Sources of Kuznets Dynamics in Thailand

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Abstract

The Kuznets curve postulates a dynamic relationship between growth and income inequality for a given economy. These two aggregate phenomena are linked through compositional changes in individual characteristics when self-selection is constrained by personal wealth. This paper attempts to identify the crucial characteristics associated with this dynamic relationship, by studying the evolution of the income distribution in Thailand between 1976 and 1996, during which the economy experienced strong growth with diminution of poverty, but with a rapid increase in income inequality. Applying comprehensive decomposition analyses to the data from the Thai Socio-Economic Survey, this paper shows that growth and income distribution dynamics were closely related to an expansion of education and credit, and to an occupational transformation. These three factors account for 39 percent of the average income growth, 39 to 54 percent of poverty reduction depending on the poverty index, and 53 percent of increase in inequality. Each of these factors contributed to growth by a similar magnitude. However, the expansion of education and credit was concentrated among wealthy households and increased inequality while the transformation of occupation occurred mainly among middle class and reduced poverty.

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1 Introduction

The Thai economy developed rapidly between 1976 and 1996.[1] Real GNP per capita grew at an average rate of 5.7% annually. In particular, for 1986-1996, the average annual growth rate of Thailand at 9% even exceeded those of neighborhood East Asian miracle economies. This rapid growth alleviated poverty remarkably. In 1976, nearly half of the population, 48 percent, earned less than $2 a day. By 1996, this had fallen to 13 percent. Income inequality, however, increased sharply over this period. Already in 1976, the income Gini coe¢cient of Thailand at 0.436 was much higher than the average income Gini coe¢cient of East Asia and Paci…c countries (0.362) and close to the average income Gini coe¢cient of Sub-Saharan African countries (0.441).[2] This high income inequality became even higher after two decades of growth. In 1996, the income Gini coe¢cient of Thailand at 0.515 even exceeded the average income Gini coe¢cient in Latin American and Caribbean countries (0.502).

Not surprisingly, Thailand went through substantial changes in socioeconomic composition over this period. Demography changed: average family size dropped, life expectancy at birth increased, and the proportion of female-headed households increased. Thai households shifted toward more productive sectors. The economy industrialized rapidly. Along with this industrialization came major occupation shifts from farmers to wage workers, and more areas became urbanized. The working population became better educated. The …nancial sector was deepened. Indeed these compositional changes are the sources of average income growth as more people join higher-income sectors, but they also a¤ect the evolution of income distribution. It is this channel of compositional changes in the course of development, through which Kuznets (1955) postulated a dynamic relationship between income growth and income inequality, the so called Kuznets Curve; an inverted-U shaped inequality dynamics along with growth.

Many empirical studies of the Kuznets curve have focused on cross-country regressions to test whether the inverted-U curve …ts the cross-section data on growth and inequality. Unfortunately, the results of these studies do not seem robust to the regression speci…cations. The cross-section relationship between inequality and growth is sometimes an inverted-U shape (Adelman and Robinson, 1989), sometimes an upright-U shape (Fields and Jakubson, 1993), sometimes negative (Alesina and Rodrik, 1994), and sometimes positive (Forbes, 1997), depending on speci…cation. This non-robustness has not been solved. One problem is …nding a regression speci…cation that perfectly controls for

[1] The 1997 Asia Crisis began in Thailand, making the study of Thai growth prior to the crisis even more important.
[2] Regional average Gini coe¢cients of income are from Deininger and Squire (1996).

country-speci…c …xed e¤ects. The source of the link between growth and inequality is thus hard to determine from cross-country studies.[3] Note that Kuznets himself explicitly postulated that the link comes from compositional changes. His leading example is one of a sectoral shift from agriculture to non-agriculture, as the underlying mechanism generating a dynamic relationship between growth and inequality for a given economy. Thus, a more adequate approach to empirical identi…cation of "Kuznets" curve would be a decomposition analysis of the trends of growth and inequality for a given economy. There are in fact several empirical studies following this line, but most of them focus only on inequality dynamics with respect to a single speci…c characteristic, e.g. education, and evaluate the compositional e¤ect on inequality dynamics of that particular characteristic.[4]

The main goal of this paper is to identify, from many possibilities, which are the crucial characteristics associated with growth and income distribution dynamics. Thus we comprehensively decompose not only the income inequality dynamics but also the average income growth and poverty dynamics. Among the various socioeconomic characteristics, we consider occupation, education, participation in formal …nancial intermediaries, industry sector, age group, gender, and community type. Comparisons of the quantitative importance of compositional e¤ects over these various characteristics allow us to infer through which, if any, characteristics the Kuznets curve is valid. As a decomposition methodology, we …rst decompose the changes in average income and indices of inequality and poverty, using the Theil-L entropy as an inequality measure, and three Foster-Greer-Thorbecke indices as poverty measures. In order to check the robustness of importance of compositional e¤ects, we then decompose the average income growth, and the changes in inequality and poverty in a nonparametric way that does not depend on speci…c choice of numeric indices.

Addressing these questions with socioeconomic survey data in Thailand, the SES, we …nd signi…cant links between growth and income distribution dynamics in Thailand through the expansion of education and credit, and through the occupational transformation. These three factors account for 39 percent of average income growth, 39 to 54 percent of poverty alleviation, depending on indices, and 53 percent of the increasing inequality. The income gaps across these characteristics widened slightly, which contributed to increasing inequality by 19 percent. These results document the importance of compositional e¤ect as a link between growth and income distribution dynamics.

This decomposition analysis sheds new light on our understanding of growth accounting itself. Stan-

[3] Earlier criticism on these cross-country empirical studies can be found in Saith (1983).

[4] In terms of educational expansion, see Knight and Sabot (1983) for East Africa, Mohan and Sabot (1988) for Columbia, and Park, Ross, and Sabot (1996) for Brazil and South Korea. In terms of compositional changes in age groups, see Mookherjee and Shorrocks (1982) for U.K.

dard growth accounting is based on an aggregate production function. It decomposes aggregate output growth into the factor accumulation and a residual, the so called "TFP" (total factor productivity). The latter may include sources of growth other than the factor accumulation. However, the share of residual TFP component in standard growth accounting does not tell us exactly the extent of "technological progress" per se. A Kuznets type growth accounting decomposes the compositional growth e¤ect and helps to better identify the purely residual "technological progress." Alternatively, the decomposition results suggests that a big part of TFP growth actually comes from compositional e¤ects.

The Kuznets curve provides us with a framework for accounting for growth and inequality dynamics. However, in the Kuznets curve itself, economic behavior is not modeled. The curve is a reduced form relationship. It does not explain why people choose di¤erent characteristics and move toward better sectors only gradually despite the persistent income gap across sectors. Varying socioeconomic characteristics among people may be explained by the di¤erences in comparative advantage, as the Roy (1951) model suggests. However, some characteristics with productive attributes such as education and access to …nancial credit appear to be bene…cial regardless of innate comparative advantage, but di¤erent choice over these characteristics is observed. We thus consider an alternative model: constrained self-selection. Suppose that entry to better sectors is costly and due to the imperfect loan markets people need to rely on personal wealth to …nance that cost. Then only the wealthy could have access to higher education and …nancial credit. In this case, the expansion of education and …nancial credit can be sources of growth in average income but also worsen the income distribution, at least in the initial stage of expansion. As the economy grows, wealth constraints in self-selection become less binding, and more people then join higher-income sectors. Thus income inequality would eventually decline. This generates exactly the inverted-U shaped inequality dynamics along with growth that Kuznets (1955) postulated. In summary, this type of selection model provides a perspective on the missing micro underpinnings of the Kuznets curve.

The estimation in this paper of discrete choice models for education, occupation, and credit participation suggests a signi…cant relationship between personal wealth and these characteristics choices, controlling for the various observable heterogeneities. We then show the asymmetric compositional changes over the wealth class. The expansion of education and credit was concentrated among wealthy households, while the occupational transformation occurred mainly among middle class. Decomposition analysis suggests that it was the expansion of education and credit that contributed to increasing inequality while it was the occupational transformation that reduced the poverty. The data from

Thailand thus supports various explicit theories of growth and inequality based on compositional changes toward more productive sectors with wealth constraints, e.g. the Lloyd-Ellis and Bernhardt (1999) model for occupational transformation, and the Greenwood and Jovanovic (1990) model for …nancial development. Here we do the measurement and analysis necessary to assess which factors are at work in actual growth and income distribution dynamics. We also explore the possible underlying impediments generating these wealth constraints in Thailand: a reversed structure of educational subsidy policy, an insecure land tenure system, and heavy dominance of commercial banking in the Thai …nancial markets, which suggest policy implications.

This paper proceeds as follows. Section 2 describes data from a nationally representative micro survey in Thailand, the SES, and discusses how the income and the household characteristics are de…ned. In Section 3, we analyze the evolution of income distribution and the evolution of socioeconomic characteristics in Thailand between 1976 and 1996. In Section 4, we decompose the aggregate growth, inequality dynamics, and poverty dynamics. Section 5 estimates discrete choice models of education, occupation, and …nancial credit use and displays the asymmetric compositional changes of these characteristics over wealth classes. Section 6 concludes the paper.

2 Data Description

2.1 De…nition of Income Measure

The Socio-Economic Survey (SES), a nationally representative micro survey conducted by the National Statistical O¢ce (NSO) in Thailand, is used to study the dynamic features of income distribution in Thailand. Between 1976 and 1996, repeated cross-sections were collected eight times (1976, 1981, 1986, 1988, 1990, 1992, 1994, and 1996.)[5] The sampling scheme of the SES is a clustered random sample strati…ed by geographic regions over the whole country.[6] The sampling unit is a household, de…ned as a group of persons who make common provision for food and other living essentials. The general criteria for membership are: common housekeeping arrangements, sharing of principal meals, common …nancial arrangements for supplying basic living essentials, and recognition of one member as head. Household members may be persons related by blood, marriage or adoption, or unrelated

[5] Although the survey from the …rst year includes the last two months of the year 1975 and the …rst ten months of the year 1976. We refer to this data set as SES 1976.

[6] We take this data structure into account to get any estimates with appropriate standard errors. For the discussions about handling the strati…ed and clustered survey data, see Deaton (1997). We also weight the data over strata, i.e. regions and community types, to re‡ect the di¤erent sampling probabilities over them.

boarders, lodgers, or servants if they do not pay for living quarters and meals.[7] If usual members of the household were absent at the time of interview and not expected to be away for more than three months, they were counted as members provided their income and expenditure could be recorded. The sample sizes were 11,362 in 1976, 11,882 in 1981, 10,897 in 1986, 11,046 in 1988, 13,177 in 1990, 13,459 in 1992, 25,208 in 1994, and 25,110 in 1996.

The income variable in this paper is constructed as follows. The original income …gure from the SES is the monthly value of total annual receipt of resources received by all household members before tax in current value of Thai currency baht.[8] This includes wages, net pro…ts from farming and non-farm business, property income, transfer payments, rental value of owner-occupied dwellings, other money receipts, and income in kind. We include income in kind since it occupies a signi…cant portion of household income in Thailand, even though its share has been monotonously decreasing over time from 26% in 1976 to 18% in 1996. Since the transfer payments include the transfer from government, the direct tax is subtracted from the household income in order to treat the tax and transfer symmetrically.[9] This household income …gure is adjusted in two ways. First, it is de‡ated into real terms with the numeraire of 1990 baht applying the consumer price indices speci…c to regions.[10] Second, the household income …gure is scaled by adult-male equivalent household size to compare the household income in terms of equivalent welfare units.[11] Even though it is hard to …nd the right equivalence scales, this adjustment helps the comparison of income …gures over households with di¤erent demographic structures.

In summary, in this paper, "income" refers to the adult-male equivalence scaled post-tax post-transfer monthly household income including both cash income and in-kind income in 1990 baht value.

[7] After 1981, married children who eat together with their parents but have their own income are treated as separate households whether they pay for meals or not. They were counted as members of same household sharing meals in 1976. The weight factors are adjusted due to this change.

[8] For the period concerned, the Thai currency baht has been pegged to the dollar, and the exchange rate between dollar and baht has been stable except for the devaluation in 1981. In the 1970s, a dollar corresponded to approximately 20 baht, and after the devaluation in 1981, to approximately 25 baht, which ratio has been stable since 1981 until the …nancial crisis in 1997.

[9] In Thailand, most tax revenue is collected in the form of indirect tax, value-added tax. Thus the di¤erence in income distributions between pre-tax income and post-tax income can be ignored because the direct income tax is tiny. According to the SES, the average direct tax payment is less than 0.6% of average total household income during the periods concerned.

[10] The CPI data are available from the Statistical Yearbook Thailand published by NSO.

[11] I adopt the adult-male equivalence scales used in Townsend (1994). They are categorized by sex and age: 1 for male over 18; 0.9 for female over 18; 0.94 for male between 13 and 18; 0.83 for female between 13 and 18; 0.67 for both sexes between 7 and 12; 0.52 for both sexes between 4 and 6; 0.32 for both sexes between 1 and 3; 0.05 for both sexes less than a year old.

2.2 De…nition of Household Characteristics

We explore the compositional changes of seven household characteristics: education, occupation, economic sector, use of …nancial credit, age, gender, and community type of residence. For person-speci…c characteristics like education, occupation, economic sector, age, and gender, the characteristics of the highest earning member in the household are used. According to the SES, the contribution shares of the highest earning member to the total household earnings are 83 to 90 percent, varying in survey year.[12] Therefore, using the characteristics of the highest earning members to represent the household characteristics seems reasonable, at least for the purpose of analyzing household income. In this paper, we will consider this highest earning member as the head of household.

Education has …ve categories based on …nal level of attainment: no formal, primary, secondary, vocational, and university or higher. Sector has nine categories: agriculture, mining, manufacturing, electricity-gas-water, construction, trade-commerce, transport-communication, service, and economically inactive. Population is categorized into …ve age groups: 30 or less, 31-40, 41-50, 51-60, 61 or more, and two gender groups: male and female. For occupation, there are four broad categories: wage worker, farmer, non-farm entrepreneur, and the inactive. Each of these broad categories of occupation has sub-categories based on earning capacity. There are three sub-categories of farmer: small farmer, big farmer, and …sher and other farmer. Small farmers are the farm operators owning less than 40 rai of land or renting land.[13] Big farmers are the farm operators owning more than or equal to 40 rai of land. Fishers and other farmers include …shing, shrimp farming, forestry, and vegetable farming. There are three types of non-farm entrepreneur: non-farm self-employed, non-farm employer, and own-account professional. There are …ve types of wage workers according to the skill level and working sector: farm worker, general worker, production worker, service worker, and professional worker. Professional workers include technical workers and employed managers. The inactive group consists of rentiers living on property income and the assisted living on transfer income.

The community type of residence and credit use are household level characteristics. The community type is categorized into urban area, sanitary district, and rural area. The sanitary district is an area which has features between those of urban and rural areas. Credit use has two categories: user and non-user. This classi…cation is based on data from the asset and liability ‡ow record, which indicates

[12] The contribution shares of the highest earning members to the total household earnings decreased monotonically and gradually over time. They were 90% in 1976, 88% in 1981, 87% in 1986, 86% in 1988, 85% in 1990 and in 1992, 84% in 1994, and 83% in 1996.

[13] A rai is equivalent to 0.4 acre.

the changes in assets and liabilities with various …nancial institutions from …nancial transactions by any member of the household. From these ‡ow data of …nancial transactions, we can identify which households had any …nancial transactions over the sample period. If any member of the household used any of the …nancial intermediaries, such as commercial banks, savings banks, the BAAC (Bank of Agriculture & Agricultural Cooperative), government housing banks, …nancial companies, or credit …nanciers, the household is categorized as user.[14] The rest are non-users.

3 Growth and Income Distribution Dynamics in Thailand

3.1 Aggregate Trends of Growth, Inequality and Poverty

The size of the Thai economy grew between 1976 and 1996 in terms of both population and income. Total income grew much faster (6.7% per year) than the total population (1.7% per year) so that the average income increased by 5.0% each year.[15] Applying Purchasing Power Parity (PPP) in Penn World Tables 5.6, this growth implies that the annual per capita income increased from $1,210 in 1976 to $3,210 in 1996. Along with this rapid growth, the shape of the income distribution changed. Figure 1 contrasts the kernel density estimates of income distributions between 1976 and 1996 in logarithmic scale. Given sample observations $(x_1; ¢¢¢ x_n)$; the kernel density estimate at point x is:

$$\hat{p}(x) = \frac{1}{h} \sum_{i=1}^{n} w_i K\left(\frac{x - x_i}{h}\right)$$

where h is the bandwidth, n is the sample size, and w_i is the sample probability weight for the observation x_i such that $\sum_{i=1}^{n} w_i = 1$. With equal probability of sampling, $w_i = \frac{1}{n}$ for all i. K (¢) is the kernel function that assigns the relative weight for the points near x over the band. The shape of the estimated density depends on the choice of bandwidth as well as the kernel function. For the kernel function, the Epanechinikov kernel is used, that is

$$\begin{aligned} K(z) &= 0.75(1 - z^2); \quad if \quad |z| \leq 1 \\ &= 0; \quad if \quad |z| > 1 \end{aligned}$$

[14] The proportion of active users of …nancial intermediaries is a partial indicator of degree of …nancial intermediation activities since it does not count the households who join the intermediaries but do not actively use the intermediaries. This is true more for the …nancial institutions such as BAAC which deals with seasonal business of farming. However, the SES is representative not only across locations but also across seasons since it randomly samples over twelve months with equal probability for a given year. Therefore, the changes in this proportion can be a good proxy for the changes in the degree of …nancial intermediation over time.

[15] This annual average growth rate of equivalent income almost agrees with that of the real GNP per capita, which is 5.7% for this period (Source: Statistical Yearbook of Thailand).

For the bandwidth choice, we follow the suggestion of Silverman (1986), that is

$$h = 1:06 \min(¾; 0:75 IQR) n^{i 1=5}$$

where ¾ is the standard deviation and IQR the interquartile range of income distribution.

In Figure 1, two vertical lines represent the average income levels in each year; the left one for 1976 and right one for 1996. The gap between two lines displays the average income growth. The support of the income distribution shifted strictly to the right with the range of support widened between years. Figure 2 suggests the implications of these changes in distributional shape for changes in inequality and poverty between 1976 and 1996. The …rst panel in Figure 2 shows that the income distribution in 1996 is dominated by that in 1976 by the Lorenz ordering, which means that inequality has increased over time by any inequality indices obeying Pigou-Dalton's Principle of transfer, such as the coe¢cient of variation, the Gini coe¢cient, the class of Atkinson indices, and the class of the generalized entropy indices.[16] This can be con…rmed from the summary statistics of income in Table A.1 in the appendix. The second panel of Figure 2 shows that the cumulative distribution function in 1996 lies strictly below that in 1976, i.e. the distribution in 1996 stochastically dominates the distribution in 1976 by the …rst order. We say that an income distribution x dominates an income distribution y by poverty ordering if the given poverty index is smaller for distribution x than for y for every possible poverty line. Foster and Shorrocks (1988) established the equivalence relationship between the Foster-Greer-Thorbecke poverty ordering and the stochastic dominance ordering. The …rst order stochastic dominance is equivalent to the poverty ordering by head-count ratio. Thus, the second panel in Figure 2 suggests that the poverty level measured by the head-count ratio declined for any poverty line. Due to the nested property of the stochastic dominance ordering, this …rst order stochastic dominance implies stochastic dominance of income distribution in 1996 over the income distribution in 1976 by any higher order. Thus, again, by the equivalence relationship between Foster-Greer-Thorbecke poverty ordering and stochastic dominance ordering, the poverty declined between 1976 and 1996 by any Foster-Greer-Thorbecke poverty index for any poverty line. The third panel of Figure 2 displaying the generalized Lorenz ordering, which is equivalent to the second order stochastic dominance, is simply a con…rmation of this nested property. In summary, the evolution of aggregate income distribution of the Thai economy between 1976 and 1996 is characterized by growth in average income, increase in inequality, and poverty alleviation, and these are robust to the choice of indices of inequality and poverty.

[16] For the equivalent relationship between Lorenz ordering and Pigou-Dalton's Principle of transfer, and their welfare implication, see Dasgupta, Sen, and Starrett (1973).

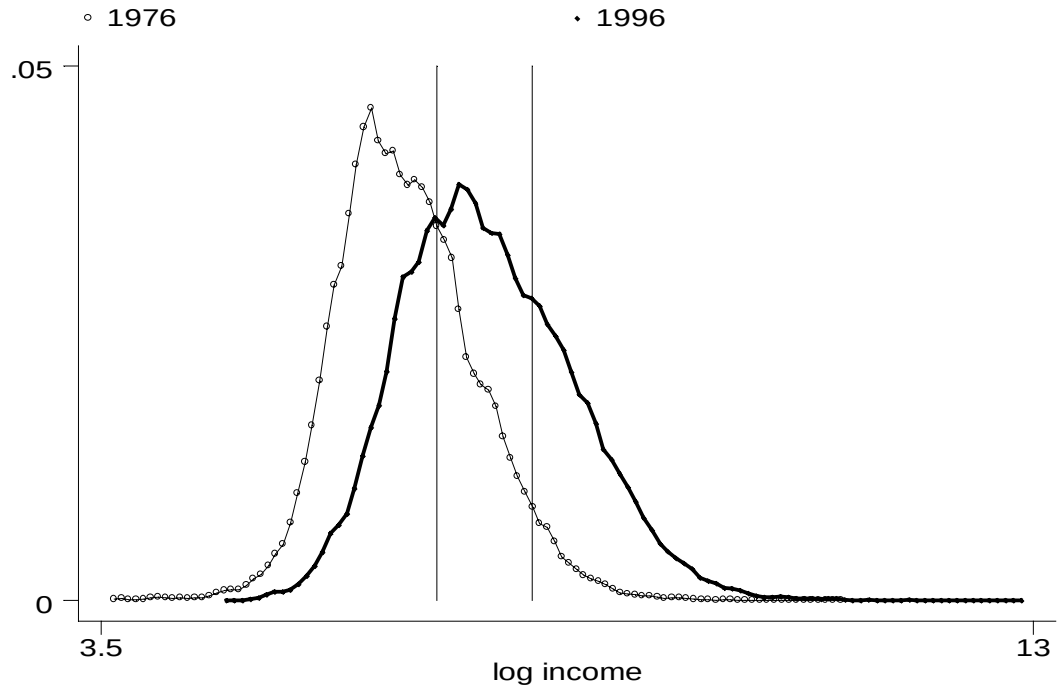
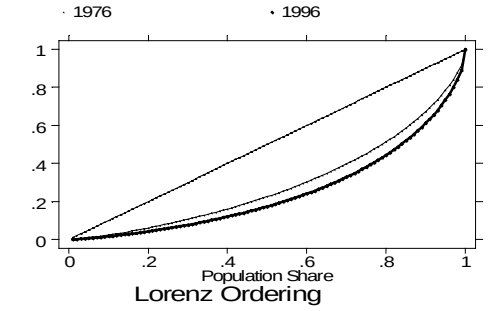
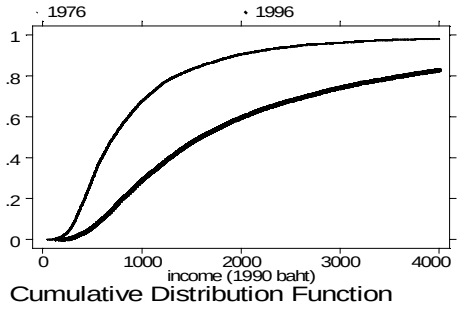


Figure 1. Estimated Densities of Log Income





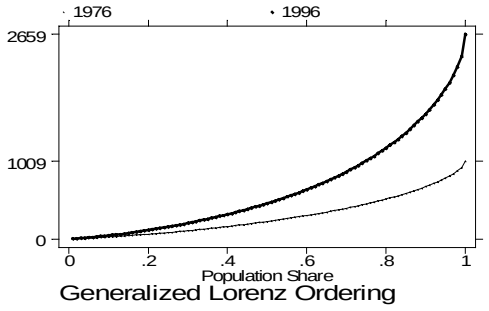


Figure 2. Inequality and Poverty Ordering

Using the Theil-L index as an inequality measure, Figure 3 summarizes the temporal pattern of growth with increasing inequality over time. It suggests that there were two turning-point years in temporal patterns of growth and inequality in Thailand. Except for a slight downturn of average income between 1981 and 1986, when the Thai economy su¤ered a macroeconomic adjustment after the oil shocks, we observe a sustained growth in average income over time. However, growth accelerated after 1986 at a rate of 8.0 percent per annum. So, in terms of growth, the 1986 is a turning point for the Thai economy. Except for a modest decrease between 1986 and 1988, the inequality has increased substantially till 1992. However, we observe a substantial drop in inequality between 1992 and 1996. So, with respect to inequality, the 1992 is a turning point in Thailand. Thus we may divide the two decades into three sub-periods: stage 1, the period of slow growth with increasing inequality (1976-1986), stage 2, the period of fast growth with increasing inequality (1986-1992), and stage 3, the period of fast growth with decreasing inequality (1992 - 1996).

