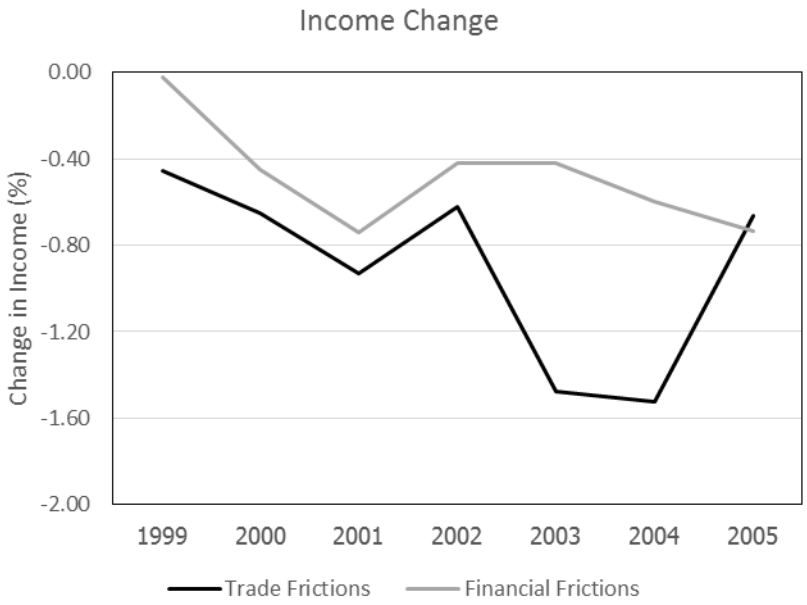
Table 24 – Occupational choice of household A in baseline and counterfactual scenarios

Year	Baseline	Trade frictions	Financial frictions
1999	Worker	Worker	Worker
2000	Worker	Worker	Worker
2001	Worker	Worker	Worker
2002	Worker	Worker	Worker
2003	Worker	Worker	Worker
2004	Worker	Worker	Worker
2005	Worker	Worker	Worker

Figure 68 reports the differences between the net incomes of household A in counterfactual scenarios and those in baseline scenario. Since household A always chooses to be a worker, two sources of this household's income are wages and interest from savings. And thus, its income will depend only on the wage rate and the interest rate. In the counterfactual scenario with trade frictions, wage rates are lower than those in baseline scenario while interest rates are the same. As a result, the net incomes of household A in the counterfactual scenario with trade frictions are lower than those in baseline scenario.

In the counterfactual scenario with financial frictions, wage rates are higher than those in baseline scenario, but interest rates are lower. Since the net incomes of household A in the counterfactual scenario with financial frictions are lower than those in baseline scenario, this result suggests that the changes in interest income are larger than the changes in labor income. The change in household A's consumption has similar pattern as the change in income.

Figure 68 – Change in the net income of household A in counterfactual scenarios



10.4.2 Household C

Table 25 reports the occupational choices of household C in baseline and counterfactual scenarios. In baseline scenario and all counterfactual scenarios, this household always chooses to be an entrepreneur in the capital-intensive sector.

Table 25 – Occupational choice of household C in baseline and counterfactual scenarios

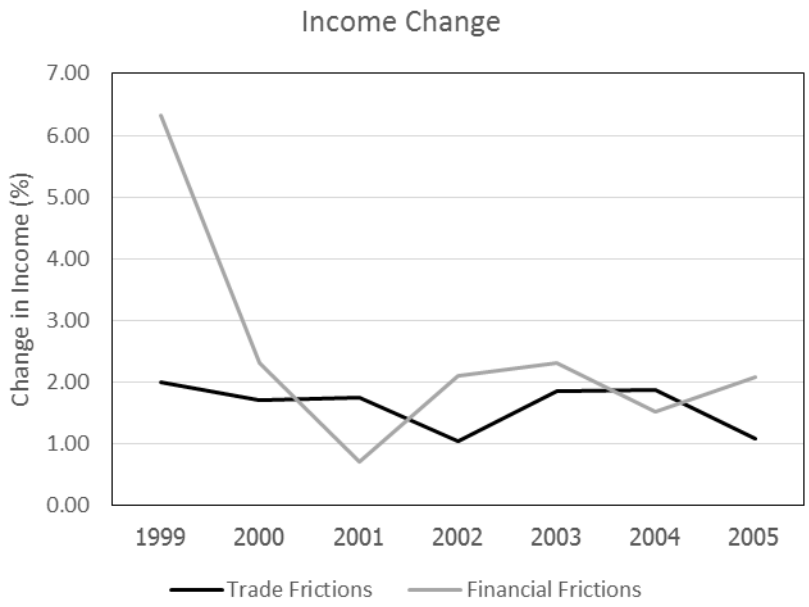
Year	Baseline	Trade frictions	Financial frictions
1999	Capital-intensive	Capital-intensive	Capital-intensive
2000	Capital-intensive	Capital-intensive	Capital-intensive
2001	Capital-intensive	Capital-intensive	Capital-intensive
2002	Capital-intensive	Capital-intensive	Capital-intensive
2003	Capital-intensive	Capital-intensive	Capital-intensive
2004	Capital-intensive	Capital-intensive	Capital-intensive
2005	Capital-intensive	Capital-intensive	Capital-intensive