Figure 4 shows that the temporal pattern of inequality is not speci…c to the Theil-L index. The temporal path of the Gini coe¢cient exactly matches that of the Theil-L. "Polarization," another dimension of inequality, deals with the dispersion away from the median to the upper and lower tails.[17] The concern of the polarization index is the collapse of the middle class. The right panel of Figure 4 suggests that more polarization accompanied the increasing inequality. The turning point year for polarization is also 1992.

To get numeric indices for the poverty level, we need to choose a speci…c poverty line. Two dollars a day per person in 1985 value is the poverty line adopted in this paper.[18] With this poverty line, Figure 5 suggests a reduction of poverty in all periods except during the recession between 1981 and 1986. The left panel displays the poverty indices of head-count ratio and poverty gap, and the right one the poverty indices that are sensitive to inequality among the poor.[19] From Figure 5, we note that the temporal pattern of poverty is driven by growth and not by inequality. It suggests that for each period, the growth e¤ect overwhelmed the inequality e¤ect on poverty.

[17] For the measurement for polarization, see Wolfson (1994).

[18] The poverty line of $2 a day per person is also adopted in a recent study of inequality and poverty in East Asian countries by Ahuja, Bidani, Ferreira, and Walton (1997). Using PPP in Penn World Tables 5.6, converting $2 a day in 1985 dollar corresponds to 536 baht per month in 1990 baht value. This poverty line is per capita, but we use equivalent income. Thus di¤erent poverty lines apply for households with di¤erent demographic structures.

[19] The Sen index depends on the Gini Coe¢cient among the poor, and the P_2 index depends on the squared coe¢cient of variation that is one of the entropy indices. So, when the inequality among the poor gets worse, the poverty measured by Sen index or P_2 index will increase even though there is no change in population share of the the poor. For details of poverty indices, see Ravallion (1993).

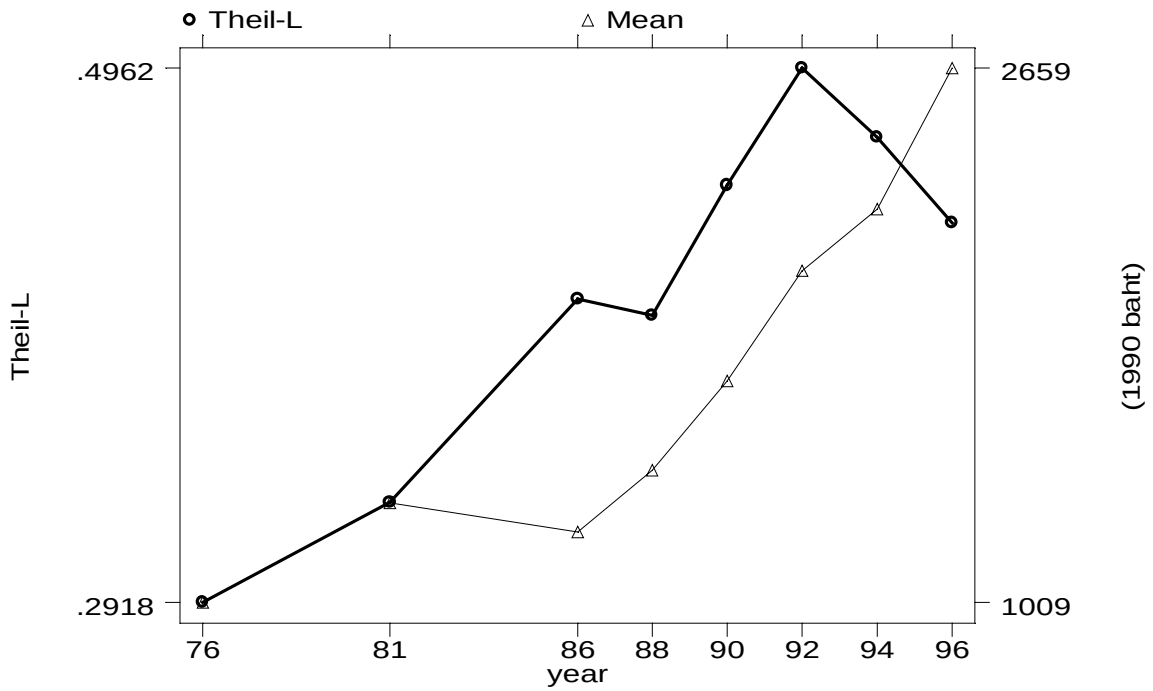


Figure 3. Growth and Inequality in Thailand

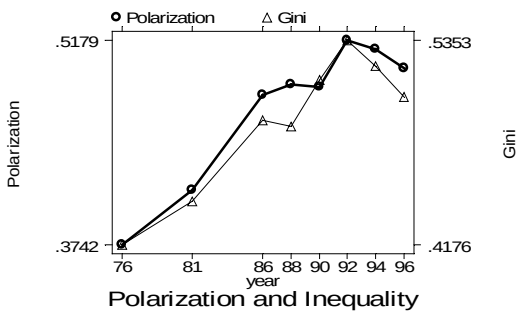
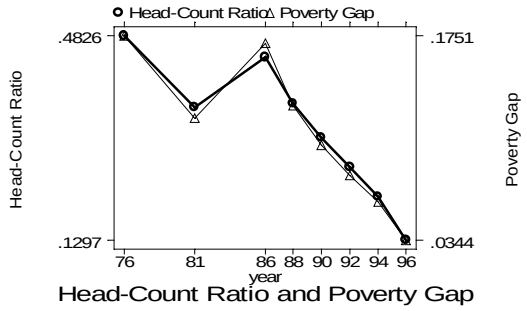


Figure 4. Trend of Other Inequality Indices



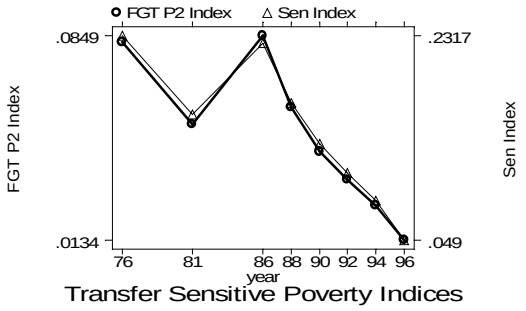


Figure 5. Trend of Poverty Indices

3.2 Sectoral Trends of Growth, Inequality, and Poverty

Figure 6 plots the growth of three percentile incomes, tenth percentile, median, and ninetieth percentile, indexed by each initial income level in 1976. It suggests that income grew among the poor as well as among the rich. However, the speed of growth di¤ered between them. Every of three income percentiles went upward except during the period between 1981 and 1986, but the distances across them widened over time. The average annual growth rate was three percent for the tenth percentile income while it was …ve percent for the ninetieth percentile income. This induced a widening income gap between the poor and the rich over time, hence the increase in inequality, even with decrease in poverty. This pattern of income growth in Thailand contrasts that of US wage growth suggested by Juhn, Murphy, and Pierce (1993). According to them, the tenth percentile weekly wage in US has declined continually ever since 1970, and after 1982 even to the value less than the wage in 1963 while ninetieth percentile wage increased almost continuously. This pattern of wage growth in US generates rising inequality and increasing poverty as well. The aspects of inequality problem in Thailand over last two decades seem di¤erent from those in US in 1980's and 1990's.

We observe a similar growth pattern, i.e. growth for everyone but with di¤erential speed, for every partition of the economy by the household characteristics of education, credit use, occupation, sector, age, gender, and community type. Figure 7 plots the trends of average income of each sub-group indexed by its own 1976 average income, which shows that every sub-group's average income grew, but higher income sub-groups, i.e. higher education group, credit users, non-farmers, service sector, middle-aged households, female-headed households, and urban areas grew faster than the counterpart poorer sub-groups. In sum, the income gap across sub-groups widened over time.

There exists a rough ordering over sub-groups by their own inequality levels. It seems that inequality prevails more extensively among the rich sub-groups than among the poor sub-groups with the exceptions of educational sub-groups and community type sub-groups. For example, the industrial and service sectors have higher inequality than the agriculture sector. Big farmers and …shers have higher inequality than small farmers. The inequality among non-farm entrepreneurs with employees is higher than that of non-farm self-employed without employees. The inequality among the self-employed is higher than among wage workers, which may be because pro…ts have more uncertain prospect than wages. Among wage workers, high-skilled workers (professional workers, service workers, and production workers) have higher inequality than the low-skilled workers (farm workers and general workers).

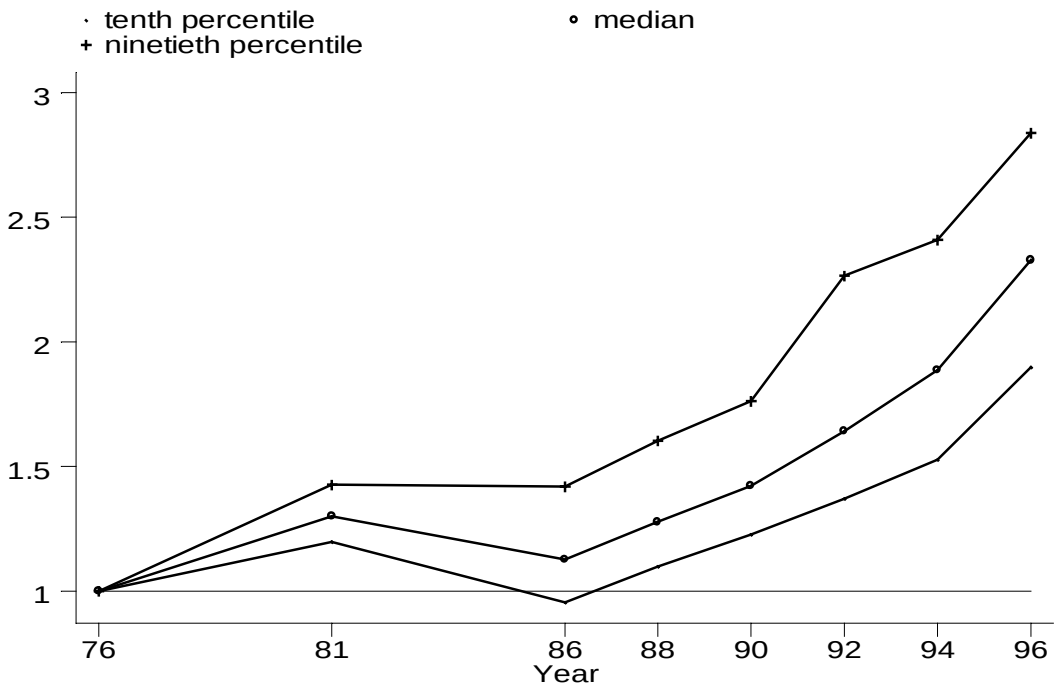


Figure 6. Indexed Percentile Income

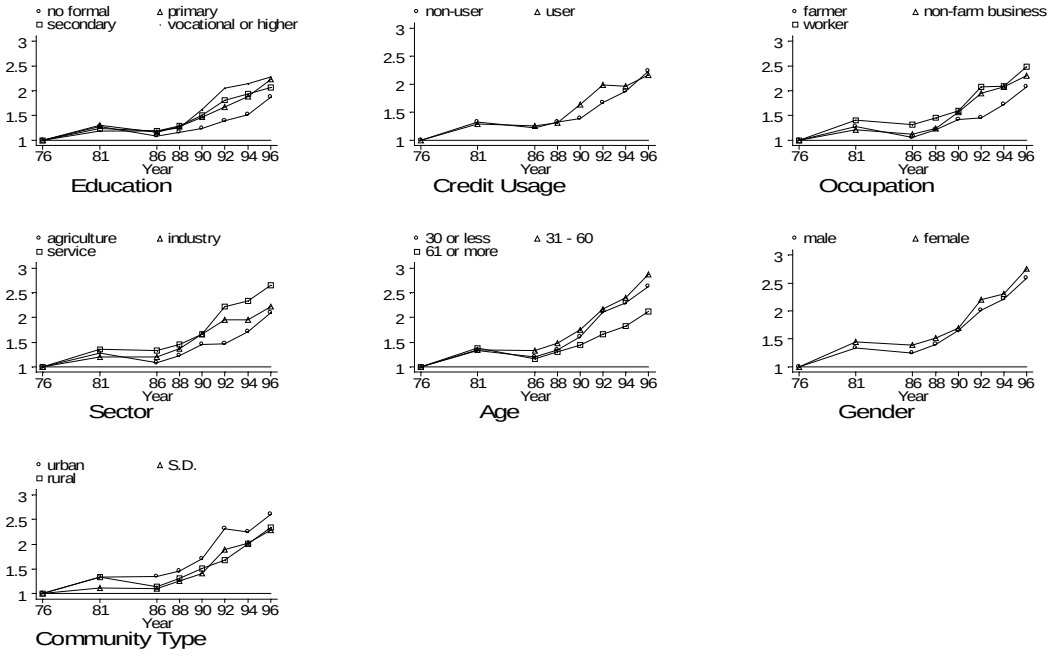


Figure 7. Indexed Average Income by Sub-group

Figure 8, which plots the sub-group inequality evolution over time, measured by the Theil-L entropy index normalized by 1976 values, suggests that increasing inequality seems universal over all sub-groups as the average income growth. Figure 9, which plots the sub-group inequality evolution over time, measured by the head-count ratio normalized by 1976 values, suggests that poverty alleviation also happened for every sub-group. Each sub-group shows patterns of growth, inequality, and poverty more or less similar to aggregate trends.

In stage 3, 1992-1996, we observe an interesting pattern of sub-group growth. Over this period, the growth among the rich sub-groups slowed down while it accelerated among the poor sub-groups. Furthermore, this catchup of poor sub-groups was so fast that the growth rates of the poor sub-groups even exceeded those of the rich sub-groups. Agriculture grew the fastest (9.3 percent) among sectors. The income growth rates of farmers (10 percent) and unskilled workers (7.5 percent) exceeded those of skilled workers (4 percent). Related to these, the growth rates over community types are ordered by rural areas (9.1 percent) > sanitary district (5.4 percent) > urban areas (3.2 percent), which is exactly the inverse ordering as before 1992; urban areas (5.9 percent) > sanitary district (3.8 percent) > rural areas (3.1 percent). The primary education (7.7 percent) group grew faster than the university education group (1.5 percent). Also the growth rate of the inactive users of intermediaries (8.2 percent) was much higher than that of the non-users (2.3 percent). Recall that stage 3 was the period when there was a growth with decreasing inequality. This catchup growth of the poor sub-groups in stage 3 may explain this.

3.3 Changes in Relative Income

We mentioned that the income gaps across sub-groups widened over time in terms of various characteristics. Here we want to sort out the income di¤erences focusing on education, occupation, and participation in …nancial credit, which are characteristics subject to self-selection. To determine the magnitude of income gaps purely due to the di¤erence in these characteristics, we need to control other characteristics. Thus we run simple OLS regressions of log income on categorical variables of occupation, education, and credit use, controlling for region, community type, gender, and experience.[20] We measure the distances across sub-groups by the relative incomes of sub-groups to a reference sub-group, usually the poorest. We choose farmer, primary education, and non-user of credit as reference groups respectively for occupation, education, and participation in …nancial credit. The regression

[20] Experience is calculated by age less years of schooling less 6 so that it measures the "e¤ective age" in the labor market.

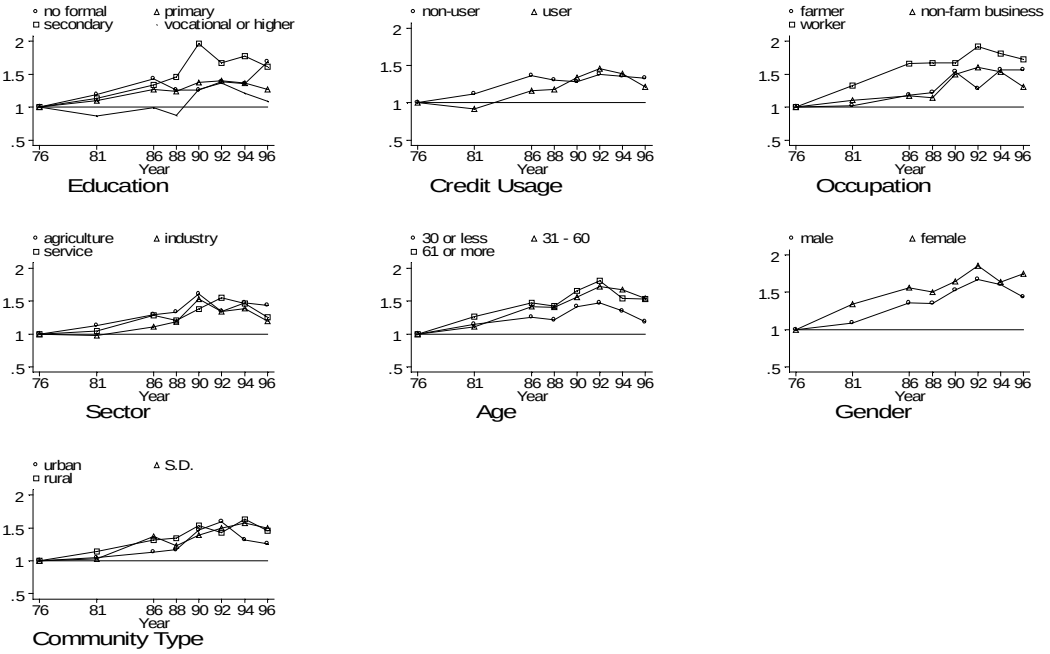


Figure 8. Indexed Inequality by Sub-group

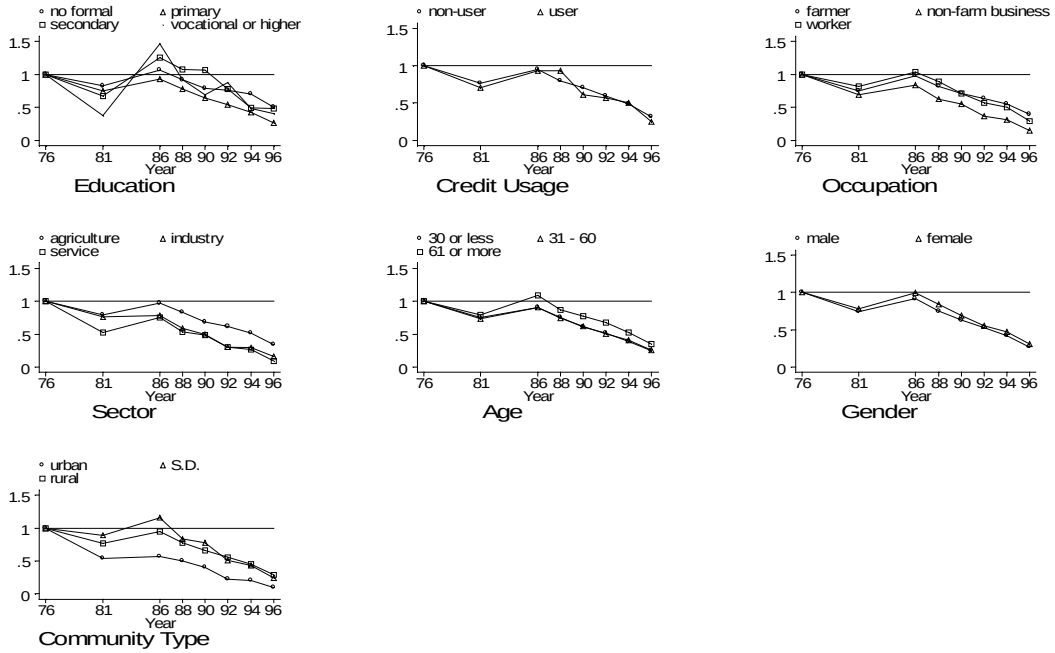


Figure 9. Indexed Poverty by Sub-group

results are reported in Table A.4 in the appendix. From these regressions, we calculate the relative incomes of occupation groups, education groups, and credit use groups as follows. A coe¢cient of this regression in year t, $®_t^{Â_j}$ on a category $Â_j$ of characteristic Â is the di¤erence in log income y_t between category $Â_j$ and reference category $Â_0$, that is,

$$®_t^{Â_j} = \ln y_t^{Â_j} ¡ \ln y_t^{Â_0} = \ln(\frac{y_t^{Â_j}}{y_t^{Â_0}}):$$

Therefore, we obtain the relative income of $Â_j$ to $Â_0$ in year t by taking exponential on $®_t^{Â_j}$.

Figures 10.1 through 10.3 display the trends of relative incomes of occupations, education groups, and credit use groups over time. They suggest that the income gaps between relatively rich sub-groups and relatively poor sub-groups have more or less diverged over time, but only moderately. The relative income of university education to primary education has increased substantially from 2.38 to 2.96. The relative income of rentier to farmer has also increased substantially, from 1.28 to 1.53. Other than these two cases, the income gaps between the rich sub-groups and poor sub-groups were quite stable or only slightly increased. Furthermore, due to the small numbers of university education group and rentiers, the substantial divergence in these income gaps may not contribute much to the increasing aggregate inequality. Thus, the increase in aggregate inequality in Thailand may not be explained much by the price e¤ect, i.e. increasing premia over productive attributes. The aggregate inequality dynamics may well be related to the distributions of the productive factors themselves. We explore whether this is actually the case in Thailand by examining the distributions of productive socioeconomic characteristics such as occupation, education, and participation in …nancial credit and their relationships to wealth.

3.4 Evolution of Socioeconomic Characteristics

Between 1976 and 1996, the socio-economic characteristics of the Thai economy have changed in many respects: demographic composition, urbanization, educational attainment, sectoral and occupational structure, and level of …nancial participation. The changes in these socioeconomic characteristics a¤ect the shape of aggregate income distribution as the compositional contents of the population changes. Here we brie‡y describe the salient changes in socioeconomic characteristics between 1976 and 1996. Tables A.2 and A.3 in the appendix report the trends of employment shares and income shares by household characteristics in detail.

Figure 10.1 Relative Income to Farmer

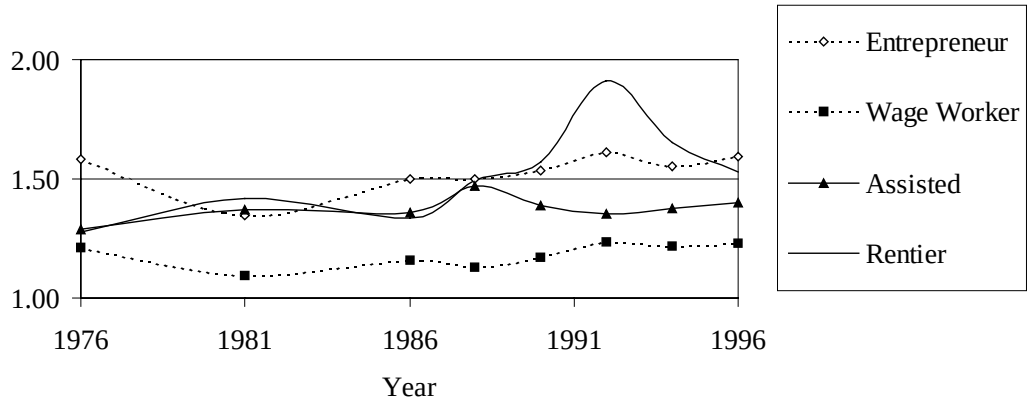


Figure 10.2 Relative Income to Primary Education

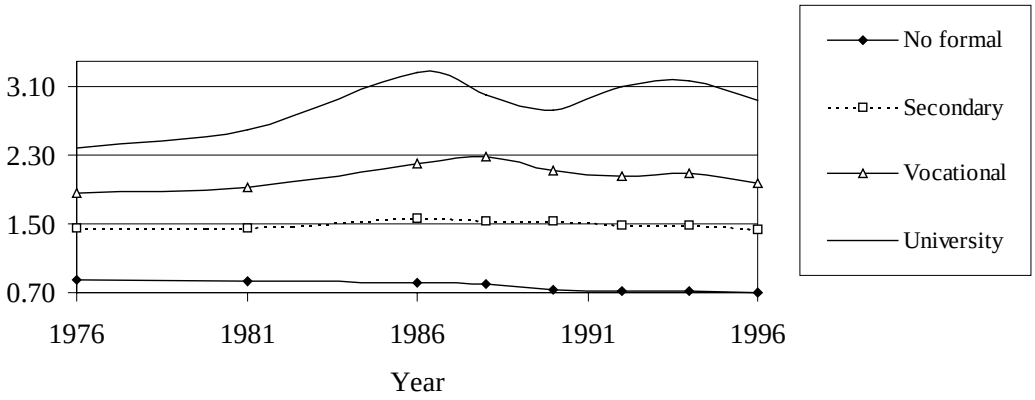
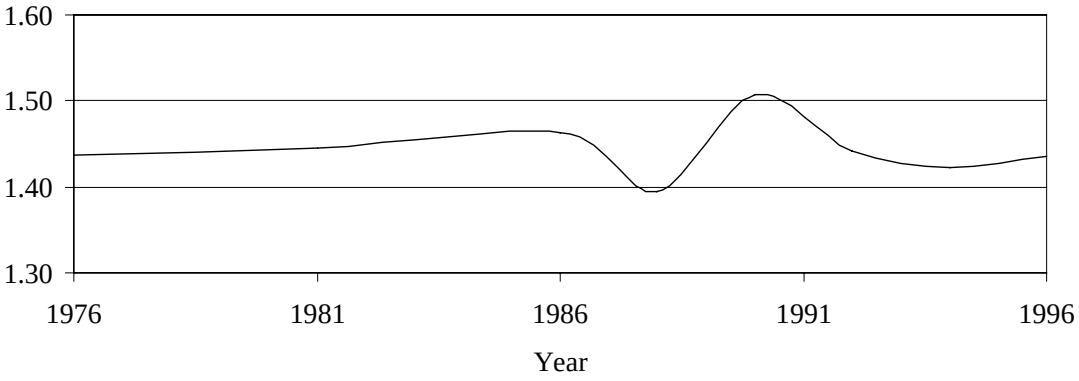


Figure 10.3 Relative Income of Credit User to Non-user



3.4.1 Demographic Changes

Over the two-decade period, the demographic composition of Thai households substantially changed. The average family size dropped from 5.5 to 3.7, while the total population increased from 43 million persons to 60 million persons. The life expectancy at birth increased by nine years, from 65 years to 74 years. The average age of the labor force increased from 31 to 37. The proportion of households with head more than 60 years old increased from 16 percent to 22 percent in the Thai population. The proportion of the female-headed households increased from 17 percent to 24 percent. As the aged and female-headed households increased, the proportion of economically inactive households increased substantially from 10 percent to 16 percent.

3.4.2 Occupational Transformation with Industrialization

Agriculture has been a dominant sector of the Thai economy for a long time in employment share and income share alike. The Thai economy has been one of the major rice suppliers in the world market. However, the relative importance of agriculture has fallen in recent days. According to the SES, 61 percent of households were involved in agriculture and accounted for 46 percent of income in 1976, while 42 percent and 25 percent, respectively, in 1996. After 1994, the service sector became the leading sector of the Thai economy in terms of income share, though agriculture is still the largest sector in terms of employment share. However, in terms of speed of growth, construction and manufacturing are the fastest growing sectors; the share of both sectors increased from 5.5 percent in 1976 to 12.9 percent in terms of employment share, and from 9.1 percent to 18.5 percent in term of income share. Thailand has been rapidly industrialized.

Along with this industrialization, the urban ratio rose from 15 percent in 1976 to 24 percent in 1996, and the major occupation was switched from farmer to wage worker. The average income of households with wage earning heads was 1.9 to 2.8 times higher than the farming households. Controlling for other characteristics, wage workers still earned approximately 20 percent more than farmers. Therefore, there existed an incentive for farmers to change their occupation to wage workers. Thus the proportion of farmers decreased from 53 percent to 27 percent while that of wage workers increased from 28 percent to 44 percent. In particular, among wage workers, the proportion of unskilled workers decreased while the skilled workers in industrial and service sectors increased.

Ironically, along with this fast and continual industrialization, the proportion of non-farm entrepreneurs

was stable around 14 percent until 1992, and then it slightly increased to 16 percent in 1996. However, within industrial entrepreneurs, production capacity seems to have increased over time. In 1976, the proportion of non-farm entrepreneurs hiring paid employees was only 10 percent, but by 1996 it had doubled to 21 percent. These observations suggest interesting features of occupational choice in Thailand. With the rapid industrialization, there may well be an increase in demand for industrial entrepreneurs. Furthermore, average income ratio of industrial entrepreneurs to farmers increased from 2.4 times to 3.2 times between 1976 and 1992, and then decreased to 2.6 times. Controlling for other characteristics, we still observe that the income gap between them has maintained. Therefore, with these rapid industrialization and persistent income gap between famers and non-farm entrepreneurs, the stable proportion of industrial entrepreneurs suggests that there might be a barrier to entry to becoming an industrial entrepreneur so that the labor force released from the agricultural sector during industrialization is absorbed in industrial sectors as wage workers rather than entrepreneurs. It suggests that the theories of occupational choice with credit constraints based on personal wealth, proposed by Evans and Jovanovic (1989), or Lloyd-Ellis and Bernhardt (1999), seem to be consistent with these observations in Thailand.

3.4.3 Educational Expansion

The working population attained more education; their average years of schooling increased from four to six. The proportion of households with heads with no formal education fell from 24 percent to 9 percent. Proportions of higher education groups increased by approximately a factor of two for secondary education (from 5.0 percent to 10.1 percent) and vocational education (from 2.0 percent to 4.5 percent), and by a factor of …ve for university or higher education (from 0.9 percent to 5.1 percent). In terms of speed of increasing average years of schooling, this educational expansion was comparable to the neighboring East Asian countries.

However, the general level of formal education in Thailand seems quite low compared with other countries. According to Barro and Lee (1993), the average population shares who …nish the secondary level education as …nal attainment in 1975 are 34 percent in OECD countries, 12 percent in East Asia, 11 percent in Latin America, 8 percent in South Asia, and 7 percent in Sub-Saharan Africa. Note that it is only 5 percent in Thailand, which is lower than any of the regions above. With this low initial level of secondary education, the expansion of secondary education was not that fast either compared with other East or Southeast Asian countries. Ahuja, Bidani, Ferreira, and Walton (1997) compare the increase in net enrollment rate for secondary education between 1970 and 1995. According to their

report, it increased from 45 percent to 93 percent in South Korea, from 75 percent to 87 percent in Taiwan, from 40 percent to 76 percent in the Philippines, from 26 percent to 56 percent in Malaysia, from 13 percent to 55 percent in Indonesia, and from 35 percent to 51 percent for the People's Republic of China. In Thailand, it has increased from 18 percent to only 35 percent.

The premium for higher education in Thailand seems very high. In 1976, without controlling for other characteristics, the secondary-eduction or vocational-education households earned more than double the income of the primary-education households. For the university-education households, the gap becomes quadruple. Even after controlling for other characteristics, the secondary-education households earned 50 percent higher income than primary-education households in 1976. For vocational education and university education, the relative incomes were 1.9 times and 2.4 times in 1976, respectively. Furthermore, Figure 10.2 suggests that those premia were increased or stable over time. Thus there existed clear incentive to pursue education higher than the primary level. However, the vast majority of people, around 92 percent in 1976 and 80 percent in 1996, do not pursue education beyond the primary level. There seems to exist a bottleneck to enter secondary education.

3.4.4 Expansion of Credit Use

The user of …nancial credit earned 2.1 times to 2.5 times higher income than the non-user earned. Even after controlling for other characteristics, credit users still had approximately 40% higher income than non-users. Therefore, there were substantial bene…ts of joining the …nancial intermediaries. With these premia of using credit, the expansion of credit use is the most remarkable compositional change in terms of both speed and magnitude among other characteristics. The population share of households who actively used any of the …nancial intermediaries of commercial banks, savings banks, government housing banks, the BAAC, …nance companies, or credit …nanciers, increased from 6 percent to 26 percent. Each year one additional percent of households have used …nancial intermediaries.

4 Decomposition of Growth and Income Distribution Dynamics

We observed the factors that possibly a¤ect the income distribution dynamics: sectoral evolution of growth, inequality, and poverty; changes in relative incomes across characteristics; and compositional changes in household characteristics. In this section, we quantify the importance of each factor on the evolution of growth, inequality, and poverty to assess which factors were signi…cantly at work. We …rst

decompose the growth in average income and increase in inequality measured by the Theil-L entropy index applying the discrete version chain rule. This index decomposition helps us to numerically identify the crucial characteristics that contribute to average income growth and the inequality changes through the compositional changes and the divergence in relative incomes. Then we decompose the poverty dynamics using three popular FGT poverty indices of head-count ratio, poverty gap index, and P_2. The poverty reduction is decomposed into the growth component and distributional component, and we further decompose the compositional e¤ects in both components. This index decomposition approach allows us to have detailed decomposition results. However, this methodology relies on the speci…c properties of the chosen indices. In order to check the robustness of the compositional e¤ects, we use another decomposition methodology based on the nonparametric estimation of counterfactual distributions that does not depend on the speci…c choice of indices. It turns out that both methods yield similar results.

4.1 Components of Aggregate Income Distribution

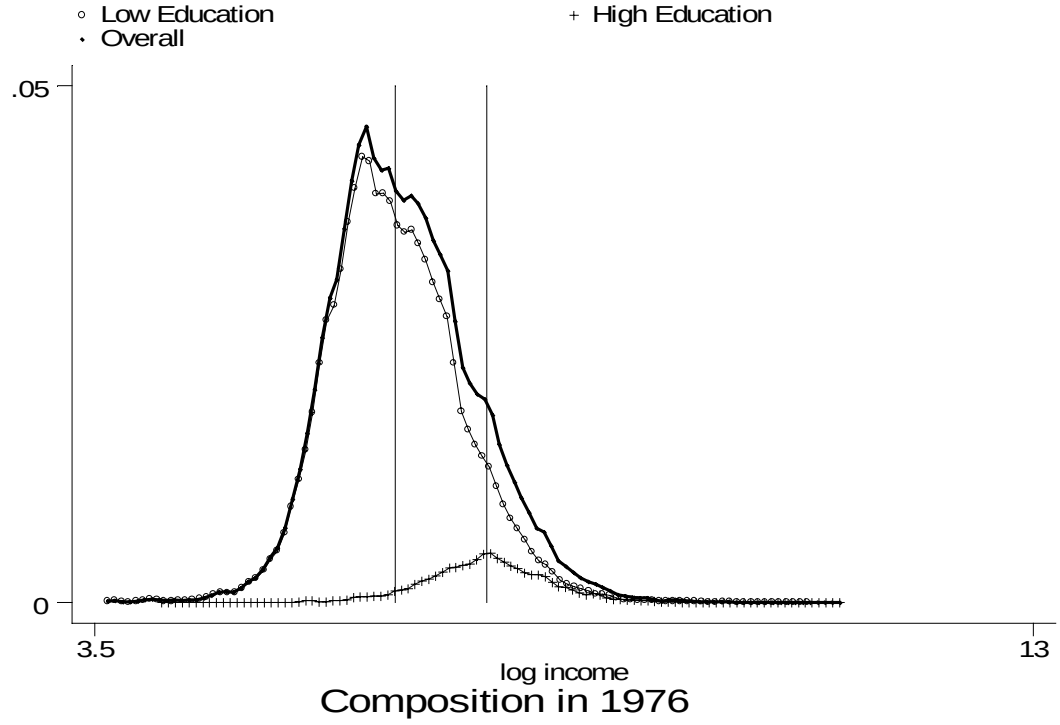
In this section, we illustrate the components of the aggregate income distribution by decomposing it into di¤erent sub-group distributions. We use both educational categories and occupational categories to show the contrasting features. This motivates the Theil-L index as an appropriate choice of inequality measure for the purpose of the decomposition.

Figure 11 overlays the income distributions of dichotomous education sub-groups on the aggregate distribution in the years of 1976 and 1996. The "low education" category includes the primary or lower education sub-groups. All the other education groups higher than the primary level belong to the "high education" category. Each sub-group density is scaled by its own population proportion to display its importance in the composition of the aggregate distribution.[21] Two vertical lines represent the average income levels of sub-groups, the left one for the poor and the right one for the rich, so that the distance between the two lines represents the income gap between sub-groups. Figure 12 plots the same information with the occupational dichotomy, farmers and wage workers. These scaled densities of sub-groups help display the possible factors that determine the shape of aggregate distribution.

Figure 11 shows that the shape of the aggregate distribution resembles that of the low education group in 1976. It suggests a common sense observation that the aggregate shape is a¤ected by the shapes of

[21] Therefore, integrating the area below the estimated density of each sub-group, we get the proportion of the sub-group in the population.

Figure 11. Composition of Aggregate Distribution by Education



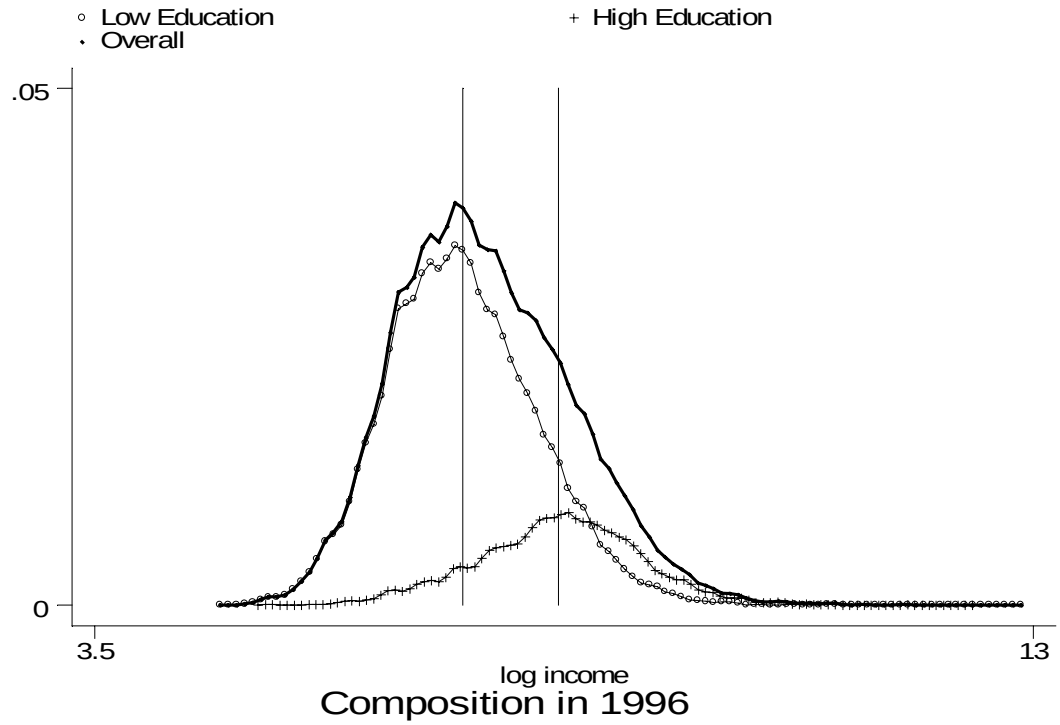
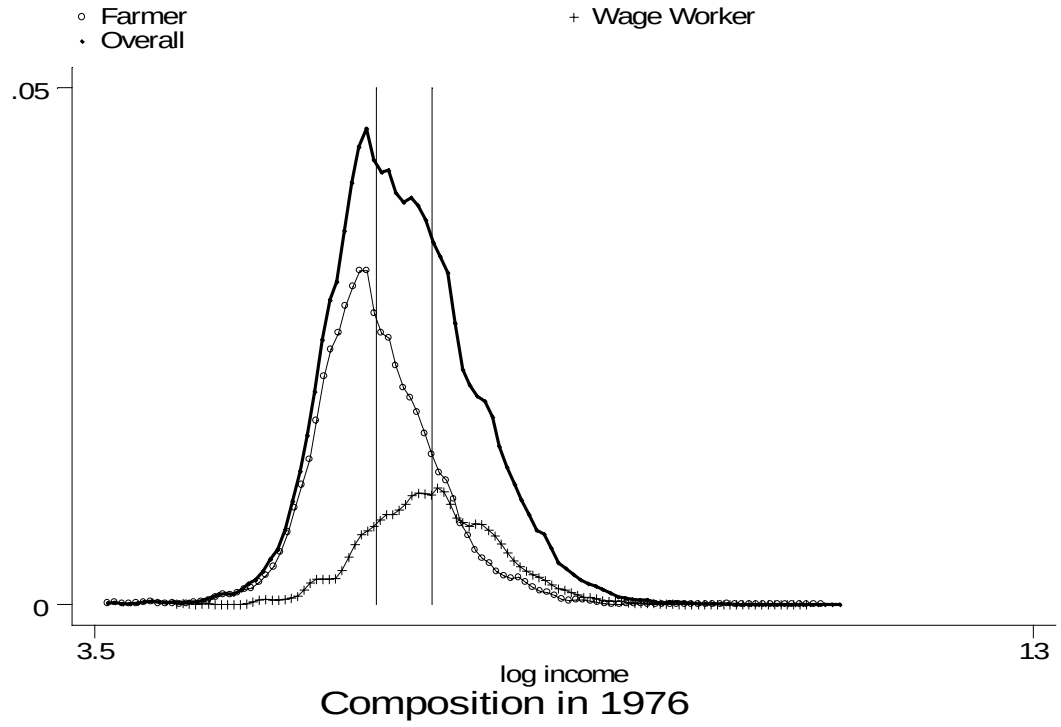
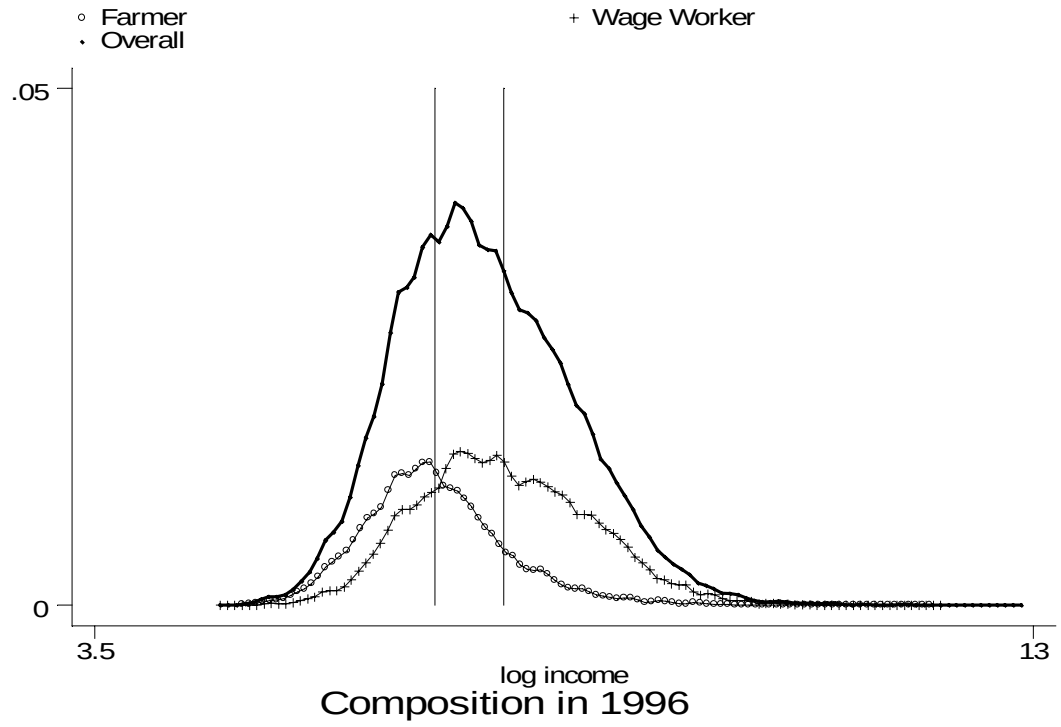


Figure 12. Composition of Aggregate Distribution by Occupation





component sub-group distributions weighted by their compositional shares. Therefore, the aggregate shape of income distribution will change as the compositional proportions change. Comparison of the upper panel, the composition in 1976, with the lower panel, the composition in 1996 in Figure 11 makes this point. In 1996, the shape of the aggregate distribution is still dominated by that of the low education group, but to a lesser extent than in 1976. So, the overall dispersion is less likely driven by the low education group. This point becomes much clearer in Figure 12. In 1976, the shape of the aggregate distribution is mainly driven by that of farmers. However, in 1996, after the massive shift of people from the farmers to the wage workers, overall shape is rather driven by that of wage workers.

However, the distributional shape of the high education group, even with its small proportion, is important in determining the shape of the aggregate distribution via another route. Because of the income gap between education levels, the high-education group stretches the aggregate distribution to the right, hence generating the skewness in the aggregate distribution, which is a big source of inequality. Therefore, the skewness of the aggregate distribution will be a¤ected by the relative proportions of sub-groups as well as by the income gap across sub-groups. With the educational expansion, more weight is put on the right tail of the aggregate distribution, which will result in an increase of the skewness of the aggregate distribution and hence aggregate inequality. This e¤ect of the compositional change through skewness will not be uniform over time. When the rich sub-group is tiny at the initial date, the population shift from the poor sub-group to the rich sub-group increases the skewness. However, as the rich sub-group becomes large enough, that population shift decreases the skewness since the population gets more homogeneous. Actually this non-uniform e¤ect of compositional change on inequality is exactly the underlying force of inverted-U shaped Kuznets curve. In Thailand, there were only a few households with higher education in 1976. Therefore, the educational expansion increased the skewness of the aggregate distribution.

In summary, the shape of the component sub-groups' income distributions and the income gap across sub-groups are the determinants of aggregate income distribution. The inequality from the …rst source is called within-group inequality and the latter is called across-group inequality. Note that both sources of inequality a¤ect the aggregate inequality through the compositional shares of component sub-groups so that the change in sub-group composition plays an important role in the evolution of the income distribution via both routes- within-group inequality and across-group inequality. In the next subsection, we adopt the Theil-L entropy as an inequality measure, which can be decomposed in the same manner as above.

4.2 Index Decomposition of Growth and Inequality Dynamics

4.2.1 Methodology

In the previous subsection, we motivated a decomposition of inequality into within-group inequality due to component sub-group distributions and the across-group inequality due to the income gap across sub-groups. Among inequality indices, there is a class of indices called generalized entropy indices that are useful to address this type of inequality decomposition. Theil (1967) suggested two original entropy indices called Theil-T and Theil-L, which were generalized and discussed by Bourguignon (1979), and Shorrocks (1980, 1984) as a unique class of inequality indices that are consistently decomposable in the way described above. The generalized entropy indices are parameterized by a single real number c as in the following formula:

$$\begin{aligned} I_c(y) &= \frac{1}{n}\frac{1}{c(c-1)}\sum_{i=1}\left[\left(\frac{y_i}{\mu_1}\right)^c - 1\right]; \quad c \neq 0,1 \\ &= \frac{1}{n}\sum_{i=1}\log\frac{\mu_1}{y_i}; \quad c = 0 \\ &= \frac{1}{n}\sum_{i=1}\frac{y_i}{\mu_1}\log\frac{y_i}{\mu_1}; \quad c = 1; \end{aligned} \tag{1}$$

where n is the population size, μ_1 is the mean income, and y denotes the income distribution prospect $(y_1; \cdots; y_n)$. It can be decomposed into the within-group inequality and the across-group inequality such that

$$\begin{aligned} I_c(y) &= WI_c(y) + AI_c(y); \\ WI_c(y) &= \sum_{k=1} p^k \left(\frac{\mu_k}{\mu_1}\right)^c I_c(y^k); \quad \text{and} \quad AI_c(y) = I_c(\mu_1; \cdots; \mu_K) \end{aligned} \tag{2}$$

where WI denotes the within-group inequality, AI the across-group inequality, k the index of sub-group, p^k the population proportion of sub-group k, y^k the income prospect of sub-group k, and μ_k the average income of sub-group k.

This decomposition suggests that the across-group inequality is de…ned from the mean income difference across sub-groups using the same index formula for the aggregate. If everyone in the same sub-group has the same sub-group mean income, then the total inequality simply coincides with the across-group inequality using the same formula. The within-group inequality is the weighted sum of sub-group inequalities again using the same formula. However, it is clear that only for the indices with c = 0 or 1, Theil's original indices, do the weights sum up to unity. Therefore, to address the e¤ects

of compositional changes on inequality dynamics, the natural choice would be either I_0 (Theil-L) or I_1 (Theil-T). For Theil-L, the weights for sub-group inequalities are the population shares while for Theil-T, they are income shares. The income share changes when the relative income gaps change. So, the within-group inequality is a¤ected by the changes in relative incomes across sub-groups, which is supposed to be captured by the changes in across-group inequality. Therefore, we cannot disentangle the changes in within-group inequality from the across-group inequality with c = 1, and hence only the Theil-L index is appropriate for the purpose of our decomposition analysis. For the remainder of the discussion, the inequality index I will refer to Theil-L index I_0:

Using the Theil-L index, Figure 13 decomposes the trend of aggregate inequality into those of within-group inequality and across-group inequality, partitioning the economy by education, occupation, and credit use. It clearly shows that the increasing trend of aggregate inequality is associated with both sources of within-group inequality and across-group inequality, but its ‡uctuation pattern is driven by the across-group inequality. The within-group inequality gradually increased without much ‡uctuation.