Figure 69 reports the differences between the net incomes of household C in counterfactual scenarios and those in baseline scenario. Since household C always chooses to be an entrepreneur in the capital-

intensive sector, all the equilibrium prices (wage rates, interest rates, and relative prices) affect the net income of household C. In the counterfactual scenario with trade frictions, the relative prices of capital-intensive goods are higher than those in the baseline scenario. In addition, the wage rates are lower. Both of these changes increase the profits of entrepreneurs in the capital-intensive sector. Therefore, the net income of household C in the counterfactual scenario with trade friction is higher than those in the baseline scenario.

In the counterfactual scenario with financial frictions, wage rates are higher than the baseline scenario, while interest rates are lower. The benefit of lower interest rates outweighs the cost of higher wage rates, as can be seen from the higher net income of household C in the counterfactual scenario. Again, the change in household C's consumption has similar pattern as the change in income.

Figure 69 – Change in the net income of household C in counterfactual scenarios



The changes in income and consumption of household B are similar to those of household C and, therefore, omitted in the interest of brevity.

11. Buri Ram

In this section, we will briefly describe villages in Buri Ram and compare them with those in Lop Buri. We will also discuss the possible similarities and differences in the outcome of the counterfactual exercises in these two provinces.

First, Buri Ram is less capital abundant in comparison to Lop Buri. Figure 69 shows the initial distribution of fixed assets in Lop Buri and Buri Ram. It is clear that households in Buri Ram have less capital than households in Lop Buri. The relative scarcity of capital in Buri Ram also reflects in factor prices. Figure 70 compares the interest rates and the wage rates in Lop Buri and Buri Ram. Not surprisingly, the capital-abundant Lop Buri has lower interest rates and higher wage rate than the labor-abundant Buri Ram.