For the Theil-L index, the decomposition formula (2) is written as follows:

$$I = WI + AI;$$
$$WI = \sum_{k=1}^{K} p^k I^k; \quad \text{and} \quad AI = \sum_{k=1}^{K} p^k \log \frac{\mu_1}{\mu_k}:$$

The within-group inequality is the sum of sub-groups inequality levels weighted by their population shares while the across-group inequality is the sum of the log inverse relative incomes also weighted by their population shares.

Note that the average income μ is an index of the central tendency of the income distribution that is also weighted by population share. More formally,

$$\mu_t = \sum_{k=1}^{K} p_t^k \mu_t^k.$$

So, the growth of average income is decomposed into two parts; one from the population shift from the lower income groups to higher income groups, and the other from the growth within sub-groups such that:

$$\Delta \mu = \sum_{k=1}^{K} \overline{p^k} \Delta \mu^k + \sum_{k=1}^{K} \overline{\mu^k} \Delta p^k; \tag{3}$$

where Δ denotes the di¤erence over time and the upper bar denotes the average over time. It is simply an application of a discrete version chain rule, which can be applied to any additive indices. The …rst

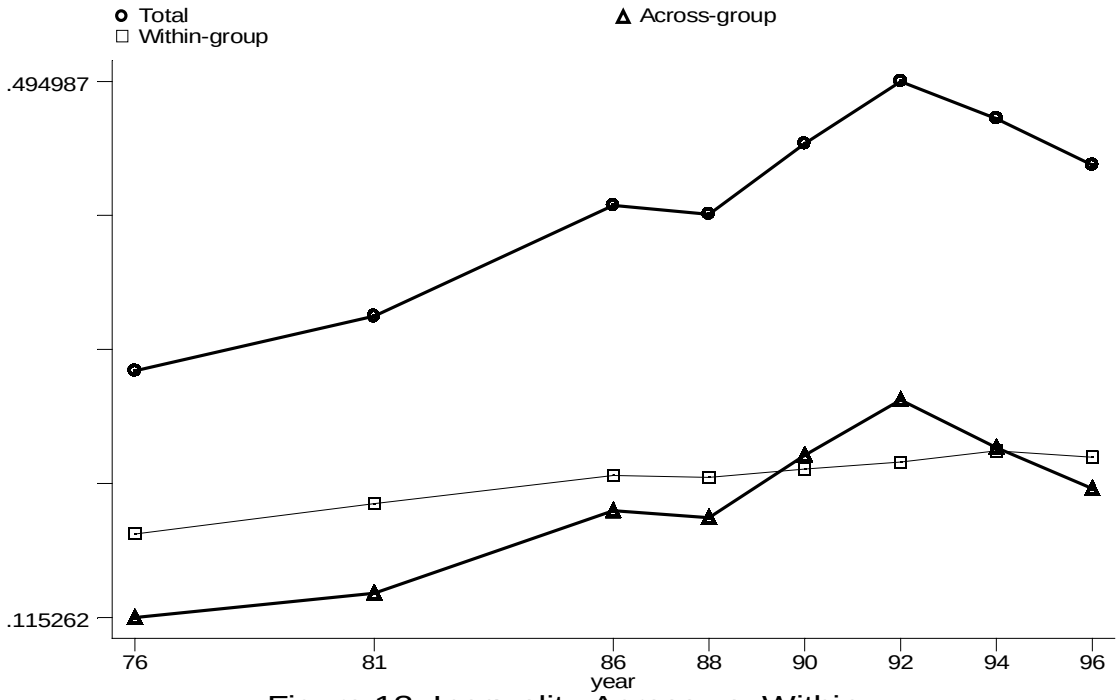


Figure 13. Inequality Across vs. Within

term in (3) is the component of growth within sub-groups and the second term in (3) is the growth due to the compositional changes in population.

Due to the additive structure of the Theil-L, we can apply the discrete chain rule to the aggregate inequality change over time as follows:[22]

$$¢I = ¢WI + ¢AI; \tag{4}$$

$$¢WI = \sum_k \overline{p^k} ¢I^k + \sum_k \overline{I^k} ¢p^k; \tag{5}$$

$$¢AI = \sum_k \overline{p^k} \left(\frac{\mu^{1k}}{\mu^1} - 1 \right) ¢\log {}^1\!k + \sum_k \left(\frac{\mu^{1k}}{\mu^1} - \log \frac{\mu^{1k}}{\mu^1} \right) ¢p^k: \tag{6}$$

The interpretation of the decomposition of within-group inequality change (5) is similar to the average income growth decomposition. The interpretation of the decomposition of the across-inequality change (6) seems unclear at …rst glance. However, each term in (6) has a straightforward interpretation related to the aspects of the changes in relative income and in skewness due to the compositional changes. Focusing on the dichotomous case for (6), we show that the formula of the Theil-L index is appropriately structured to address the observations about inequality dynamics in terms of changes in component sub-group inequalities, income gap across sub-groups, and their composition.

Consider an economy with dichotomous sub-groups, l and h. The group l has lower mean income ${}^1\!l$ and the group h has higher mean income ${}^1\!h$. Then the decomposition equations (5) and (6) are written as follows.

$$¢WI = \left[1 - \overline{p^h} \right] ¢I^l + \overline{p^h} ¢I^h + \left[\overline{I^h} - \overline{I^l} \right] ¢p^h; \tag{7}$$

$$¢AI = \overline{p^h} \left[\overline{\varsigma^h} - 1 \right] ¢\log {}^1\!h - ¢\log {}^1\!l + \left[\overline{\varsigma^h} - \overline{\varsigma^l} - \log \frac{\overline{\varsigma^h}}{\overline{\varsigma^l}} \right] ¢p^h; \tag{8}$$

where $\varsigma^k \equiv \frac{{}^1\!k}{{}^1\!}$ is the relative income of sub-group k for $k = l; h$. We will omit the upper bar notation unless it is necessary for clarity. In the course of development, the households shift from the low income group l to the high income group h, i.e. $¢p^h > 0$:

[22] This method of decomposition was …rst adopted by Mookherjee and Shorrocks (1982) to decompose the trend of increasing inequality of UK by age groups.

From equation (7), the contribution of the increase in sub-group k inequality ΔI^k is weighted by the average population share of that sub-group $\overline{p^k}$. The direction of the contribution of a population shift, Δp^h to ΔWI; depends on the difference of inequality levels between sub-groups $\overline{I^h} - \overline{I^l}$. If the high income group has a higher level of inequality, the shift from l to h will increase WI. Otherwise, it will decrease WI.

Now consider equation (8) for the across-group inequality dynamics. Note that $\gamma^h > 1$ since $\tau_h > \tau_l$ by construction. So, the coefficient of $\left[\Delta \log \tau^h - \Delta \log \tau^l\right]$ in equation (8) is positive. Also note that $\Delta \log \tau^k = \Delta t g^k$, where g^k is the growth rate of sub-group k between time interval Δt. So, we have $\left[\Delta \log \tau^h - \Delta \log \tau^l\right] = \Delta t \left[g^h - g^l\right]$. The growth rate difference between sub-groups will change the across-group inequality over time. If $g^h - g^l > 0$, i.e. the high income group grows faster than the low income group, AI will increase since the income gap between the two will diverge and vice versa. Therefore, the first term in (8) captures the effect of changing relative income on inequality dynamics due to growth rate differences across sub-groups.

The remaining term is $\left[\overline{\gamma^h} - \overline{\gamma^l} - \overline{\log \frac{\gamma^h}{T}}\right] \Delta p^h$: It captures the compositional effect on inequality dynamics through the across-group inequality. This term explains exactly the underlying force generating the inverted-U shaped Kuznets curve, inequality rising in the initial stage of development and then falling after some critical point. Since we consider the situation where $\Delta p^h > 0$, the sign of $\left[\overline{\gamma^h} - \overline{\gamma^l} - \overline{\log \frac{\gamma^h}{T}}\right]$ determines the compositional effect on inequality dynamics. Therefore, it is enough to pick up some critical value of p^h, $\hat{p}^h$ such that $\left[\overline{\gamma^h} - \overline{\gamma^l} - \overline{\log \frac{\gamma^h}{T}}\right]$ is positive for $p^h \leq \hat{p}^h$, and negative for $p^h > \hat{p}^h$ to show that inequality increases along with the compositional shift until the proportion of higher income group reaches to $\hat{p}^h$, and then decreases after $\hat{p}^h$. The unique existence of such $\hat{p}^h$ can be proved using the intermediate value theorem.

We can define "sectors" by various characteristics with differential income levels. Then, the same mechanics of the Kuznets dynamics applies for the growth and inequality changes. Applying the decomposition equations (3), (5), and (6) to each characteristic, the quantitative importance of that characteristics as a link between the growth and inequality changes can be evaluated.

4.2.2 Results

We apply this index decomposition to seven characteristics of education, occupation, credit use, sector, age, gender, and community type. The results are summarized in Table 1 and 2: Table 1 for the average

Table 1. Decomposition of Growth [1]

	1976 - 1996		1976 - 1986		1986 - 1992		1992 - 1996	
	Composition	Sub-group	Composition	Sub-group	Composition	Sub-group	Composition	Sub-group
Education	1.24 (25%)	3.72	0.89 (45%)	1.09	1.75 (20%)	7.03	1.66 (24%)	5.28
Sector	0.9 (18%)	4.06	0.65 (33%)	1.32	1.17 (13%)	7.6	1.48 (21%)	5.46
Occupation	1.05 (21%)	3.92	0.78 (39%)	1.2	1.45 (17%)	7.32	2.07 (30%)	4.87
Credit	1.01 (20%)	3.96	0.45 (23%)	1.53	2.36 (27%)	6.42	1.27 (18%)	5.67
Age	-0.02 (0%)	4.98	0.07 (3%)	1.91	-0.03 (0%)	8.81	-0.01 (0%)	6.95
Gender	0.12 (2%)	4.85	0.10 (5%)	1.88	0.06 (1%)	8.71	0.28 (4%)	6.66
Community Type	0.36 (7%)	4.61	0.34 (17%)	1.64	0.09 (2%)	8.69	0.81 (12%)	6.13
Joint Three [2]	1.93 (39%)	3.03	1.31 (66%)	0.67	3.32 (38%)	5.46	2.65 (38%)	4.29

Note 1. This table decomposes the average income growth by the growth from composition changes in household characteristics, and the growth within sub-groups.

The column "Composition" is the annual average growth from the composition changes. The figures in parantheses are the relative share to total growth.

The column "Sub-group" is the annual average growth from all sub-groups.

Note 2. The "Joint Three" is the joint category of education, occupation, and financial intermediation.

income growth and Table 2 for the inequality changes. We decompose the growth for the overall period, and for each sub-period as well. The growth due to the compositional changes in education, occupation, and credit use explains 39 percent of the total growth. In other words, the average income grew by 1.93% per year due to the compositional changes in education, occupation, and credit use. Table 1 also reports the growth decomposition by each of the above seven characteristics. Among the characteristics, it is the educational expansion that contributed to growth the most, a quarter of total growth. The change in occupational structure alone or the credit expansion alone each account for more than 20 percent of total growth. The sectoral shift from agriculture to non-agriculture also accounts for a signi…cant portion (18 percent) of total growth. However, the transformation of demography of age and gender, and the urbanization do not seem to be signi…cant in accounting for the growth in Thailand.

In terms of contribution share to the total growth, the compositional e¤ect on growth is remarkable for stage 1, 1976-1986. For this period, two-thirds of the total growth is due to the compositional changes in education, occupation, and credit use. The educational expansion alone explains 45 percent of total growth during stage 1. However, the absolute amount of growth due to them is 1.31% per year, much less than that of stage 2, 3.32% per year, when the growth was the fastest. It is now the expansion of credit rather than education that contributes the most to the growth in stage 2. The expansion of credit contributes 2.36% per year for 1986-1992 while the expansion of educational attainment contributes 1.75% per year during this stage. In stage 3, occupational transformation contributes the most (30 percent) to the total growth among the compositional changes, which corresponds to an average growth rate of 2.07% per year. So, the most important characteristic for growth varies over sub-periods, but education, occupation, and credit use all seem to be important components of the growth in Thailand.

Do they explain the inequality dynamics also in a signi…cant magnitude? The answer is very a¢r-mative, as shown in Table 2 which decomposes the inequality dynamics using equations (5) and (6). More than half, 53 percent, of the increasing inequality for 1976-1996 is explained by the changes in the composition of joint sub-groups by education, occupation, and credit use. In particular, 51 percent of the increasing inequality is due to the increasing across-group inequality driven by the compositional changes. Nineteen percent of increase in inequality is due to the diverging relative incomes across sub-groups related to the di¤erential growth rates across sub-groups. Attributing this portion of inequality increase to the growth features, the remaining portion of the increase in inequality between 1976 and 1996 that is not related to the growth features is only 28 percent. This comes from the increase in

Table 2. Decomposition of Inequality Dynamics [1]

1976 - 1996 [2]

	Within-group Inequality		Across-group Inequality	
	Composition	Sub-group	Composition	Income Gap
Education	-0.97 (-7%)	7.86 (54%)	6.83 (47%)	0.80 (5%)
Sector	1.32 (9%)	8.38 (58%)	1.26 (9%)	3.56 (25%)
Occupation	0.25 (2%)	8.56 (59%)	1.00 (7%)	4.71 (32%)
Credit	1.73 (12%)	8.58 (59%)	3.88 (27%)	0.32 (2%)
Age	-0.27 (-2%)	14.68 (101%)	0.02 (0%)	0.08 (1%)
Gender	0.04 (0%)	14.12 (97%)	0.09 (1%)	0.26 (2%)
Community Type	-0.09 (-1%)	9.65 (67%)	1.47 (10%)	3.48 (24%)
Joint Three [4]	0.29 (2%)	4.06 (28%)	7.45 (51%)	2.71 (19%)

1976 - 1986 [3]

	Within-group Inequality		Across-group Inequality	
	Composition	Sub-group	Composition	Income Gap
Education	-0.06 (-5%)	0.71 (61%)	0.31 (27%)	0.20 (17%)
Sector	0.08 (7%)	0.50 (43%)	0.18 (15%)	0.40 (35%)
Occupation	0.06 (5%)	0.47 (40%)	0.10 (9%)	0.54 (46%)
Credit	0.03 (3%)	0.93 (80%)	0.12 (10%)	0.08 (7%)
Age	-0.02 (-1%)	1.19 (102%)	0.00 (0%)	-0.01 (-1%)
Gender	0.00 (0%)	1.10 (95%)	0.01 (1%)	0.05 (4%)
Community Type	0.00 (0%)	0.66 (57%)	0.08 (7%)	0.43 (37%)
Joint Three [4]	0.05 (4%)	0.56 (48%)	0.23 (20%)	0.32 (28%)

1986 - 1992 [3]

	Within-group Inequality		Across-group Inequality	
	Composition	Sub-group	Composition	Income Gap
Education	-0.05 (-3%)	0.56 (38%)	0.56 (38%)	0.40 (27%)
Sector	0.13 (9%)	0.65 (44%)	-0.04 (-3%)	0.73 (49%)
Occupation	0.07 (5%)	0.52 (35%)	0.09 (6%)	0.79 (54%)
Credit	0.20 (13%)	0.35 (24%)	0.51 (35%)	0.41 (28%)
Age	0.00 (0%)	1.44 (98%)	0.00 (0%)	0.03 (2%)
Gender	0.00 (0%)	1.51 (103%)	0.00 (0%)	-0.04 (-3%)
Community Type	-0.02 (-2%)	0.70 (48%)	0.11 (7%)	0.69 (47%)
Joint Three [4]	0.10 (7%)	0.02 (2%)	0.85 (58%)	0.49 (34%)

1992 - 1996 [3]

	Within-group Inequality		Across-group Inequality	
	Composition	Sub-group	Composition	Income Gap
Education	-0.03 (2%)	-0.68 (46%)	0.42 (-28%)	-1.19 (80%)
Sector	0.20 (-13%)	-0.35 (24%)	-0.21 (14%)	-1.12 (75%)
Occupation	0.11 (-7%)	-0.06 (4%)	-0.27 (18%)	-1.26 (85%)
Credit	0.14 (-10%)	-0.77 (52%)	0.21 (-14%)	-1.07 (72%)
Age	-0.01 (1%)	-1.47 (99%)	0.00 (0%)	0.00 (0%)
Gender	-0.01 (1%)	-1.48 (100%)	0.01 (-1%)	0.00 (0%)
Community Type	0.03 (-2%)	-0.30 (20%)	0.14 (-9%)	-1.35 (91%)
Joint Three [4]	0.03 (-2%)	0.06 (-4%)	-0.11 (7%)	-1.46 (99%)

Note 1. This table decomposes the change in inequality into within-group inequality change and across-group inequality change.
The within-group inequality change is decomposed into the effect of composition change (column "Composition" under "Within-group Inequality") and that of sub-group inequality changes (column "Sub-group").
The across-group inequality change is decomposed into the effect of composition change (column "Composition" under "Across-group Inequality") and that of relative income gap change due to the differential growth rates across sub-groups (column "Income Gap").
The percent terms in parentheses are the relative shares of each effect on overall change in inequality.

Note 2. For 1976 - 1996, total change of Theil-L index is decomposed in percentage figure

Note 3. For the sub-periods of 1976 - 1986, 1986 - 1992, and 1992 - 1996, the annual average change of Theil-L index is decomposed in percentage figure to make the numbers comparable over sub-periods.

Note 4. The "Joint Three" is the joint category of education, occupation, and financial intermediation.

sub-group inequality. In this sense, the inequality dynamics are closely related to the growth features and more than half is directly linked to growth through the compositional changes in education, credit use, and occupation. These results strongly support the validity of the Kuznets curve in Thailand through the above three characteristics.

The sub-period decomposition of inequality changes in Table 2 reveals interesting features about the changes in relative income across sub-groups. Recall from Section 3 that the rich sub-groups grew faster than the poor sub-groups, especially in stage 2. For this period, the e¤ect of diverging relative incomes on increasing inequality is higher (34 percent) than for the overall period (19 percent) so that the e¤ect of premia for higher education, better occupation, and more credit on inequality was intensi…ed in stage 2 when the growth was the fastest and the increasing inequality was the sharpest. A much more remarkable feature is found for stage 3. Recall that the growth rate ordering over the sub-groups was reversed after 1992, hence relative income converged between 1992 and 1996. In Section 3, we expected that it would be a source of decreasing inequality, but could not tell how signi…cant this e¤ect would be. Current decomposition analysis suggests that 99 percent of the decreasing inequality of this period is explained by the converging relative incomes across sub-groups of education, occupation, and credit. That is, almost all the decrease in inequality between 1992 and 1996 is due to the decrease in the premia for higher education, better occupation, and more credit.

The sub-period decomposition in Table 2 also suggests the most important characteristic among the compositional e¤ects on inequality change di¤ers over time. Before 1992, all three compositional changes in education, credit use, and occupation contributed to increasing inequality. In particular, it was the educational expansion (22 percent) in stage 1, and the expansion of credit (48 percent) in stage 2 that contributed the most to the inequality increase in each sub-period. After 1992, however, the directions themselves of impacts of compositional change on inequality di¤er among the three characteristics: the changes in occupational structure began to decrease the inequality while the expansion of education and credit continued to increase it.

4.3 Index Decomposition of Poverty Dynamics

Poverty is a special concept of welfare that puts all the weights on the lower tail of the distribution. Holding the inequality level constant, growth tends to alleviate poverty. Holding the average income constant, increasing inequality worsens poverty. So, for a growing economy with increasing inequality, these e¤ects counteract each other. In Section 3, we observed a substantial drop of poverty in Thailand

between 1976 and 1996. We mentioned there that it means that the growth effect dominated the inequality effect on poverty dynamics in the case of Thailand. In this section, this statement is quantitatively evaluated modifying the methodology adopted by Datt and Ravallion (1992). We also extend their methodology to sort out the compositional effects on poverty dynamics through their effects on growth and inequality changes by constructing counterfactual Lorenz curves.

4.3.1 Methodology

Datt and Ravallion (1992) suggested a way to decompose the poverty change into the growth component and the distributional component using a parametric estimation of the Lorenz curve. After estimating the parameters of a Lorenz curve, they characterize the three most popular poverty indices (head-count ratio, poverty gap, and Foster-Greer-Thorbecke index P_2) in terms of the average income and the parameters of a Lorenz curve; that is, poverty index is formulated such as $P = P(\frac{z}{\mu}; L)$, where z is a poverty line, μ is an average income, and L is a list of parameters characterizing a Lorenz curve. Then, the change in poverty index P between date s and $t > s$ can be written as follows:

$$
\begin{aligned}
P_t - P_s &= G(s;t;r) + D(s;t;r) + \text{residual } R \qquad (9)\\
G(s;t;r) &= P\left(\frac{z}{\mu_t}; L_r\right) - P\left(\frac{z}{\mu_s}; L_r\right) : \text{Growth component}\\
D(s;t;r) &= P\left(\frac{z}{\mu_r}; L_t\right) - P\left(\frac{z}{\mu_r}; L_s\right) : \text{Distribution component}
\end{aligned}
$$

Note that r denotes the reference date, which can be the initial date s, final date t, or any date between them. The growth component is obtained by the poverty difference only from changing the average income over time with fixed parameters of the Lorenz curve at the reference date. The distributional component is obtained by the poverty difference by changing the parameters of the Lorenz curve over time with fixed average income at the reference date. The residual term is due to the interaction effect between the growth component and the distributional component.[23] We take the reference period as the initial date in the following decomposition.

The methodology above depends on the choice of the parametric form of Lorenz curve. We adopt the elliptical form of Lorenz curve suggested by Villasenor and Arnold (1989). The elliptical Lorenz curve

[23] Setting the reference date as the initial date, it can be formulated as follows.

$$
\begin{aligned}
R &= G(s;t;t) - G(s;t;s)\\
&= D(s;t;t) - D(s;t;s)
\end{aligned}
$$

From this formulation, residual R can be interpreted either as the difference between the growth components or as the difference between the distributional components at the terminal date and initial date. If there is no change either in average income or in inequality over time, the residual vanishes.

is a special version of the general quadratic form such that

$$ax^2 + bxy + cy^2 + dx + ey + f = 0:$$

Since the Lorenz curve must pass through $(0;0)$ and $(1;1)$, we have $f = 0$, and $e = ¡(a + b + c + d)$: The elliptical Lorenz curve is a special case with $b^2 ¡ 4ac < 0$, $c = 1$, $a + b + d + 1 > 0$, $d ¸ 0$, and $a + d ¡ 1 · 0$. With these speci…cations, there are three parameters $a; b;$ and d characterizing the Lorenz curve such that

$$L(1 ¡ L) = a(p^2 ¡ L) + bL(p ¡ 1) + d(p ¡ L)$$

where L is the ordered income share and p is the ordered population share. We get the parameters $a; b;$ and d by least square estimation for each relevant year. The …tting performance of the estimation for the elliptical form of Lorenz curve is extremely good for the income distributions in Thailand; R^2 is close to unity in each year. The estimates for $a; b;$ and d are reported in the appendix.

Once we have the estimates for $a; b;$ and d, the poverty indices of head-count ratio, poverty gap, and P_2 can be characterized as follows:

$$\begin{aligned} H &= ¡\left[\bar{} + r(b + 2z=¹)\right]\left(\bar{}(b + 2z=¹)^2 ¡ ®\right)^{¡1=2}\Big]=2® \\ PG &= H ¡ (¹=z)L(H) \\ P_2 &= 2PG ¡ H ¡ (¹=z)^2[aH + bL(H) ¡ (r=16)\ln f(1 ¡ H=s_1)=(1 ¡ H=s_2)g] \end{aligned} \tag{10}$$

where $e = ¡(a + b + d + 1)$, $® = b^2 ¡ 4ad$, $\bar{} = 2be ¡ 4d$, $r = (\bar{}^2 ¡ 4®e^2)^{1=2}$, $s_1 = (r ¡ \bar{})=2®$, $s_2 = ¡(r + \bar{})=2®$, $¹$ is mean income, and z is poverty line.

The methodology of Datt and Ravallion (1992) decomposes the poverty change into components of growth and inequality change in aggregate level. However, we know that both the growth and the inequality change share common sources, i.e. the compositional changes, which are our main concerns. From the previous observation of the substantial compositional e¤ects on growth and inequality dynamics, we may also expect the signi…cant compositional e¤ects on poverty dynamics in Thailand. We attempt to identify these sources of poverty dynamics: poverty dynamics through the compositional changes associated with growth as well as with inequality change.

To pursue this decomposition, we extend their methodology with a simple idea as follows. We construct the counterfactual Lorenz curve $L^¤_s$, and counterfactual mean income $¹^¤_s$ (the counterfactual poverty line $z^¤_s$ is also constructed when it varies over time) for the reference date s by re-weighting the income

distribution at date s the same way we did in constructing the counterfactual density in (13) and (15). After obtaining the counterfactual L_s^{α} and Λ_s^{α}, the growth component and distribution component can be further decomposed as follows:

$$\text{Growth}: G(s;t;s) = \left[P\left(\frac{z_t}{\Lambda_t}; L_s\right) - P\left(\frac{z_s^{\alpha}}{\Lambda_s^{\alpha}}; L_s\right) \right] + \left[P\left(\frac{z_s^{\alpha}}{\Lambda_s^{\alpha}}; L_s\right) - P\left(\frac{z_s}{\Lambda_s}; L_s\right) \right] \quad (11)$$

$$\text{Distribution}: D(s;t;s) = \left[P\left(\frac{z_s}{\Lambda_s}; L_t\right) - P\left(\frac{z_s}{\Lambda_s}; L_s^{\alpha}\right) \right] + \left[P\left(\frac{z_s}{\Lambda_s}; L_s^{\alpha}\right) - P\left(\frac{z_s}{\Lambda_s}; L_s\right) \right] \quad (12)$$

The term $\left[P\left(\frac{z_t^{\alpha}}{\Lambda_s^{\alpha}}; L_s\right) - P\left(\frac{z_s}{\Lambda_s}; L_s\right) \right]$ in (11) is the poverty change from the growth component due to the compositional changes in household characteristics. The term $\left[P\left(\frac{z_s}{\Lambda_s}; L_s^{\alpha}\right) - P\left(\frac{z_s}{\Lambda_s}; L_s\right) \right]$ in (12) is the poverty change from the distribution component due to the compositional change in household characteristics.

4.3.2 Results

Applying the methodology above to three poverty indices of head-count ratio, poverty gap, and Foster-Greer-Thorbecke index P_2, Table 3 summarizes the results of decomposition of poverty change in Thailand for the entire period between 1976 and 1996 and for the three sub-periods. The estimates of parameters of a; b; and d for actual and counterfactual Lorenz curves are reported in Table A.7.1 through A.7.5 in the appendix.

For the overall period, poverty declined according to all three indices. Focusing on the head-count ratio, poverty declined by 34 percent. Within this poverty reduction, 45 percent is due to the growth component, but inequality increased poverty by 7 percent, and the residual e¤ect also increased 4 percent. Therefore, the poverty reduction is due to the dominant e¤ect of fast growth. Note that the poverty indices of poverty gap and P_2 take the distribution among the poor into account. Even with these inequality sensitive poverty indices, we obtain similar results; growth e¤ect dominated the distributional e¤ect. The poverty decompositions for the sub-periods of stages 1, 2, and 3 in Table 3 are annualized for appropriate comparison since each sub-period has a di¤erent time span. Table 3 suggests that poverty reduction becomes much more substantial after 1986. Each year the proportion of poor people was reduced by 0.37 percent for 1976-1986, by 2.9 percent for 1986-1996, and by 3.27 percent for 1992 - 1996. In particular for 1992-1996, due to the decrease in inequality for this period, even the distribution e¤ect contributed to poverty alleviation.

The previous decomposition of growth and inequality change suggests that the growth and inequality

Table 3. Decomposition of Poverty Change into Growth Effect and Distribution Effect [1]

Head-count Ratio

	1976-1996 [2]				1976-1986 [3]				1986-1992 [3]				1992-1996 [3]			
	growth	distribution	residual	all	growth	distribution	residual	all	growth	distribution	residual	all	growth	distribution	residual	all
Overall	-45.60	7.23	4.18	-34.20	-1.28	0.68	0.23	-0.37	-3.82	0.86	0.07	-2.90	-2.72	-0.89	0.33	-3.27
Composition Change																
Education	-12.10	3.50	2.53	-6.08	-0.43	0.18	0.09	-0.17	-0.70	0.26	0.04	-0.40	-0.73	0.36	0.07	-0.30
Occupation	-11.24	-1.02	2.37	-9.90	-0.38	0.03	0.08	-0.27	-0.62	-0.02	0.04	-0.60	-0.91	-0.09	0.09	-0.90
Credit	-10.49	3.42	2.23	-4.84	-0.23	0.10	0.05	-0.09	-0.92	0.30	0.05	-0.57	-0.59	0.33	0.06	-0.20
Joint Three [4]	-21.32	4.09	3.96	-13.27	-0.69	0.22	0.13	-0.34	-1.38	0.35	0.07	-0.96	-1.13	-0.09	0.12	-1.09

Poverty Gap

	1976-1996 [2]				1976-1986 [3]				1986-1992 [3]				1992-1996 [3]			
	growth	distribution	residual	all	growth	distribution	residual	all	growth	distribution	residual	all	growth	distribution	residual	all
Overall	-16.97	7.76	-5.04	-14.25	-0.64	0.65	-0.04	-0.03	-1.93	0.61	-0.22	-1.54	-1.10	-0.24	0.16	-1.18
Composition Change																
Education	-6.14	3.56	-0.18	-2.76	-0.23	0.14	-0.01	-0.09	-0.41	0.25	-0.03	-0.18	-0.33	0.24	0.05	-0.04
Occupation	-5.73	0.78	-0.15	-5.11	-0.20	0.07	0.00	-0.14	-0.36	0.11	-0.02	-0.28	-0.41	0.12	0.06	-0.23
Credit	-5.38	3.04	-0.12	-2.46	-0.13	0.08	0.00	-0.05	-0.53	0.29	-0.04	-0.28	-0.27	0.21	0.04	-0.08
Joint Three [3]	-10.14	4.45	-0.76	-6.46	-0.36	0.19	-0.01	-0.18	-0.78	0.39	-0.06	-0.45	-0.50	0.15	0.07	-0.27

FGT Index P_2

	1976-1996 [2]				1976-1986 [3]				1986-1992 [3]				1992-1996 [3]			
	growth	distribution	residual	all	growth	distribution	residual	all	growth	distribution	residual	all	growth	distribution	residual	all
Overall	-7.83	6.05	-5.30	-7.07	-0.36	0.48	-0.09	0.03	-1.07	0.41	-0.23	-0.89	-0.48	-0.07	0.06	-0.49
Composition Change																
Education	-3.46	2.62	-0.92	-1.76	-0.14	0.09	-0.03	-0.07	-0.25	0.19	-0.04	-0.10	-0.16	0.14	0.02	0.00
Occupation	-3.25	1.04	-0.84	-3.05	-0.12	0.06	-0.02	-0.08	-0.22	0.11	-0.03	-0.15	-0.20	0.10	0.03	-0.06
Credit	-3.06	2.16	-0.78	-1.68	-0.08	0.05	-0.01	-0.04	-0.33	0.22	-0.05	-0.16	-0.13	0.12	0.02	0.00
Joint Three [3]	-5.45	3.49	-1.87	-3.83	-0.21	0.13	-0.05	-0.12	-0.48	0.31	-0.08	-0.24	-0.24	0.13	0.03	-0.07

Note 1. This table decomposes the changes in poverty into growth component (column "growth") and distribution change component (column "distribution") applying Datt & Ravallion (1992). The residual term (column "residual") is due to the interaction between growth and change in inequality. The column "all" is the sum total of "growth", "distribution", and "residual". In the row "overall", the overall poverty is decomposed while the rows under "composition change" decompose the poverty due to the composition change of sub-groups of each characteristics.

Note 2. The decomposition for 1976 -1996 is done for total change in poverty.

Note 3. The decompositions for sub-periods of 1976 - 1986, 1986 - 1992, 1992 - 1996 are done for annual average change in poverty to make the numbers comparable over sub-periods.

Note 4. The "Joint Three" is the joint category of education, occupation, and Credit.

increase share the same source: 53 percent of the increasing inequality and 39 percent of growth are due to the common compositional changes in education, occupation, and intermediation. Then, those compositional changes may increase the poverty through the distributional component on the one hand, and decrease the poverty through the growth component on the other hand. The overall e¤ect of compositional changes on poverty is unclear a priori. We need to sort out the e¤ect of composition changes on poverty from the growth component as well as from the distribution component. Equations (11) and (12) help these decompositions; the results are reported in Table 3.

The decomposition results suggest that the joint compositional change in education, occupation, and credit use increased the head-count ratio by 4 percent through the distributional component, but reduced it by 21 percent through the growth component. Overall, including the residual e¤ect, the proportion of poor people fell by 13 percent purely from the combined compositional changes in education, occupation, and credit use. We observe similar patterns for the other poverty indices in Table 3. The poverty gap decreased by 6.5 percent and the P_2 index decreased by 3.8 percent between 1976 and 1996. This poverty alleviation through compositional change accounts for 39, 45, and 54 percent of the total poverty reduction for the head-count ratio, the poverty gap, and the P_2 index respectively.

The sub-period poverty decompositions report results consistent with those in the decomposition for growth and inequality dynamics. In terms of the relative contribution of compositional e¤ects to total poverty reduction, stage 1 was the most remarkable period. In stage 1, out of total head-count ratio reduction of 0.37 percent per year, 0.34 percent was purely due to the joint compositional change. In terms of the absolute magnitude of poverty reduction, however, the compositional e¤ect on poverty reduction was most outstanding in stage 3: each year 1.09 percent of poor people escaped from poverty purely due to the joint compositional change. These results are closely related with the features of the sub-period decomposition of growth and inequality.

Focusing on the compositional e¤ect of each characteristic yields an interesting observation. The most signi…cant compositional e¤ect on poverty reduction is due to the occupational structure change for every sub-period as well as for the entire period using any poverty index. Through occupational transformation alone, the head-count ratio was reduced by 10 percent between 1976 and 1996 while it was reduced by 6 percent and 5 percent through the expansion of education and credit respectively. From the decomposition of inequality dynamics in Table 2, the occupational transformation is seen as not an important factor for increasing inequality. The expansion of education and credit accounts

for the inequality increase the most. Note that the growth component of poverty reduction from the expansion of education is higher (-12 percent of head-count ratio) than from the occupational transformation (-11 percent of head-count ratio). However, the distributional component of poverty change from the occupational transformation decreased poverty by 1.02 percent by head-count ratio, while that from the expansion of education or credit increased poverty by 3.50 percent and 3.42 percent, respectively. Recall that the relative contributions of compositional changes to the total growth are 25, 20, and 21 percent for education, credit, and occupation, respectively. So, their contributions to growth are similar. However, for the impacts on inequality and poverty, education and credit sharply contrast with occupation.

4.4 Nonparametric Decomposition

4.4.1 Counterfactual Distribution

The above decomposition analysis relies on the additive structure of the Theil-L index. Choosing di¤erent inequality indices might yield di¤erent signi…cance results of compositional e¤ects. Here we check the robustness of the signi…cance of compositional e¤ects adopting another way of decomposition which does not depend on the choice of the inequality index. Suppose we construct a counterfactual distribution in 1976 such that we maintain the income prospects in 1976 but with the distribution of concerning characteristics in 1996. We then can calculate the compositional e¤ects of total changes in any distributional summary index from the di¤erence between the actual one and the counterfactual one.

Consider the income distribution at a given date as a marginal distribution obtained from the joint distribution of income prospect and household characteristics as proposed in DiNardo, Fortin, and Lemieux (1996). That is, income distribution can be expressed as a conditional expectation of the joint distribution conditioned on the distribution of characteristics. The counterfactual density for date s with respect to the characteristics distribution at date t can be obtained by re-weighting the conditional expectation. Formally, suppose the joint distribution of income y and some characteristic $\hat{A}$ at date s is given by $F(y_s; \hat{A}_s)$. Then, the probability density of income at date s is given by

$$\begin{aligned} f(y_s; \hat{A}_s) &= \int dF(y_s; \hat{A}_s) \\ &= \int_{D_{\hat{A}}} f(y_s | \hat{A}_s) dF_{\hat{A}}(\hat{A}_s) \quad ; \end{aligned}$$

where $D_{\hat{A}}$ denotes the domain of $\hat{A}$, $F_{\hat{A}}$ the marginal distribution function of $\hat{A}$, and $f(y_s|\hat{A}_s)$ the

conditional density function of income y.

The counterfactual income distribution at date s with respect to the characteristics distribution at date t is given by

$$f(y_s;\hat{A}_t) = \int f(y_s|\hat{A}_s)\,dF_{\hat{A}}(\hat{A}_t) \tag{13}$$

$$= \int_{D_{\hat{A}}} f(y_s|\hat{A}_s)\,\psi_{t;s}(\hat{A}_s)\,dF_{\hat{A}}(\hat{A}_s); \tag{14}$$

$$\psi_{t;s}(\hat{A}_s) \equiv dF_{\hat{A}}(\hat{A}_t)/dF_{\hat{A}}(\hat{A}_s)$$

Now note that the counterfactual density in (15) is expressed by the conditional density of y and the marginal distribution of $\hat{A}$ at date s except for the re-weighting factor $\psi_{t;s}(\hat{A}_s)$. Thus we can estimate the counterfactual density applying the non-parametric kernel method by re-weighting the estimation by $\psi_{t;s}(\hat{A}_s)$ such as:

$$\hat{f}(y_s;\hat{A}_t) = \sum_{i \in D_{y_s}} \frac{w_i}{h}\,\psi_{t;s}(\hat{A}_i)\,K\left(\frac{y - y_i}{h}\right); \tag{15}$$

where D_{y_s} is the support of the income distribution at date s. We obtain the re-weighting factor $\psi_{t;s}(\hat{A}_s)$ from the data. This is the estimated counterfactual density at date s if the composition of characteristics were the same as that of date t. Similarly we also can construct the counterfactual distribution at date t; $f(y_t;\hat{A}_s)$ by re-weighting the actual one with the characteristics distribution at date s.

The the aggregate changes in distribution between date s and date t > s can be decomposed as follows:

$$\#\{f(y_t;\hat{A}_t)\} - \#\{f(y_s;\hat{A}_s)\}$$

$$= [\#\{f(y_t;\hat{A}_t)\} - \#\{f(y_t;\hat{A}_s)\}] + [\#\{f(y_t;\hat{A}_s)\} - \#\{f(y_s;\hat{A}_s)\}] \tag{16}$$

$$= [\#\{f(y_t;\hat{A}_t)\} - \#\{f(y_s;\hat{A}_t)\}] + [\#\{f(y_s;\hat{A}_t)\} - \#\{f(y_s;\hat{A}_s)\}]; \tag{17}$$

where $\#\{f\}$ is any distributional summary index for distribution f. It can be the mean, any inequality index, or any poverty index. The term $[\#\{f(y_t;\hat{A}_t)\} - \#\{f(y_t;\hat{A}_s)\}]$ in (16) represents the compositional effects with reference date at t while the term $[\#\{f(y_s;\hat{A}_t)\} - \#\{f(y_s;\hat{A}_s)\}]$ in (17) with reference date at s. We take the average of the two terms to calculate the compositional effects, i.e. the contribution share of compositional changes in aggregate change in # is calculated by:

$$\frac{1}{2}\left[\frac{\#\{f(y_t;\hat{A}_t)\} - \#\{f(y_t;\hat{A}_s)\}}{\#\{f(y_t;\hat{A}_t)\} - \#\{f(y_s;\hat{A}_s)\}} + \frac{\#\{f(y_s;\hat{A}_t)\} - \#\{f(y_s;\hat{A}_s)\}}{\#\{f(y_t;\hat{A}_t)\} - \#\{f(y_s;\hat{A}_s)\}}\right]. \tag{18}$$

This decomposition does not depend on specific choice of index. Thus we can check whether the importance of the compositional effects is robust to the choice of index.

4.4.2 Results

Table 4 reports the contribution shares of compositional e¤ects for average income growth, changes in various inequality measures (Theil-L, Theil-T, coe¢cient of variation, and Gini coe¢cient), and various poverty measures (P_0, P_1, and P_2) between 1976 and 1996, calculated by the decomposition formula in (18). Comparing the …gures in the …rst two columns in Table 4 with those in Tables 1 and 2, we …nd that both decomposition methodologies report very close magnitudes of compositional e¤ects on growth and inequality changes. Previous poverty index decomposition in Table 3 involved a parametric estimation. Thus there is a little di¤erence between this nonparametric decomposition and index decomposition for poverty, but the di¤erence is small. Furthermore, the compositional e¤ects are very robust to the choice of index. This nonparametric decomposition also identi…es education, occupation, and credit use as the three most important characteristics associated with the Kuznets dynamics. All three factors account for 40 percent average income growth, more than half of increasing inequality by any of the four measures, and around 30 percent of poverty reduction.

Table 4. Contribution Shares of Compositional E¤ects from Counterfactual Distribution (%)

	Mean	Theil-L	Theil-T	C.V.	Gini	P_0	P_1	P_2
Education	25	41	37	24	41	15	14	13
Credit	20	39	38	25	39	13	11	11
Occupation	21	8	-2	-13	4	23	21	20
Sector	16	2	-3	-7	-1	16	16	15
Age	0	-2	-2	-1	-2	0	0	0
Gender	2	1	0	-5	1	2	2	2
Community Type	7	10	8	8	9	4	4	3
Joint Three	40	54	57	59	53	33	30	29

We construct a counterfactual income density in 1976 with the composition of education, occupation, and intermediation in 1996. Figure 14 compares the counterfactual density in 1976 with the actual densities in 1976 and in 1996. The three vertical lines in Figure 14 represent the average income levels for the actual distribution in 1976, the counterfactual distribution in 1976, and the actual distribution in 1996, respectively from left to right. The distance between the left two lines represents the growth in average income purely from the compositional changes. The compositional changes in education, occupation, or intermediation shift the aggregate distribution itself to the right. Figure 15 plots the curves of inequality and poverty ordering. They suggests how these changes in the shape of income distribution due to compositional changes a¤ect inequality and poverty. The left panel in Figure 15 displays the transformed Lorenz curve of the counterfactual distribution overlaid on those of two

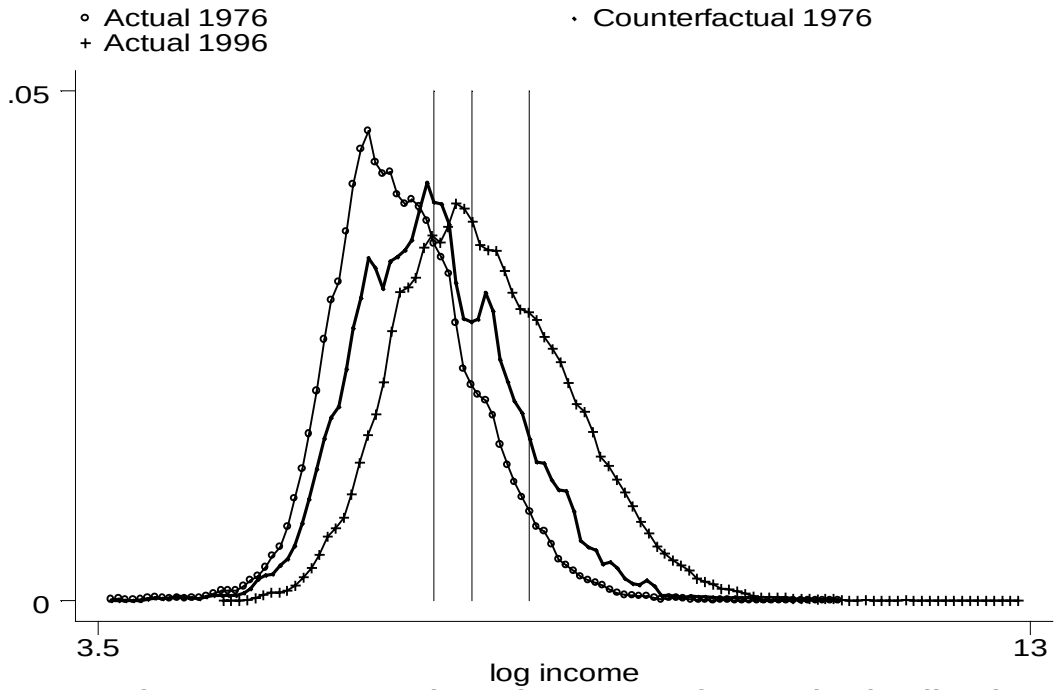
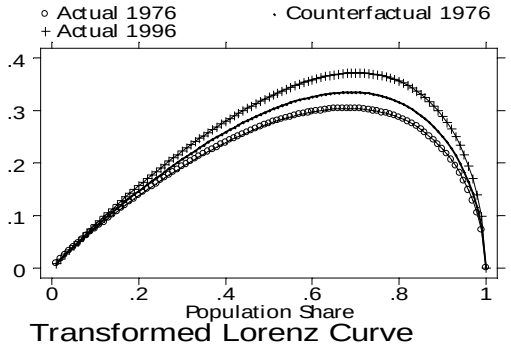
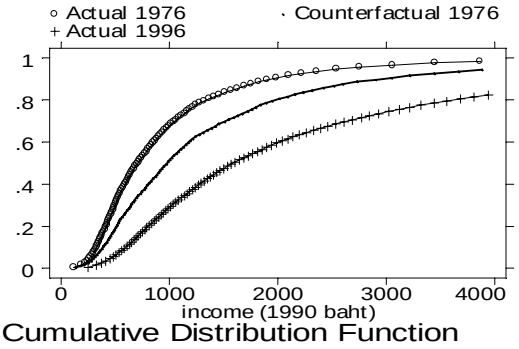


Figure 14. Density of Counterfactual Distribution



Transformed Lorenz Curve



Cumulative Distribution Function

Figure 15. Ordering for Counterfactual Distribution

actual distributions in 1976 and 1996.[24] The transformed Lorenz curve is the distance between the 45 degree line and the Lorenz curve. When the transformed Lorenz curve of distribution f strictly lies below that of distribution g, the distribution f Lorenz dominates the distribution g and hence we see more inequality for distribution g than f by Lorenz ordering. Thus the left panel in Figure 15 clearly suggests that the compositional changes increased inequality by every inequality index that obeys the Pigou-Dalton Principle of transfer. The right panel in Figure 15 plots the cumulative distribution function of the counterfactual distribution overlaid on those of two actual distributions in 1976 and 1996. It suggests the counterfactual distribution in 1976 dominates the actual one by the …rst-order stochastic dominance, i.e. compositional changes reduced poverty by any poverty lines and any poverty indices in FGT class.

All the above results con…rm the importance of the compositional changes in education, occupation, and credit use in explaining the growth and income distribution in Thailand.

5 Characteristic Choice Associated with Wealth

The Kuznets curve provides us with a framework for accounting for growth and inequality dynamics. From the above decomposition analyses, we have identi…ed education, occupation, and …nancial credit use as the three most important characteristics that account for the Kuznets dynamics in Thailand. However, in the Kuznets curve itself, economic behavior is not modeled. The curve is a reduced form relationship. It does not explain why people choose di¤erent characteristics and move toward better sectors only gradually despite the persistent income gap across sectors. The changes in composition over di¤erent sectors are the key driving forces in the Kuznets dynamics. Thus modeling individual choice behavior over di¤erent sectors seems crucial to understanding the underlying mechanism of Kuznets dynamics.

Varying socioeconomic characteristics among people may be explained by the di¤erences in comparative advantage, as the Roy (1951) model suggests. However, some characteristics with productive attributes such as education and access to …nancial credit appear to be bene…cial regardless of innate comparative advantage, but di¤erent choice over these characteristics is observed. We thus consider an alternative model: constrained self-selection. Suppose that entry to better sectors is costly and due to the imperfect loan markets people need to rely on personal wealth to …nance that cost. Then only

[24] We plot the transformed Lorenz curve rather than the normal Lorenz curve since the former better visualizes the crossing among curves when there are many overlays.

the wealthy could have access to higher education and …nancial credit. In this case, the expansion of education and …nancial credit can be sources of growth in average income but also worsen the income distribution, at least in the initial stage of expansion. As the economy grows, wealth constraints in self-selection become less binding, and more people then join higher-income sectors. Thus income inequality would eventually decline. This generates exactly the inverted-U shaped inequality dynamics along with growth that Kuznets (1955) postulated. In summary, this type of selection model provides a perspective on the missing micro underpinnings of the Kuznets curve.

In this section, we estimate discrete choice models for the above three characteristics with wealth variables. We consider two types of wealth in the estimation: land ownership and asset index for physical and …nancial wealth. The estimation results suggest that the choice of these characteristics was substantially associated with physical and …nancial wealth and the compositional changes toward more productive sectors were concentrated among the wealthy households. Thus the data supports a model of self-selection constrained by personal wealth as an underlying mechanism of the Kuznets dynamics.

5.1 Distribution of Wealth

5.1.1 Land Distribution

Agriculture has long been a major economic activity in Thailand. Even after rapid industrialization, the agricultural population remained 60 to 40 percent of the total population between 1976 and 1996. Thus we might consider an unequal distribution in land as a potential explanation of the high income inequality, as in Brazil.[25] However, this is not the case in Thailand. Thailand has one of the most egalitarian land distributions in the world. Taylor and Hudson (1972) reported the Gini coe¢cients of land distributions in 54 countries in years around 1960.[26] According to them, Thailand is the …fth egalitarian society in terms of land distribution among those countries. The Gini coe¢cient of land distribution in Thailand was 0.460. This was even smaller than in Taiwan (0.463), which performed a postwar land reform in 1950's, and much smaller than in South Africa (0.700) and Brazil (0.845).[27]

Furthermore, this low inequality in land distribution had even improved over time. The time series

[25] I appreciate Michael Carter's comments on this point.