Figure 69 – Initial distribution of fixed assets in Lop Buri and Buri Ram

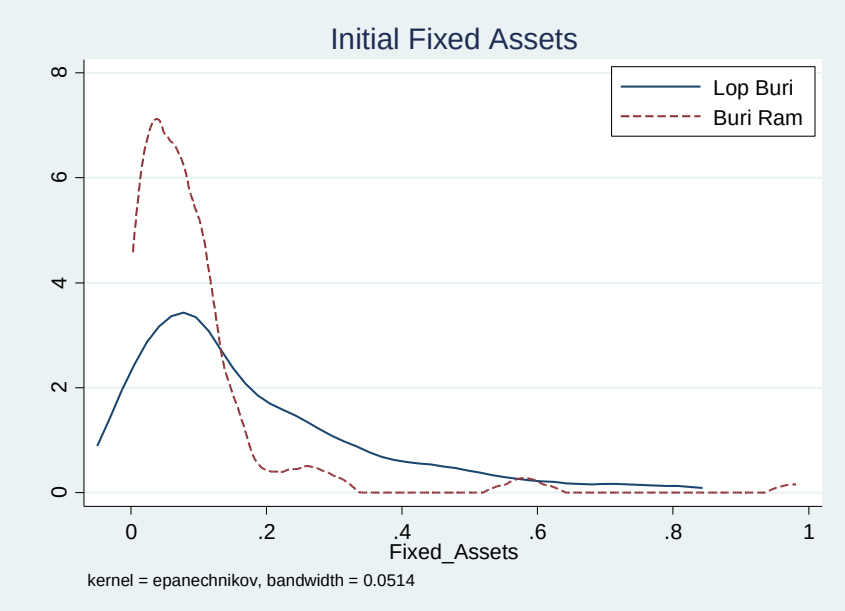


Figure 70 – Comparison of interest rates and wage rates in Lop Buri and Buri Ram

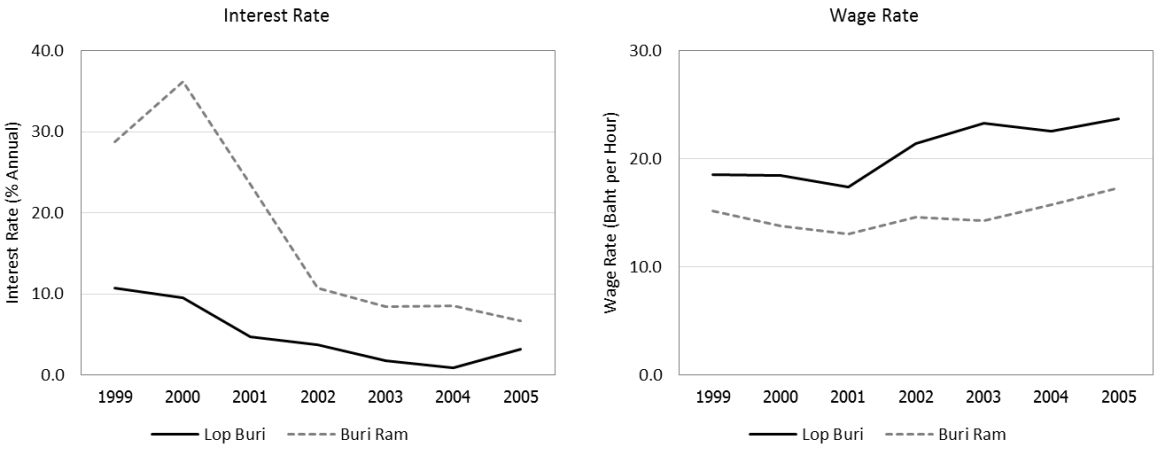
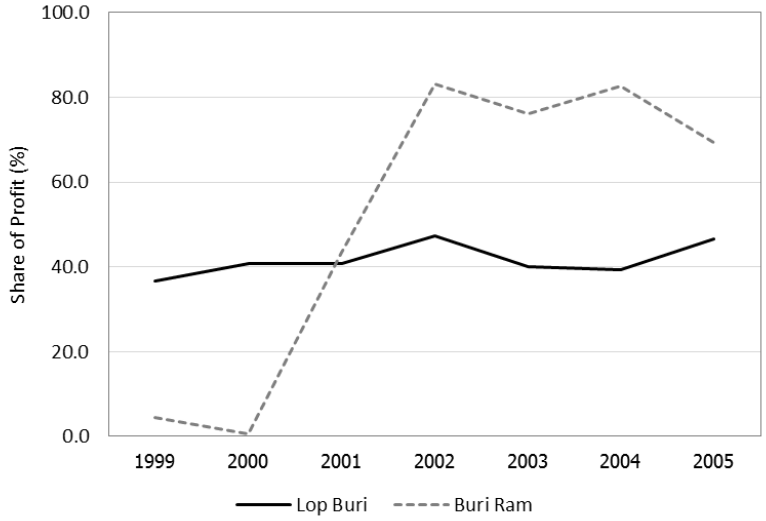


Figure 71 – Share of profit from the capital-intensive activities



The differences in factor endowments and factor prices across provinces also affect the production activities within the villages. The standard Heckscher-Ohlin model predicts that villages in the Central would have an advantage in producing the capital-intensive goods, while for villages in the Northeast, the labor-intensive goods. We do observe such patterns, at least in the early years. In 1999–2000, almost all of the profit in Buri Ram come from labor-intensive activities.[17] On the other hand, capital-intensive activities account for 40% of the profit in Lop Buri. However, the share of capital-intensive

[17] We define growing crops as the labor-intensive activity and define operating fish/shrimp ponds, raising livestock, or operating household businesses as the capital-intensive activities.

profit in Buri Ram increases significantly since then, reaches the Lop Buri level in 2001 and accounts for 80% of the profit in Buri Ram since 2002. This change happens at the same time as the sharp drop of the interest rate in Buri Ram. Thus, the calibration results of Buri Ram would provide a more-dynamic picture of transition economies.

The difference in occupational compositions between Lop Buri and Buri Ram will also lead to the different outcome in counterfactual exercises. For example, suppose that a village in Buri Ram is also a net lender. In the counterfactual exercise, financial frictions will lower the local interest rate, as in Lop Buri. The interest decrease will have different effects on households with different occupation (i.e., workers, labor-intensive entrepreneurs, capital-intensive entrepreneurs). More specifically, capital-intensive entrepreneurs will be benefitted more than labor-intensive entrepreneurs. On the other hand, workers will be negatively affected from the lower interest rate due to the loss in interest income. And, for example, if Buri Ram has less capital-intensive entrepreneurs than Lop Buri (as in 1999–2000), it could be affected less. Therefore, counterfactual exercises in Buri Ram could illustrate different outcomes of trade and financial frictions.

12. Conclusions

In this paper, we disentangle the impacts of real and financial factors on village economies. To do so, we start by developing a two-factor two-sector trade model with occupational choices and financial frictions. Then, we calibrate our model using both the macro-level stylized facts of Thai economy and the micro-level household data. The calibrated model can perfectly match the village-level stylized facts (i.e., wage rate and the share of profit from each sector).

Then, we evaluate the calibrated model by comparing the occupational choices, income, and wealth level predicted by the model with those in the data. The model can predict the occupational choices of high-ability and low-ability particularly well. However, the model under-predicts entrepreneurs with intermediate ability. Moreover, the model can predict the average-level of household income but fails to predict the change in income due to the lack of income shocks in the model.

Lastly, we conduct two counterfactual experiments. In the first counterfactual experiment, we disentangle the impacts of real and financial factors by keeping one factor at the initial level and varying the others. In the second counterfactual experiment, we impose frictions on trade or on capital flows, one at a time. The results suggest that the impact of frictions on real and financial factors can be significant and heterogeneous, generating both gains and losses and non-monotone impact across wealth classes and occupations (even allowing for occupation shifts).

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