[26] Alesina and Rodrik (1994) used this data in their regressions to show that initial inequality in land distribution contributed negatively to the growth between 1960 and 1985.

[27] The only countries with smaller Gini coe¢cients in land distributions are Finland, South Korea, Yugoslavia, and Denmark.

data on land inequality indices are not available during the period concerned. The SES does not report the landholding in continuous unit so that we may not obtain Gini coe¢cients of land distributions over time from the SES. However, it does report the landholding by seven categories; no land, less than 2 rai, 2-4 rai, 5-9 rai, 10-19 rai, 20-39 rai, and 40 or more rai. From this information, we may have an idea of how the land distribution has changed between 1976 and 1996. Figure 16, which contrasts the land distributions among farmers between 1976 and 1996 shows that land distribution has been more concentrated in the middle ranges of landholding over time, which suggests that the land distribution in Thailand has even more equalized during the periods concerned. Therefore, the land inequality itself is not the reason of inequality dynamics in Thailand. Thai farmers seem to have fairly equal access to land compared with other countries.

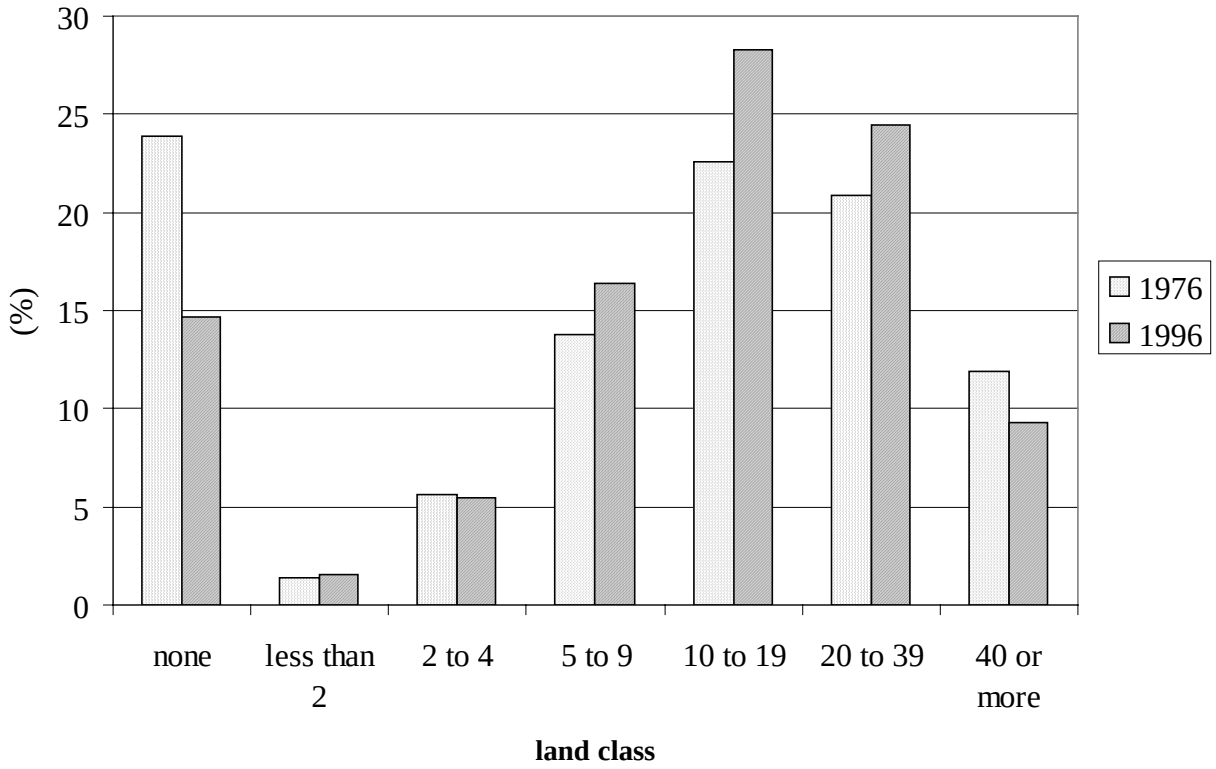
This low initial level of land inequality and the equalizing trend of land ownership is related to the peculiar land ownership system in Thailand. According to Feder, Onchan, Chalamwong, and Hongladarom (1988), 62 percent of land is owned by the state. The proportion of private landholding itself is small in Thailand. Furthermore, Thai land tenure is not fully established; many landless farmers deforest and settle on state-owned forest reserve, and evictions are rare. Feder, Onchan, Chalamwong, and Hongladarom (1988) estimate that a million farmers were operating on a …fth of the designated forest reserve areas owned by the state. Thai farmers could get easy access to land due to this tenure system in Thailand and hence there has been not much incentive for them to own land.

5.1.2 Non-land Assets Distribution

When we turn our focus from land to non-land assets, the picture looks quite di¤erent. The distribution of non-land wealth looks quite skewed in 1976 and the proportion of wealth-poor people has increased over time. Unfortunately the SES does not record direct estimates for wealth. However, it records detailed information related to physical and …nancial assets: ownership of various household assets, rental value of owned houses, interest and dividend income from …nancial assets, and rental income from land, lodging etc. We construct an index for household wealth using a principal component analysis of these variables. In each year t, principal component analysis …nds the best proxy for the latent wealth variable expressed as a linear combination of these variables

$$K_t = \cdot_t^1 K_t^1 + ¢¢¢ \cdot_t^M K_t^M;$$

Figure 16. Land Distribution Among Farmers



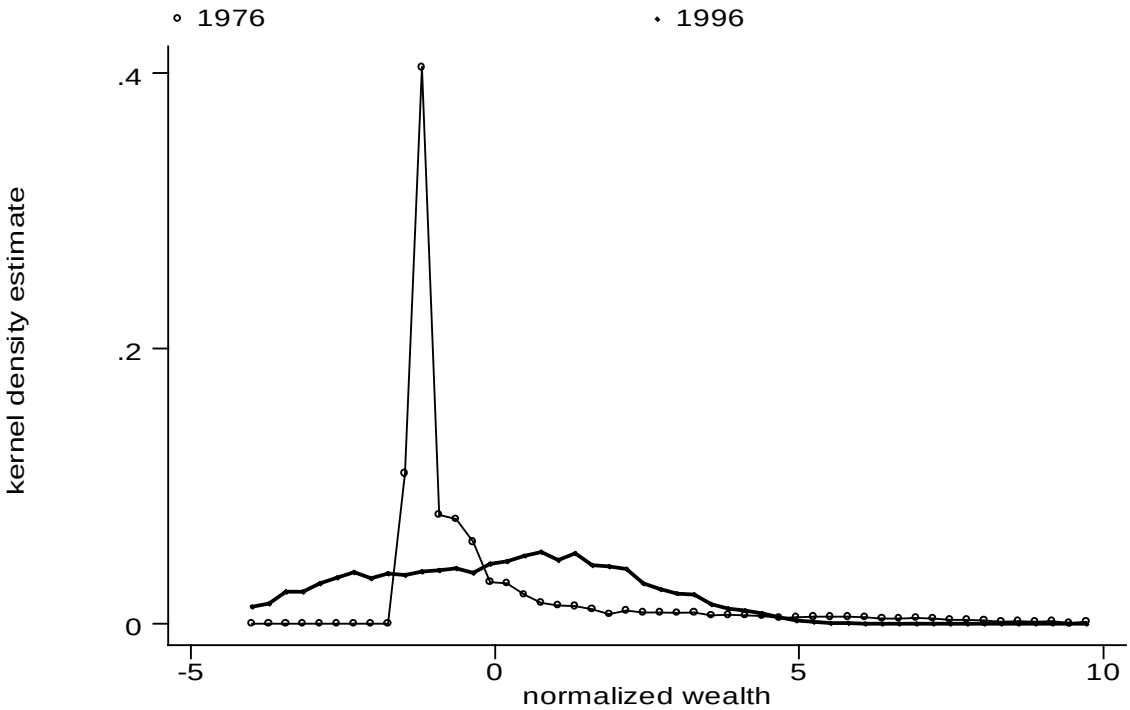


Figure 17.1. Non-land Wealth Distribution

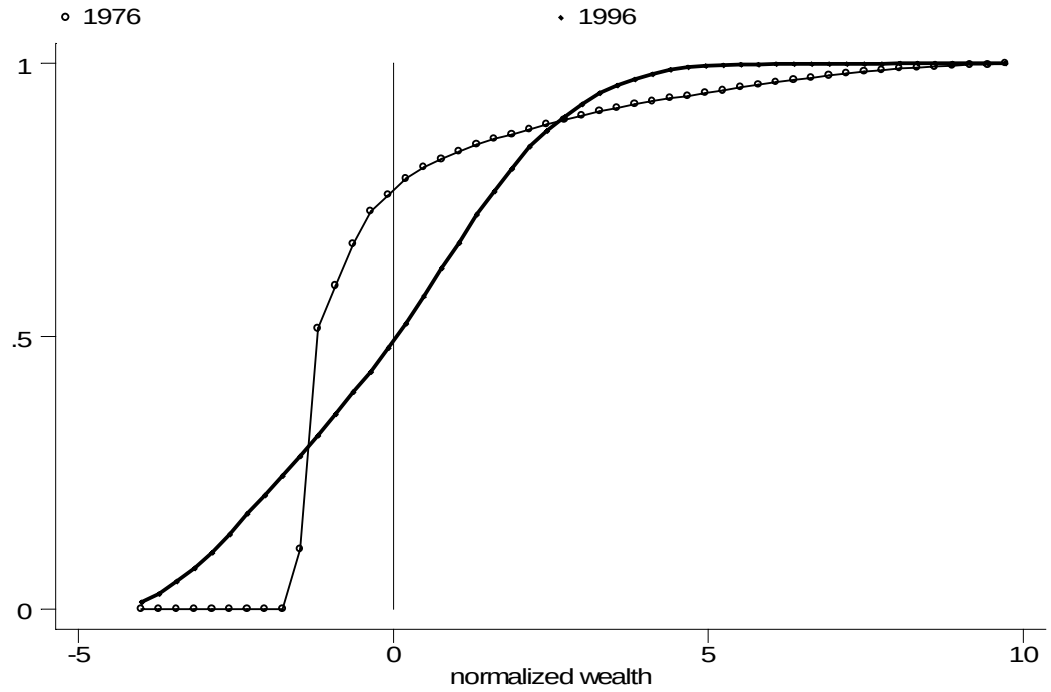


Figure 17.2. CDF of Non-land Wealth Distribution

Figure 17.3. Area under CDF of Wealth Distributions: Checking MPS

which maximizes the variation of K_t given the correlation structure among wealth covariates $K_t^1; ¢¢¢ ; K_t^M$. We use the …rst principal component as our wealth index.[28] The principal component analysis does not recover the scale of wealth since it normalizes the covariates in the analysis such that K_t has zero mean for each year t. However, it gives us the best information about the shape of distribution of the latent wealth for each year t. Thus we may consider this asset index as normalized wealth around the mean. The scoring coe¢cients for asset items $(\cdot_t^1; ¢¢¢ ; \cdot_t^M)$ in each year are reported in Table A.5 in the appendix.

Figure 17.1 contrasts the distributions of this wealth index between 1976 and 1996 and suggests that the probability mass of non-land wealth has spread toward the tails from the middle in contrast to the changes in landholding distribution. However, the fraction at the upper tail decreased as well. Thus we observe double-crossing between cumulative distribution functions of non-land wealth between 1976 and 1996 in Figure 17.2. To evaluate the overall changes in inequality of this wealth, we calculate the areas under these cumulative distribution functions. If the areas under the cumulative distribution function of a distribution x strictly lie above that of a distribution y after controlling the mean levels, we can say that the inequality of distribution x is higher than that of y in the sense of second-order stochastic dominance or mean-preserving-spread (Rothschild and Stiglitz 1970). As Figure 17.3 suggests, the overall inequality ordering for non-land wealth between 1976 and 1996 is not clear. The curves plotting the areas under the cumulative distribution functions for 1976 wealth and 1996 wealth cross around the mean. Even though the ordering for overall inequality is not clear, however, the non-land wealth distribution became worse for the poor households whose wealth level was below average.

5.2 Estimation of Characteristics Choice

We estimate the discrete choice model for education, occupation, credit use, focusing on the binary choices of these three characteristics: between secondary-or-higher level or not for education, between being non-farm entrepreneur or not, and between participation in the formal …nancial institutions or not. Using the above wealth variables of land ownership dummy L_t and non-land asset index K_t, we estimate these binary choice models using a probit maximum likelihood estimation at each date t controlling for the observable characteristics $\hat{A}_t$ including age, gender, geographic region, and community type. From these estimations, we may assess the importance of association between family

[28] A similar approach is used in Filmer and Pritchett (1998) to estimate the wealth e¤ect on educational attainment in India.

wealth and the choice of education, occupation, and participation in formal …nancial system. Even though these are simply reduced form estimations, they allow us to check if we do …nd evidence consistent with the wealth constraint story. If the family wealth does not matter, these estimation should report negligible coe¢cients on L_t or K_t.

Consider an economy with two sectors indexed by $j = 0; 1$. At date t, an agent i earns di¤erent levels of income in di¤erent sectors depending on deterministic characteristics $\hat{A}_{it}$ such as age and gender, random characteristic ε^j_{it} such as unobservable ability, according to the income generating function $y^j_t(\hat{A}_{it}; \varepsilon^j_{it})$ in sector j. The random characteristics ε^0_{it} and ε^1_{it} are independent of each other and independent and identical over time with mean zero. Agents choose between sectors to maximize income. We assume the sector 1 is superior to sector 0 in the sense that the average income in sector 1 is higher than in sector 0. Now suppose there is no entry cost to sector 1. Then, ex ante every agent has a uniform desire to enter sector 1; and ex post the entrance to sector 1 is randomly determined by the realization of characteristics ε^0_{it} and ε^1_{it}: Thus sector choice would not be systematically relate to the personal wealth. However, when there exists an entry cost to sector 1, the sector choice will depend not only on the income gap $y^1_t(\hat{A}_{it}; \varepsilon^1_{it}) - y^0_t(\hat{A}_{it}; \varepsilon^0_{it})$ between sectors and hence the characteristics $\hat{A}_{it}$, ε^0_{it}, and ε^1_{it} but also on personal wealth such as land ownership L_{it} or physical and …nancial assets K_{it}.

Assuming the random characteristics ε^0_{it}, and ε^1_{it} follow normal distributions, we estimate the reduced form sector choice using probit estimation. The probability that agent i enters sector 1 is written:

$$\Pr\{d_{it} = 1\} = \Phi(\alpha_t + \beta^L_t L_{it} + \beta^K_t K_{it} + \gamma_t \hat{A}_{it}); \tag{19}$$

where Φ denotes standard normal cumulative distribution function. Now the estimates for α_t, β^L_t, β^K_t, and γ_t are obtained by maximizing the following log likelihood function:

$$\log L\left(\alpha_t; \beta^L_t; \beta^K_t; \gamma_t\right)$$
$$= \sum_{i=1}^{n} \{d_{it} \ln \Phi(\alpha_t + \beta^L_t L_{it} + \beta^K_t K_{it} + \gamma_t \hat{A}_{it}) + (1 - d_{it}) \ln[1 - \Phi(\alpha_t + \beta^L_t L_{it} + \beta^K_t K_{it} + \gamma_t \hat{A}_{it})]\};$$

where n_t denotes the sample size at date t.

We estimate these discrete choice models only among "young" households, whose heads' ages are between 20 and 29, to minimize the endogeneity problem between sector choice and wealth accumulation. Suppose we observe a wealthy household in the higher-income sector. It can be the case here either that the household chooses to enter the higher-income sector because of its initial high wealth or that the household is wealthy because of its previous choice of the higher-income sector. For these "young"

households, we can take their wealth to approximate initial wealth because they have not had much time to accumulate wealth. Thus focusing on young households, we can approximately estimate the effects of wealth on sector choice. The results of these maximum likelihood estimations for educational choice, occupational choice, and financial participation choice are reported in Tables A.6.1, A.6.2, and A.6.3, respectively, in the appendix.

From these estimations, we calculate the marginal increase in probability specified in (19) by increasing one-standard-deviation units of dependent variables for the average household, that is

$$\frac{\partial \Phi(\alpha_t + \beta^L_t L_{it} + \beta^K_t K_{it} + \gamma_t \hat{A}_{it})}{\partial z_t} \text{std.dev}(z_t) \Big|_{A_{it}=\bar{A}_t;\ \hat{A}_{it}=\bar{\hat{A}}_t}; \tag{20}$$

where z_t denotes any one of the dependent variables. These numbers suggest how much the sector choices are associated with each of dependent variables for the average household. Table 5.1, Table 5.2, and Table 5.3 report these numbers in estimation of educational choice, occupational choice, and financial credit participation choice, respectively.

Table 5.1. Marginal Increase in Probability of Attaining Secondary-or-higher Education

Year	1976	1981	1986	1988	1990	1992	1994	1996
Age	-1.45	-3.94	-1.07	.18	-.98	-1.68	-2.29	-2.51
Male	-1.23	1.03	-.86	.14	-.47	1.62	-.79	.00
Wealth	11.66	14.77	19.03	17.43	18.74	21.62	21.09	20.55
Own Land	-5.79	-7.54	-5.66	-4.09	-1.67	-5.98	-2.60	-3.48
North	-1.78	-2.25	-3.69	-3.18	-2.21	-4.39	-.78	.99
Central	-1.28	-1.79	-4.60	-3.43	-4.19	-5.36	-.17	1.07
South	2.22	.61	-.99	-1.50	.83	.02	4.75	2.01
Bangkok	-1.47	-3.00	-2.44	-2.44	.59	-1.66	4.12	5.46
Urban	1.90	4.26	6.41	8.18	8.89	7.68	11.11	11.12
Sanitary	1.19	1.85	1.94	2.64	3.15	3.91	4.64	4.75

Table 5.2. Marginal Increase in Probability of Being a Non-farm Entrepreneur

Year	1976	1981	1986	1988	1990	1992	1994	1996
Schooling	-4.79	-4.75	-3.65	-3.59	-3.20	-3.78	-4.30	-4.85
Age	.31	1.00	1.21	-.53	.36	1.94	1.87	2.28
Male	-.62	-1.21	-1.77	-.99	-1.48	-.63	-.31	-.38
Wealth	3.76	4.05	3.44	4.12	5.38	5.70	6.19	6.09
Own Land	-4.81	-4.72	-4.27	-3.67	-3.69	-4.40	-3.23	-3.60
North	-1.33	-1.22	-.10	-.41	-.25	-1.00	-1.74	-.70
Central	-.45	.51	-1.31	-1.01	.40	-.70	-1.52	-1.44
South	.13	1.40	.30	.18	1.36	-.20	-.41	.29
Bangkok	-1.71	-1.79	-1.76	-1.63	-1.32	-1.77	-2.42	-3.26
Urban	3.71	2.73	2.55	2.90	1.95	2.42	3.95	4.61
Sanitary	2.04	1.39	1.42	1.94	.68	1.79	2.09	1.24

Table 5.3. Marginal Increase in Probability of Using Financial Intermediaries

Year	1976	1981	1986	1988	1990	1992	1994	1996
Schooling	.60	3.13	1.67	2.27	5.99	4.40	4.56	5.60
Age	0.52	1.44	1.69	2.71	0.75	2.48	1.79	2.22
Male	-.14	-.92	-.62	-2.23	-1.02	-2.07	-2.65	.06
Wealth	2.79	1.74	4.41	4.70	5.83	9.40	7.40	8.20
Own Land	-.05	.40	-.44	-.81	.50	.26	.50	-1.36
North	-.05	1.41	2.68	-.78	.13	-1.30	.27	.54
Central	.78	-.86	.42	-1.49	1.08	-2.26	-1.21	-.11
South	3.44	1.02	.38	-1.82	-.90	-.14	-.30	-.42
Bangkok	-.54	.61	.50	-1.54	1.72	2.29	3.70	2.92
Urban	.88	1.56	1.06	2.20	1.76	.53	-.60	.99
Sanitary	.50	.14	.66	-.78	-.06	.00	.90	.67

In each estimation of the choices of education, occupation, and credit participation, land ownership is either negatively related with attaining higher education or being a non-farm entrepreneur, and negligibly related with using …nancial intermediaries. The negative relationships of land ownership

with higher education and entrepreneurship are anticipated since land owners are more likely to be farmers than to be entrepreneurs and they do not need higher education for farming. The negligible association of land ownership with using …nancial credit, however, does not seem to comply with common sense at …rst glance. Land is de…nitely a tangible and important form of wealth, but did not play as much role as non-land wealth in improving access to credit. This is due to the insecure land tenure system in Thailand. The land tenure in Thailand was not well established as mentioned above. Even among private lands, only …fteen percent of them are covered by full legal title. The rest are documented as certi…cate of use or even not documented at all, which implies insecure market value of land as a tradable asset. This may restrict social mobility and access to credit among farmers. Thus land ownership is negligibly associated with …nancial credit use and negatively with being a non-farm entrepreneur and with attaining higher education.

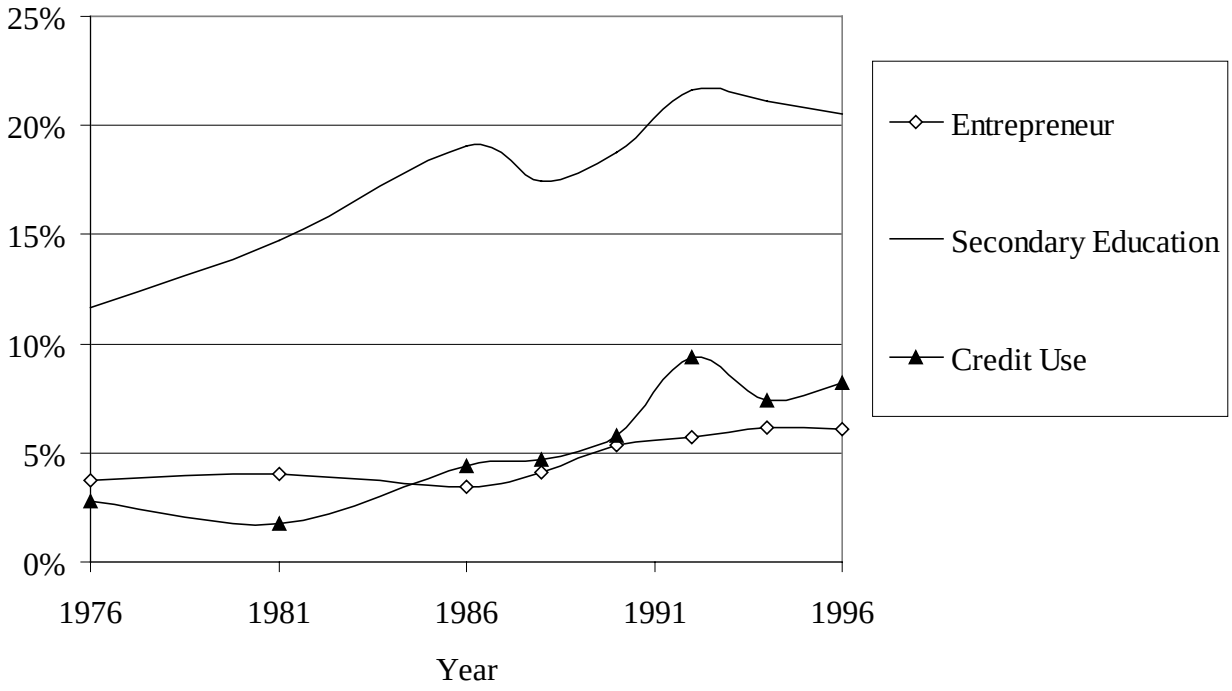
Physical and …nancial wealth, however, positively contribute to increasing the probability of attaining higher education, being a non-farm entrepreneur, and participating in the formal …nancial sector. Furthermore, it is the most substantial variable among others in increasing the probability of selecting these higher-income sectors. In particular, the magnitudes related to attaining secondary-or-higher education are remarkably large. By adding one standard deviation of wealth to the average household, the chance of attaining secondary-or-higher education could have increased by 11.7% in 1976 and 20.6% in 1996. This could have increased the participation in …nancial credit by 2.8% in 1976 and 8.2% in 1996, and the non-farm entrepreneurs by 3.8% in 1976 and 6.1% in 1996. Figure 18 plots the time series of $f^{-K}_{t}g$ between 1976 and 1996 for attaining higher education, being a non-farm entrepreneur, and using …nancial credit. All three series show increasing trends over time; that is, the marginal increase in probability of choosing higher-income sectors by additional non-land wealth has increased over time for each of the three characteristics.

The simple message from these estimation results is that wealth matters in the choice of socioeconomic characteristics such as education, occupation, and …nancial credit use.

5.3 Asymmetric Compositional Changes over Wealth Class

Due to these positive relationships between wealth and self-selection, we expect that the expansion of education and credit and occupational transformation would be asymmetric over the wealth class. Figures 19.1 through 19.3 plot the changes in proportions of each category of characteristics between 1976 and 1996 by wealth decile classes. These …gures suggest that the entry and exit of occupational

Figure 18. Marginal Increase in Probability by Adding Unit Standard Deviation of Non-land Wealth



groups, educational groups, and participation in …nancial intermediary occurred asymmetrically over the wealth classes.

In Figure 19.1 we observe that the major occupational transformation was from farmers to non-farmers, and was most substantial around the middle classes. At the …fth wealth decile group, we observe almost 50 percent reduction of farmers toward non-farmers. At the poorest class and the wealthiest class, there was not much occupational change. In every wealth class, the proportion of farmers dropped and that of wage workers increased except at the ninth wealth class. The proportion of rentiers was more or less stable. The proportion of assisted households increased in every class, and more heavily among the bottom half classes. The net entry to non-farm entrepreneurs was made among households between the fourth decile group and the eighth decile group. Interestingly the wealthiest households actually exited from the non-farm entrepreneur toward wage worker.

Figure 19.2 shows that every household escaped from the no-education group. However, the entry to the education groups higher than secondary level was limited by wealth. Net entry to vocational education and university education was negligible among the households at the bottom half wealth classes. In particular, the signi…cant entry to university education was made only at top two wealth classes. Focusing on bottom half wealth classes, Figure 19.2 displays another problem in the Thai educational expansion. Among these poor classes, no-education group decreased by 13 percent. Within these new entrants to formal educational system, 41 percent simply stopped pursuing education higher than primary level even though they could have earned 50% more income if they had pursued simply one step further. We observe only two percent of net entry to vocational or university educational system among these bottom …ve wealth classes. Among the top half wealth classes, no-education group decreased also by a similar magnitude, 13 percent. However, almost all of these new wealthy entrants to formal educational system pursued to vocational or university level of education.

At every wealth class, a substantial increase in participation in …nancial intermediaries occurred. However, Figure 19.3 shows that the magnitude of new entry is almost proportional to wealth level. The participation among the bottom half classes increased from 2.2% in 1976 to 15.6% in 1996 while the participation among the top half classes increased from 21% in 1976 to 55% in 1996. Thus the gap in participation rate in …nancial credit between the poor and the wealthy increased from 18.8 % in 1976 to 39.4 % in 1996.

These di¤erential compositional changes over wealth classes explain the results of the decomposition analyses in section 4. It was the expansion of education and credit that substantially contributed

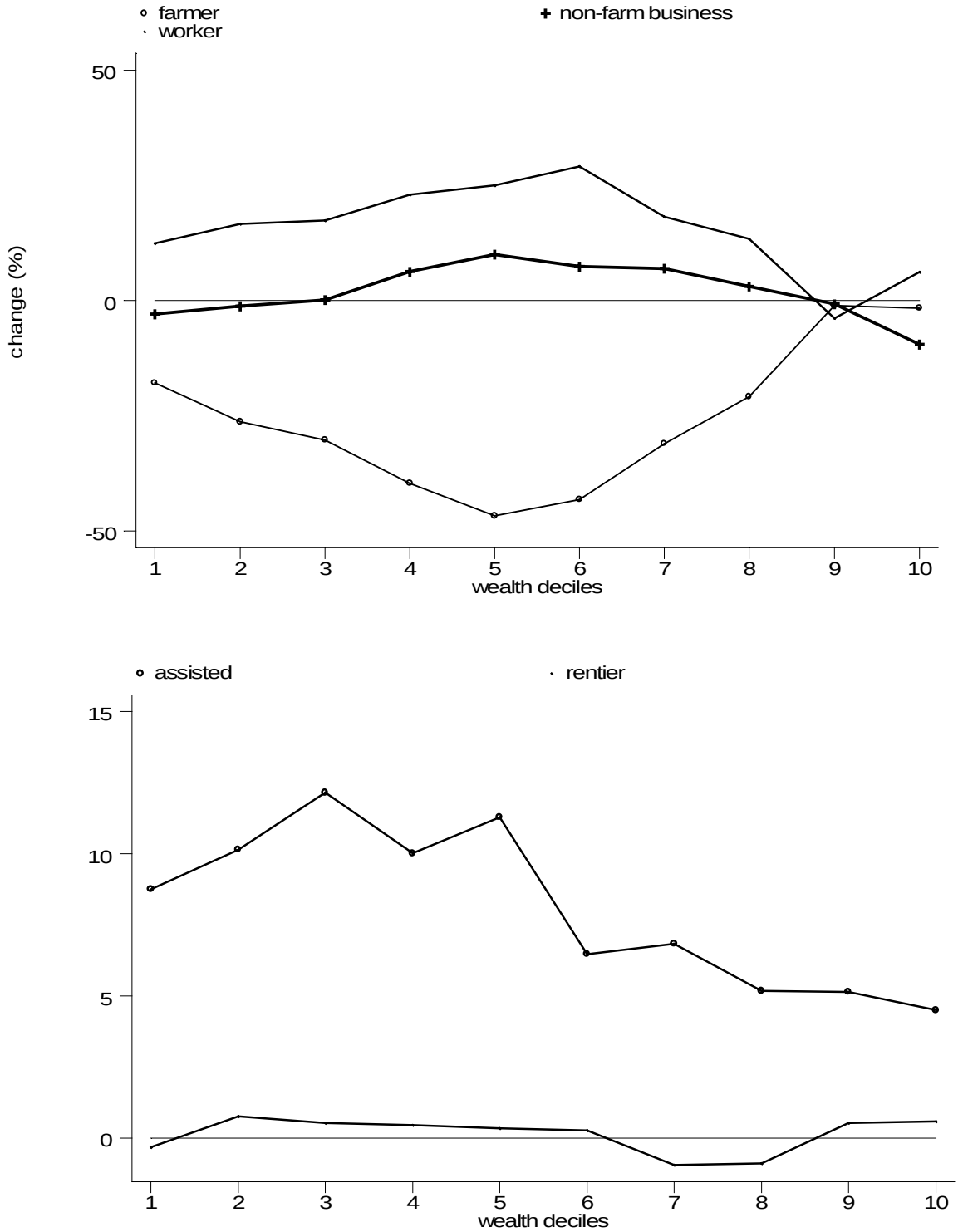


Figure 19.1 Occupational Transformation by Wealth Class, 76-96

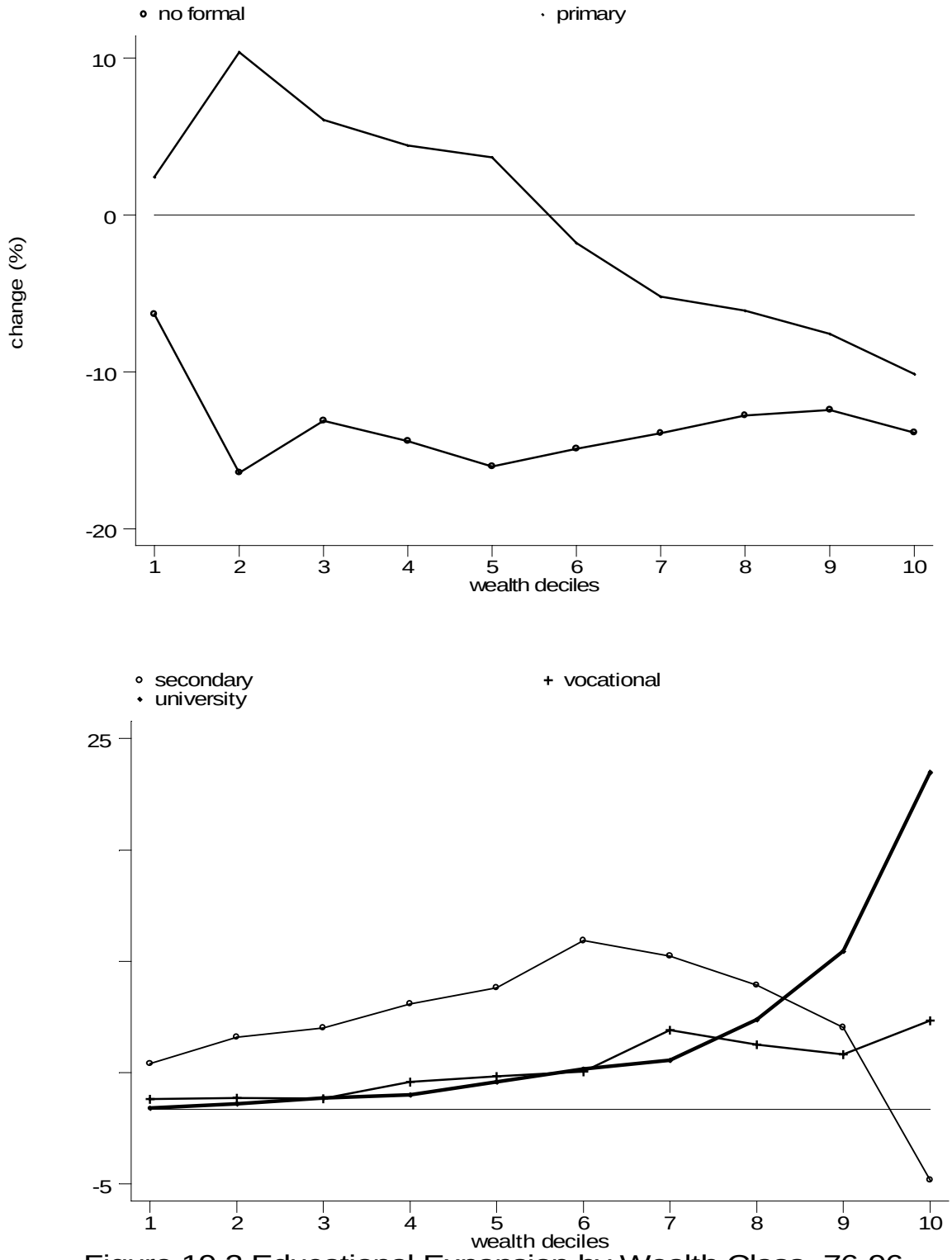


Figure 19.2 Educational Expansion by Wealth Class, 76-96

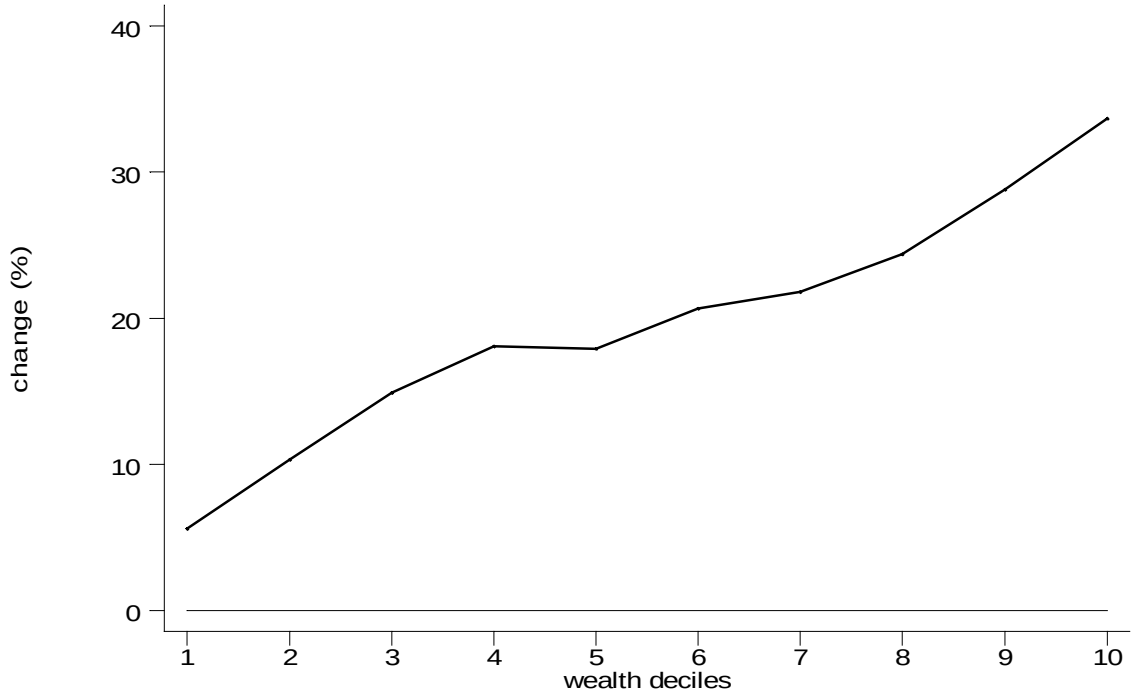


Figure 19.3. Expansion of Credit Use by Wealth Class, 76-96

to increasing inequality. In contrast, the occupational transformation rather contributed to poverty reduction. This is because the expansion of higher education and credit was biased toward the wealthy while the occupational transformation was more or less concentrated among the middle class.

5.4 Underlying Impediments to Self-Selection in Thailand

The above results support the constrained self-selection model as a tentative hypothesis for Kuznets dynamics in Thailand. Here we explore the three possible underlying reasons that generate these wealth constraints in Thailand: insecure land tenure system, reversed educational subsidy policy, and commercial banking biased …nancial system.

5.4.1 Insecure Land Tenure System

As already mentioned, the land tenure system in Thailand is not well-established due to the lack of documentation and registration of land ownership. Thai farmers could get easy access to land due to this tenure system in Thailand and hence not much incentive for them to own lands. For example, according to Feder, Onchan, Chalamwong, and Hongladarom (1988), in Nakhon Ratchasiam, one of their survey provinces, only 25% of land tracts were acquired by purchase. It reduces land inequality per se among farmers on the one hand. However, the overall implications of this insecure land tenure are not particularly clear. When the land tenure is insecure, the market value of land as a tradable asset is also insecure. Thus it restricts the access of farmers to formal credit due to the lack of collateral, even though they have tangible forms of wealth. Feder, Onchan, Chalamwong, and Hongladarom (1988) suggest that in Lop Buri, one of their survey provinces, institutional lenders accept land as collateral only by 8% among the total collateral types for untitled land owners while 78% of total collateral was land for the titled land owners. Furthermore, in their sample in Lop Buri, none of the untitled land owners could get loans from commercial banks while 6% of the titled owners could. This lack of access to credit in turn may a¤ect the productivity of farming itself. It may also discourage the land-owning farmers who are willing to sell their lands in order to change their occupation to non-farm business or in order to …nance higher education. Note that most of farmers are the poorest people in Thailand. Thus this insecure land tenure system seems to be a serious impediment to social mobility in Thailand.

5.4.2 Reversed Educational Subsidy Policy

Educational expansion is usually considered as one of the most fundamental engines of growth with enhancing social welfare. The usual evidence for the existence of this "virtuous circle" between educational expansion and growth is the persistent experience of strong growth with reduced inequality in East Asian countries (Birdsall, Ross, and Sabot 1995). However, the existence of this virtuous circle per se does not imply that it is e¤ective for every country. On the contrary, as Fields (1980) noted, "despite the rapid growth of educational systems in developing countries, there has been at best little reduction in income inequality in those countries." Thailand is one of these seemingly paradoxical countries. The growth performance in Thailand almost matches those in East Asian countries. Even though the average education level in Thailand is much lower than those in other East Asian countries, the speed of educational expansion was fast over these periods. Furthermore, educational expansion contributed 25 percent of total aggregate growth. In relation to income growth and its strong relationship to human capital accumulation, Thailand resembles its neighboring East Asian countries.

When we turn our attention from growth to inequality, however, Thailand rather resembles remote Latin American countries. Ironically, it is again in the feature of educational expansion that we …nd a similarity between Thailand and Latin America for inequality aspects as we do for growth aspects between Thailand and East Asia. Thailand looks like Brazil in terms of low level of attainment in secondary education and the policy emphasis on university education rather than on primary and secondary education (Birdsall and Sabot, 1996).

As mentioned in Section 3, the premium for higher education in Thailand is very high. However, private education for secondary or higher levels seems to be too expensive in Thailand, particularly for the poor rural households. Sirilaksana (1990) suggests rough estimates of the cost of private education in 1983. The annual cost of private middle school was 4,400 baht in current value, which was more than half of the total annual household income in rural areas. For the public middle school, the cost becomes smaller, 2,882 baht. However, high-quality public schools are rare in Thailand, and even the rare high-quality public schools select students by an entrance exam for which the children from rich households are much better prepared. Most high-quality secondary education is obtained through private schools. Let alone the expensive tuition of the private secondary education, parents need to contribute some enormous amount of money to the schools. Even after this selection, a large asymmetry in drop-out ratio between urban and rural areas exits. The Survey of Children and Youth

in Thailand (NSO, 1977, 1983) found that around 60 percent of youths aged 15 to 19 remained in school in urban areas while only 18 percent did in rural areas.

These facts suggest that the cost of education in Thailand is very high even at the secondary level. Note that human capital is an intangible asset so that loan markets for human capital are usually missing. Thus many countries subsidize education. However, the educational subsidy structure is arranged in the wrong direction in Thailand. The Thai government hardly subsidizes secondary education while university education is heavily subsidized. According to Sirilaksana (1990), only 17 percent of the direct social cost was subsidized at the secondary level while 92 percent was subsidized at the university level. Thus only the wealthy households can a¤ord secondary education and then keep pursuing to university education attained with almost free of charge. These cost-subsidy structures created huge barriers to higher education for the poor. This educational subsidy policy is exactly the same as the one in Brazil, and just the opposite of those in South Korea and Taiwan. Thus educational expansion seems severely constrained by personal wealth due to this bottleneck at the secondary level.

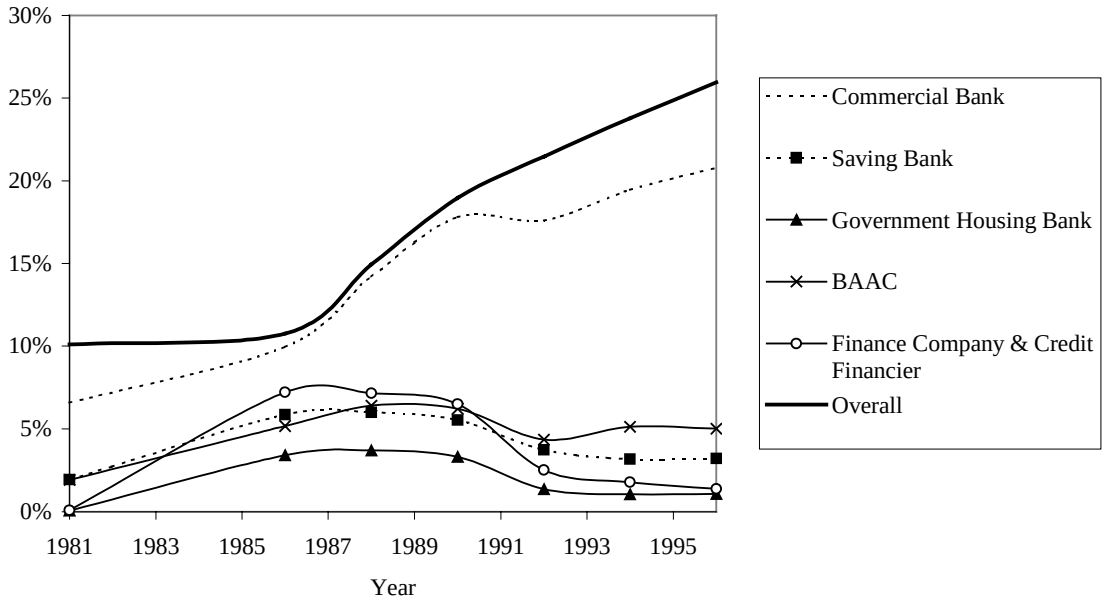
5.4.3 Commercial Banking Dominance

Goldsmith (1969) noted two salient trends in …nancial structure in the course of development: …rst, increase in share of assets from …nancial institutions and second, marked decline in share of commercial banking with increasing share of insurance organizations. The average share of deposit banks in total private …nancial assets had declined from 45 percent in 1860 to 32 percent in 1963 among developed countries, and from 69 percent in 1900 to 58 percent in 1963 among less developed countries.[29] The trend of general expansion of …nancial credit is observed in Thailand. However, the Thai …nancial system is heavily biased to commercial banking; according to Naris (1990), in 1987 the shares of commercial banks are 69 percent, 73 percent, and 76 percent among total assets, total savings, and total credit, respectively. In this regard, Thailand does not resemble Brazil, whose commercial banks asset share is only 44 percent.[30] After 1981, the SES records …nancial transactions by institutions so that we can decompose the intermediary use by institutions. Figure 20, which plots the trend of intermediary use by institutions, suggests that the overall trend of increasing credit is mostly driven by the commercial banks even with their initial dominance in …nancial markets. The usual contractual form of bank loan is collateralized debt possibly due to costly veri…cation as predicted in Townsend

[29] Data source: Goldsmith (1969) Table 5-23. Total private …nancial asset is de…ned by total …nancial asset less the asset owned by central bank.

[30] Data source: World Development Report 1989.

Figure 20. Trend of Participation in Financial Credit by Institutions



(1979). There might also be some screening of customers by the commercial banks based on wealth due to the asymmetric information between lenders and borrowers. In either case, the dominance of commercial banks implies that access to institutional credit is limited by wealth in general. The insecure land tenure system makes access to institutional credit even harder for the untitled farmers, who are generally the poorest in Thailand.

6 Conclusions

Thailand grew rapidly with increasing inequality for the last two decades between 1976 and 1996. This growth was substantial enough to reduce poverty remarkably, but accompanied a sharp increase in inequality. This paper tried to seek and quantify the link between growth and income distribution dynamics by analyzing compositional changes in the course of development. We found that an expansion of education and credit, and an occupational transformation were the signi…cant common sources of these growth and income distribution dynamics. Thus the Kuznets dynamics were relevant in Thailand through these three characteristics. The estimation of discrete choice models of these characteristics suggests that wealth matters for the choices of these characteristics. Indeed the data showed compositional changes of these characteristics were asymmetric over the wealth classes. These empirical observations thus support the explicit theories of growth and inequality based on compositional changes toward more productive sectors with wealth constraints.

The importance of compositional e¤ects does not seem to be unique in Thailand. There are several empirical studies which identi…ed the substantial e¤ect of educational expansion on income inequality for other countries: Brazil (Park, Ross, and Sabot, 1996), Columbia (Mohan and Sabot, 1988), and East Africa (Knight and Sabot, 1983). This paper suggests that compositional e¤ects can be substantial through other characteristics such as participation in …nancial credit and occupational choice as well. However, these compositional e¤ects in general do not seem well appreciated yet in the literature, empirically and theoretically, even though they can be signi…cant micro links for the two important aggregate dynamics of growth and inequality.

This motivates future research in two directions, which feedback each other. We may apply the decomposition methodologies used in this paper to any country to identify crucial characteristics associated with the Kuznets dynamics for that country. This will identify important factors of growth and inequality dynamics speci…c to a particular country, which may suggest policy designs relevant for that

particular country. We then may compare the decomposition results across countries to identify common factors of growth and inequality dynamics. This will help evaluate existing theories of growth and inequality and suggest new theories of growth and inequality. Another direction is to study dynamic models of constrained self-selection with explicit micro underpinnings. We may consider the evaluation of existing theories of growth and inequality based on compositional changes subject to wealth constraints with explicit speci…cation of micro underpinnings and impediments to trade. Jeong and Townsend (1999) study two distinct models of growth and inequality following this line: the Lloyd-Ellis and Bernhardt (1999) model for occupational transformation, and the Greenwood and Jovanovic (1990) model for …nancial deepening. They estimate these models by maximum likelihood methods utilizing the stationary structure of characteristics choice of the models and then test them by measuring the distance between simulated income distributions at the estimated underpinning parameters and actual distribution. We also may consider constructing models of constrained self-selection for the characteristics, of which the empirical importance on growth and inequality is con…rmed, but is addressed without explicit micro underpinnings such as educational expansion. This will help us to understand the importance of compositional e¤ects on growth and inequality as implied by economic models that are explicit about micro underpinnings and impediments to trade.

7 Appendix

Table A.1. Summary Statiscs for Income in Thailand SES

Year	1976	1981	1986	1988	1990	1992	1994	1996	1976-1996 [1]
Population (million)	43.1	47.9	53.6	55.2	56.8	58.9	60.2	60.3	1.7%
Total Income (billion)	43.5	63.1	65.8	78.2	96.2	119.7	133.9	160.4	6.7%
Mean	1009	1317	1227	1418	1693	2033	2225	2659	5.0%
Median	709	884	745	859	981	1113	1270	1584	4.1%
Standard Deviation	1201	1575	1643	1795	3228	3985	3909	4223	6.5%
Interquartile Ratio	1.01	1.12	1.30	1.31	1.31	1.38	1.38	1.36	1.5%
Theil-L	0.292	0.330	0.408	0.402	0.451	0.496	0.470	0.437	2.0%
Theil-T	0.340	0.373	0.461	0.441	0.564	0.603	0.559	0.504	2.0%
Gini Coefficient	0.418	0.443	0.489	0.486	0.512	0.535	0.521	0.503	0.9%
Coefficient of Variation	1.191	1.195	1.339	1.266	1.906	1.960	1.757	1.588	1.5%
Atkinson Index (e=1)	0.253	0.281	0.335	0.331	0.363	0.391	0.375	0.354	1.7%
Polarization	0.374	0.413	0.480	0.487	0.485	0.518	0.512	0.499	1.4%
Head-count Ratio	0.483	0.359	0.446	0.365	0.307	0.256	0.205	0.130	-6.4%
Poverty Gap	0.175	0.119	0.170	0.127	0.100	0.079	0.061	0.034	-7.8%
FGT P_2	0.083	0.054	0.085	0.060	0.044	0.034	0.026	0.013	-8.7%
Number of Observations	11356	11880	10895	11044	13174	13458	25208	25110	

Note 1: This column reports the annual average rates of change between 1976 and 1996 for each summary statistics.

Table A.2. Composition of Household Characteristics (%)

Year	1976	1981	1986	1988	1990	1992	1994	1996	76-96 [1]	76-86 [2]	86-92 [2]	92-96 [2]
Education												
No Formal	24.2	17.7	13.4	11.5	11.7	10.5	10.0	9.4	-14.8	-1.07	-0.49	-0.28
Primary	68.0	70.7	73.6	73.8	73.5	72.5	72.7	71.1	3.1	0.56	-0.17	-0.37
Secondary	5.0	6.5	6.3	6.9	7.8	8.2	9.0	10.1	5.0	0.13	0.31	0.47
Vocational	2.0	3.6	3.8	4.4	3.5	4.2	3.9	4.5	2.5	0.18	0.07	0.07
University or Higher	0.9	1.6	2.9	3.4	3.4	4.6	4.5	5.1	4.2	0.20	0.28	0.11
Sector												
Agriculture	60.5	55.7	52.5	51.3	51.2	47.6	44.0	42.0	-18.4	-0.80	-0.82	-1.39
Mining	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	-0.1	-0.01	-0.01	0.01
Manufacture	4.0	6.5	6.1	6.0	7.1	6.8	7.4	7.5	3.5	0.21	0.11	0.18
Electricity, Gas & Water	0.2	3.2	0.3	0.5	0.7	0.5	0.4	0.4	0.2	0.01	0.04	-0.03
Construction	1.5	0.3	2.7	2.9	3.4	4.0	4.6	5.4	3.9	0.11	0.23	0.35
Trade & Commerce	8.5	8.7	9.5	9.3	8.7	9.5	10.1	10.4	1.9	0.11	0.00	0.21
Transport & Communication	2.2	2.9	2.9	3.1	2.9	2.8	3.1	3.2	1.1	0.07	-0.02	0.10
Service	13.0	12.6	13.0	13.6	12.8	14.7	14.1	14.6	1.6	0.00	0.28	-0.03
Inactive	10.0	9.8	12.9	13.2	13.1	13.9	16.2	16.4	6.5	0.29	0.18	0.62
Occupation												
Small Farmer	44.5	42.2	35.9	35.2	33.9	31.5	25.6	23.8	-20.7	-0.86	-0.75	-1.92
Fisher & Other Farmer	2.1	1.7	1.2	1.0	0.8	0.6	0.8	0.6	-1.5	-0.09	-0.10	-0.01
Big Farmer	6.3	5.2	5.3	3.9	4.4	3.8	2.4	2.5	-3.8	-0.10	-0.26	-0.31
Non-farm Self-employed	13.1	11.4	11.8	11.4	11.5	11.5	12.3	13.0	-0.1	-0.13	-0.05	0.39
Non-farm Employer	1.3	2.3	2.4	2.3	2.3	2.9	2.9	3.2	1.9	0.11	0.09	0.08
Own-account Professional	0.2	0.1	0.1	0.0	0.1	0.2	0.3	0.2	0.0	0.00	0.01	-0.01
Farm Worker	4.7	6.1	6.4	6.6	6.3	5.9	6.2	5.3	0.6	0.17	-0.09	-0.16
General Worker	5.6	1.8	4.3	3.8	4.1	4.2	3.6	3.1	-2.4	-0.13	-0.02	-0.26
Production Worker	5.9	8.3	9.3	9.2	10.9	11.9	14.2	15.2	9.3	0.34	0.44	0.82
Service Worker	8.0	8.8	9.6	10.9	11.4	12.0	13.0	13.6	5.7	0.16	0.40	0.40
Professional Worker	4.1	5.2	5.4	6.0	5.2	5.7	6.1	6.6	2.5	0.13	0.06	0.22
Assisted	3.5	5.6	7.4	8.5	8.0	8.8	11.9	12.1	8.6	0.39	0.23	0.83
Rentier	0.8	1.4	0.9	1.1	1.2	1.1	0.9	0.9	0.1	0.01	0.04	-0.06
Credit												
Non-user	93.7	89.9	89.2	85.1	81.0	78.5	76.2	74.1	-19.6	-0.44	-1.78	-1.12
User	6.3	10.1	10.8	14.9	19.0	21.5	23.8	26.0	19.6	0.44	1.78	1.12
Age												
30 or less	14.6	19.6	17.8	17.8	14.6	15.0	13.7	12.9	-1.7	0.32	-0.47	-0.53
31 - 40	25.0	23.3	25.0	25.5	25.2	25.2	24.4	23.9	-1.0	0.00	0.03	-0.31
41 - 50	26.1	23.1	21.5	21.4	21.6	22.2	22.5	22.7	-3.3	-0.45	0.11	0.13
51 - 60	18.9	18.2	18.6	18.5	20.1	18.7	19.2	18.8	-0.1	-0.02	0.01	0.01
61 or more	15.6	15.8	17.0	16.8	18.4	18.9	20.3	21.7	6.1	0.15	0.32	0.69
Gender												
Male	83.3	80.3	80.1	79.3	79.4	79.6	76.5	75.8	-7.5	-0.32	-0.08	-0.96
Female	16.7	19.7	19.9	20.7	20.6	20.4	23.5	24.3	7.5	0.32	0.08	0.96
Community Type												
Urban	14.9	19.5	20.1	21.3	21.7	21.3	22.1	23.6	8.7	0.52	0.19	0.59
Sanitary District	13.3	12.5	12.8	9.8	9.5	10.3	10.9	10.6	-2.7	-0.05	-0.42	0.09
Rural	71.8	68.0	67.1	68.9	68.8	68.5	67.0	65.8	-6.0	-0.47	0.23	-0.67

Note 1. Total change between 1976 and 1996

Note 2. Annual average change for corresponding periods

Table A.3. Income Share (%)

Year	1976	1981	1986	1988	1990	1992	1994	1996	76-96 [1]	76-86 [2]	86-92 [2]	92-96 [2]
Education												
No Formal	15.4	10.5	6.2	5.4	4.4	3.9	3.3	3.0	-12.4	-0.92	-0.38	-0.24
Primary	65.8	65.4	62.9	60.9	58.6	53.2	52.8	52.5	-13.3	-0.28	-1.62	-0.18
Secondary	9.9	11.0	11.1	11.9	14.6	14.1	15.6	15.4	5.5	0.13	0.50	0.33
Vocational	5.0	7.7	9.9	10.4	9.8	10.4	10.7	10.4	5.4	0.49	0.08	0.00
University or Higher	3.9	5.3	9.8	11.5	12.6	18.4	17.6	18.7	14.8	0.59	1.42	0.09
Sector												
Agriculture	46.4	40.6	35.6	35.2	34.4	26.6	25.1	25.0	-21.3	-1.08	-1.50	-0.38
Mining	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.0	0.00	-0.02	0.03
Manufacture	6.9	9.2	9.8	9.4	10.5	10.5	12.5	12.4	5.5	0.29	0.11	0.48
Electricity, Gas & Water	0.5	0.8	0.5	1.6	1.6	1.4	1.2	1.1	0.6	0.00	0.15	-0.08
Construction	2.2	3.4	3.2	3.1	5.0	5.0	4.8	6.1	3.8	0.10	0.30	0.27
Trade & Commerce	17.2	17.5	18.8	18.0	17.4	20.6	19.8	19.2	1.9	0.15	0.31	-0.37
Transport & Communication	3.7	4.1	4.4	4.2	4.8	4.6	4.6	4.5	0.8	0.07	0.05	-0.04
Service	18.2	20.1	22.3	22.7	21.9	25.9	26.6	26.3	8.1	0.41	0.59	0.10
Inactive	1.6	4.2	5.2	5.5	4.3	5.2	5.3	5.2	3.6	0.36	0.01	-0.01
Occupation												
Small Farmer	29.1	27.8	20.9	20.4	18.4	15.6	13.4	12.9	-16.2	-0.83	-0.87	-0.68
Fisher & Other Farmer	1.8	1.5	0.8	1.1	0.8	0.7	1.2	0.7	-1.1	-0.09	-0.02	-0.01
Big Farmer	8.3	6.9	6.2	5.1	6.5	3.6	2.3	2.7	-5.5	-0.21	-0.43	-0.22
Non-farm Self-employed	18.6	14.1	13.9	13.3	13.0	12.6	13.4	14.8	-3.8	-0.47	-0.21	0.56
Non-farm Employer	4.9	7.0	7.1	6.6	8.5	9.6	9.5	9.3	4.4	0.22	0.42	-0.09
Own-account Professional	0.4	0.1	0.3	0.2	0.1	1.3	1.3	0.5	0.1	-0.01	0.17	-0.21
Farm Worker	3.3	3.2	3.3	3.2	2.7	2.5	2.7	2.4	-1.0	0.00	-0.14	-0.02
General Worker	3.8	1.1	2.3	1.8	1.8	2.0	1.8	1.5	-2.2	-0.15	-0.04	-0.12
Production Worker	7.1	8.6	9.9	9.2	10.3	10.8	11.4	12.1	5.0	0.28	0.16	0.32
Service Worker	11.1	12.3	14.4	15.4	15.8	17.1	17.8	17.8	6.7	0.33	0.44	0.18
Professional Worker	8.3	10.4	12.7	14.4	13.4	15.7	15.5	16.2	7.9	0.44	0.49	0.14
Assisted	2.7	5.2	7.1	8.2	6.4	6.6	8.2	8.1	5.4	0.44	-0.09	0.38
Rentier	0.7	1.7	1.3	1.2	2.2	2.0	1.4	1.0	0.4	0.06	0.12	-0.24
Credit												
Non-user	87.3	81.0	78.6	72.2	61.6	57.3	57.0	56.4	-30.9	-0.87	-3.55	-0.23
User	12.7	19.0	21.4	27.8	38.4	42.7	43.0	43.6	30.9	0.87	3.55	0.23
Age												
30 or less	19.4	23.3	22.1	20.3	19.7	19.6	20.2	19.5	0.0	0.27	-0.42	-0.03
31 - 40	28.3	27.1	30.5	32.4	30.9	31.9	31.5	31.7	3.3	0.21	0.23	-0.06
41 - 50	28.3	24.3	23.8	22.7	23.4	25.0	25.2	24.9	-3.4	-0.46	0.20	-0.02
51 - 60	16.3	17.3	16.4	16.8	17.8	16.0	15.9	16.4	0.2	0.01	-0.06	0.10
61 or more	7.6	8.0	7.2	7.9	8.2	7.5	7.3	7.6	-0.1	-0.04	0.05	0.01
Gender												
Male	83.2	77.7	75.8	75.5	76.5	75.3	72.0	70.1	-13.1	-0.73	-0.09	-1.30
Female	16.8	22.3	24.2	24.5	23.5	24.7	28.0	29.9	13.1	0.73	0.09	1.30
Community Type												
Urban	27.8	35.0	38.3	39.1	41.0	44.1	40.4	41.9	14.1	1.05	0.97	-0.55
Sanitary District	16.2	12.4	13.0	10.3	9.6	11.0	12.0	11.2	-5.0	-0.32	-0.34	0.05
Rural	55.9	52.6	48.7	50.6	49.5	44.9	47.7	46.8	-9.1	-0.73	-0.64	0.49

Note 1. Total change between 1976 and 1996
Note 2. Annual average change for corresponding periods

Table A.4. Equivalent Income Regression

(Standard Errors are in parentheses. Asterisk mark indicates insigni…cance by 90 percent con…dence level)

Year	1976	1981	1986	1988	1990	1992	1994	1996
Entrepreneur	.458	.300	.407	.405	.427	.477	.442	.465
	(.018)	(.020)	(.020)	(.020)	(.019)	(.018)	(.013)	(.013)
Worker	.194	.089	.147	.124	.156	.210	.195	.204
	(.015)	(.016)	(.016)	(.016)	(.015)	(.015)	(.011)	(.011)
Assited	.254	.316	.305	.384	.326	.304	.319	.335
	(.038)	(.033)	(.029)	(.028)	(.026)	(.025)	(.016)	(.016)
Rentier	.244	.347	.288	.400	.453	.648	.501	.426
	(.076)	(.057)	(.074)	(.067)	(.062)	(.057)	(.047)	(.047)
No Educ.	-.156	-.183	-.213	-.234	-.306	-.327	-.332	-.351
	(.017)	(.019)	(.024)	(.025)	(.024)	(.024)	(.018)	(.018)
Second Educ.	.377	.378	.446	.424	.430	.398	.394	.358
	(.026)	(.025)	(.027)	(.026)	(.022)	(.021)	(.014)	(.014)
Vocation Educ.	.625	.652	.790	.828	.753	.720	.736	.681
	(.039)	(.034)	(.034)	(.032)	(.031)	(.029)	(.020)	(.019)
Univ. Educ.	.867	.955	1.185	1.104	1.041	1.135	1.156	1.080
	(.056)	(.053)	(.042)	(.037)	(.033)	(.030)	(.020)	(.019)
Credit User	.362	.368	.381	.333	.411	.366	.352	.362
	(.022)	(.019)	(.020)	(.017)	(.015)	(.014)	(.010)	(.009)
North	.095	.232	.271	.238	.242	.190	.193	.210
	(.015)	(.016)	(.017)	(.017)	(.016)	(.016)	(.012)	(.011)
Central	.457	.400	.456	.393	.349	.412	.424	.439
	(.015)	(.016)	(.017)	(.018)	(.017)	(.016)	(.012)	(.012)
South	.094	.262	.324	.289	.227	.217	.195	.276
	(.018)	(.019)	(.020)	(.020)	(.018)	(.018)	(.013)	(.013)
Bangkok	.492	.582	.662	.719	.648	.721	.695	.671
	(.022)	(.024)	(.025)	(.025)	(.023)	(.023)	(.016)	(.016)
Urban	.250	.323	.453	.330	.275	.363	.346	.313
	(.021)	(.022)	(.023)	(.023)	(.021)	(.020)	(.014)	(.014)
Sanitary	.188	.117	.131	.153	.117	.201	.121	.108
	(.017)	(.018)	(.019)	(.022)	(.020)	(.019)	(.014)	(.013)
Experience	-.006	.005	.003	.005	.009	.008	.010	.011
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.001)	(.001)
Experience^2	.000	.000	.000¤	.000¤	-.000	-.000	-.000	-.000
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Male	-.003¤	-.0045	0.010¤	0.008¤	-.011¤	-.015¤	-.032	-.062
	(.015)	(.015)	(.016)	(.016)	(.015)	(.014)	(.010)	(.010)
Constant	6.306	6.427	6.014	6.127	6.183	6.294	6.367	6.532
	(.033)	(.033)	(.035)	(.034)	(.032)	(.030)	(.022)	(.021)
Adjusted R^2	.387	.382	.474	.459	.457	.532	.507	.506
Residual s.d.	.561	.603	.611	.622	.633	.618	.627	.614

Table A.5 Scoring Coe¢cients for Non-land Wealth Index from Principal Component Analysis

Asset Item	1976	1981	1986	1988	1990	1992	1994	1996
Private Water	.188	.267	.230	.226	.233	.223	.220	.175
Gasoline Cook	.221	.267	.279	.290	.291	.294	.315	.311
Electricity	.314	.240	.199	.179	.161	.145	.143	.138
Phone	.232	.196	.192	.191	.200	.213	.223	.251
Sofa	.259	.264	.266	.271	.268	.280	.284	.281
Bed	.268	.272	.284	.288	.285	.291	.292	.285
Stove	.298	.304	.312	.312	.313	.315	.324	.322
Refrigerator	.312	.316	.324	.324	.326	.330	.342	.337
Iron	.335	.306	.310	.305	.306	.307	.305	.301
Pot	.284	.305	.296	.293	.283	.275	.266	.259
Radio	.037	.107	.148	.165	.172	.189	.194	.197
TV	.295	.313	.290	.281	.263	.253	.261	.247
Motor Cycle	.105	.123	.150	.149	.166	.165	.171	.142
Car	.172	.169	.166	.168	.168	.176	.185	.187
Motor Boat	.005	.015	.018	.018	.008	.019	.019	.014
Sewing Machine	.219	.166	.145	.152	.158	.142	.123	.106
Room Number	.132	.122	.152	.164	.186	.185	.208	.193
Rental Value of Owned House	.202	.186	.206	.211	.205	.198	.210	.213
Rental Income	.093	.082	.085	.071	.079	.051	.065	.053
Interest and Dividend	.034	.051	.075	.195	.041	.043	.056	.063
Explained Variation (%)	26.40	32.03	30.30	30.31	29.55	28.21	26.56	24.16

Table A.6.1 Probit Estimation for Secondary-or-higher Educational Choice

(Standard Errors are in parentheses. Asterisk mark indicates insigni…cance by 90 percent con…dence level)

Year	1976	1981	1986	1988	1990	1992	1994	1996
Age	-.028	-.062	-.017	.002	-.011	-.019	-.024	-.026
	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Male	-.162	.108	-.068	.011	-.032	.111	-.047	-.000¤
	(.004)	(.003)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Wealth	.278	.268	.294	.269	.251	.300	.283	.270
	(.001)	(.001)	(.001)	(.001)	(.000)	(.001)	(.000)	(.000)
Own Land	-.847	-.803	-.521	-.351	-.129	-.514	-.227	-.290
	(.006)	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
North	-.227	-.228	-.314	-.262	-.173	-.353	-.057	.071
	(.005)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
Central	-.193	-.213	-.465	-.338	-.355	-.461	-.013	.072
	(.005)	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
South	.295	.075	-.104	-.150	.072	.002¤	.365	.160
	(.005)	(.004)	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)
Bangkok	-.232	-.358	-.223	-.203	.041	-.115	.253	.323
	(.005)	(.004)	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)
Urban	.235	.380	.466	.562	.556	.483	.650	.629
	(.005)	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
Sanitary	.156	.209	.193	.269	.303	.362	.401	.404
	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
Constant	-.073	.834	-.071	-.570	-.289	.026	-.006	.079
	(.015)	(.012)	(.010)	(.010)	(.010)	(.010)	(.009)	(.009)

Table A.6.2 Probit Estimation of Occupational Choice of Being a Non-farm Entrepreneur

(Standard Errors are in parentheses. Asterisk mark indicates insigni…cance by 90 percent con…dence level)

Year	1976	1981	1986	1988	1990	1992	1994	1996
Schooling	-.122	-.105	-.079	-.098	-.066	-.071	-.084	-.094
	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Age	.010	.031	.038	-.020	.010	.051	.049	.056
	(.001)	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Male	-.130	-.219	-.303	-.211	-.240	-.094	-.046	-.051
	(.004)	(.003)	(.003)	(.003)	(.003)	(.002)	(.002)	(.002)
Wealth	.142	.143	.130	.196	.185	.182	.206	.192
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Own Land	-1.278	-1.085	-1.350	-1.530	-1.102	-1.315	-1.251	-1.276
	(.008)	(.005)	(.007)	(.010)	(.007)	(.007)	(.008)	(.007)
North	-.280	-.250	-.020	-.105	-.049	-.186	-.374	-.129
	(.005)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
Central	-.106	.104	-.333	-.336	.077	-.132	-.319	-.263
	(.005)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)	(.003)
South	.032	.294	.071	.051	.266	-.041	-.086	.055
	(.005)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
Bangkok	-.508	-.460	-.460	-.501	-.261	-.307	-.435	-.560
	(.006)	(.005)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
Urban	.596	.437	.415	.534	.300	.331	.514	.554
	(.005)	(.004)	(.004)	(.004)	(.003)	(.003)	(.003)	(.003)
Sanitary	.372	.282	.305	.480	.162	.338	.384	.232
	(.004)	(.004)	(.004)	(.004)	(.004)	(.003)	(.004)	(.004)
Constant	-.696	-1.215	-1.426	.072	-.905	-1.809	-1.657	-1.738
	(.017)	(.014)	(.013)	(.013)	(.013)	(.013)	(.012)	(.012)

Table A.6.3 Probit Estimation for Participation in Financial Intermediaries

(Standard Errors are in parentheses. Asterisk mark indicates insigni…cance by 90 percent con…dence level)

Year	1976	1981	1986	1988	1990	1992	1994	1996
Schooling	.021	.070	.030	.034	.076	.045	.044	.055
	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Age	.022	.044	.044	.056	.013	.035	.023	.028
	(.001)	(.001)	(.001)	(.000)	(.000)	(.000)	(.000)	(.000)
Male	-.040	-.171	-.097	-.263	-.108	-.168	-.186	.004
	(.005)	(.003)	(.003)	(.002)	(.002)	(.002)	(.002)	(.002)
Wealth	.143	.062	.138	.122	.124	.163	.120	.132
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
Own Land	-.012	.069	-.075	-.112	.058	.024	.050	-.138
	(.006)	(.004)	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)
North	-.012	.240	.375	-.106	.015	-.126	.023	.048
	(.006)	(.004)	(.004)	(.003)	(.004)	(.003)	(.003)	(.003)
Central	.208	-.210	.074	-.252	.129	-.235	-.111	-.009
	(.006)	(.005)	(.004)	(.004)	(.004)	(.003)	(.003)	(.003)
South	.715	.224	.075	-.345	-.133	-.016	-.029	-.043
	(.006)	(.005)	(.005)	(.004)	(.004)	(.003)	(.003)	(.003)
Bangkok	-.187	.120	.084	-.223	.181	.186	.269	.210
	(.007)	(.005)	(.005)	(.004)	(.004)	(.003)	(.003)	(.003)
Urban	.226	.271	.159	.255	.177	.043	-.044	.070
	(.006)	(.004)	(.004)	(.003)	(.003)	(.003)	(.003)	(.003)
Sanitary	.137	.033	.131	-.157	-.009	.000	.096	.071
	(.005)	(.004)	(.004)	(.004)	(.004)	(003)	(.003)	(.003)
Constant	-2.495	-3.070	-2.760	-2.511	-2.004	-1.937	-1.566	-1.925
	(.020)	(.015)	(.013)	(.012)	(.012)	(.011)	(.009)	(.010)

Table A.7.1 Parameter Estimates of Elliptical Lorenz Curve for Actual Distributions

Year	a	b	d	$\frac{z}{1}$
1976	0.755	-0.523	0.354	0.684
1986	0.725	0.449	0.443	0.542
1992	0.620	0.974	0.462	0.320
1996	0.772	0.414	0.373	0.243

Table A.7.2 Parameter Estimates of Elliptical Lorenz Curve for Distributions with Counterfactual Education

Year	a	b	d	$\frac{z}{1}$
1976 (1996)	0.771	-0.022	0.403	0.549
1976 (1986)	0.735	-0.320	0.384	0.633
1986 (1992)	0.757	0.807	0.473	0.494
1992 (1996)	0.651	1.163	0.461	0.298

Table A.7.3 Parameter Estimates of Elliptical Lorenz Curve for Distributions with Counterfactual Occupation

Year	a	b	d	$\frac{z}{1}$
1976 (1996)	0.858	-0.709	0.245	0.558
1976 (1986)	0.781	-0.517	0.328	0.639
1986 (1992)	0.801	0.445	0.404	0.500
1992 (1996)	0.713	0.745	0.389	0.293

Table A.7.4 Parameter Estimates of Elliptical Lorenz Curve for Distributions with Counterfactual Credit Use

Year	a	b	d	$\frac{z}{1}$
1976 (1996)	0.733	-0.199	0.369	0.566
1976 (1986)	0.742	-0.443	0.359	0.656
1986 (1992)	0.749	0.780	0.458	0.480
1992 (1996)	0.639	1.133	0.461	0.302

Table A.7.5 Parameter Estimates of Elliptical Lorenz Curve for Distributions with Counterfactual Education, Occupation, and Credit Use

Year	a	b	d	$\frac{z}{1}$
1976 (1996)	0.771	-0.269	0.290	0.459
1976 (1986)	0.742	-0.319	0.365	0.604
1986 (1992)	0.778	0.746	0.419	0.451
1992 (1996)	0.724	0.688	0.371	0.286

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