An Assessment of Relationship Between Growth and Inequality Using Micro Data from Thailand

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Abstract

Applying comprehensive decomposition analyses to the micro data from Thailand, this paper shows that growth and income distribution dynamics are closely linked through occupation, financial intermediation, and education. The compositional change of these characteristics accounts for more than half of the Thai inequality increase while it contributed to nearly forty percent of the Thai growth and poverty reduction between 1976 and 1996, which not only validates the empirical importance of the relationship between growth and income inequality that Kuznets (1955) speculated on, but also identifies the key factors through which they are linked. This study thus lays a cornerstone on the works searching for the relevant specification of underlying mechanisms of growth and inequality and the scope of potential policies for equity-enhancing growth. The orders of magnitudes of the compositional effects on growth are similar over these characteristics but their effects on income distribution dynamics sharply contrast. Financial deepening and educational expansion contributed to increase in inequality while occupational transformation did not so much contributed to inequality increase as to poverty alleviation. However, the effect of diverging income levels across income-status groups on inequality is most remarkable via occupation, suggesting the importance of a rise in skill premia on inequality dynamics along growth, which is the main factor together with the occupational transformation that shapes the aggregate inequality dynamics along growth as an inverted-U curve.

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The relationship between growth and inequality is one of the central questions in economics, which has attracted numerous endeavors to answer. The literature on this issue flourished in particular after the seminal work of Kuznets (1955), where he speculated on a specific nonlinear, inverted-U shaped, dynamic relationship between growth and income inequality, the so called "Kuznets curve." Various theories were suggested to deliver this dynamic relationship. Most of empirical studies have, however, focused on *cross-country regressions* to test this dynamic relationship mainly due to the scarcity of appropriate data. The results of these studies are unfortunately not robust to the specification of estimation and to the selection of data. The cross-sectional relationship between levels of inequality and development, measured by per capita national income, is inverted-U shaped in Ahluwalia (1976), upright-U shaped in Fields and Jakubson (1994), and insignificant in Deininger and Squire (1998). The effect of initial inequality on subsequent growth is negative in Alesina and Rodrik (1994), positive in Forbes (2000), and inverted-U shaped in Barro (1999).

Fundamental assumption underlying these studies is that all countries are homogeneous in all respects other than explanatory variables, control variables, and random residual. Thus, in part, this non-robustness is due to the genuine difficulty of controlling *country-specific fixed effects*. Forbes (2000) is one of the most careful studies dealing with this difficulty but under the genuine non-linearity of inequality dynamics, various treatments of fixed effects in linear models may not help identifying the relationship as Banerjee and Duflo

(2000) emphasize. Had a complete solution for the fixed effect problem in nonlinear models, international dependency in development process, as was explicitly pointed out by Saith (1983), brings another problem of *spatial correlation* on these cross-country regressions. Thus though these prevalent cross-country studies have provided suggestive leads, the relationship between growth and inequality seems hard to determine from them. A more natural and promising way to verify this dynamic relationship would be an analysis of evolution of income distribution for a given economy using the time series of micro data.

To study the factors determining the trends of income inequality in the course of a country's economic growth, Kuznets (1955) suggested that data be classified by average income levels for a sufficiently long span, say a generation, so that one can form long-term "income-status groups." Then, long-term changes in the income distribution consist of the population shifts across income-status groups and changes in the income levels of these groups. Consistent with this idea, we classify the population into income-status groups according to various household characteristics and try to seek and quantify the link between growth and income distribution dynamics, using the micro data from Thailand over two decades between 1976 and 1996, when the Thai economy grew rapidly, which reduced poverty remarkably, but accompanied a sharp increase in inequality.

Kuznets's own inverted-U shaped relationship between growth and income inequality was indeed derived from this classified array of data. His leading example is one of the labor force shift from agriculture to non-agriculture. However, compositional changes in any socioeconomic characteristics that partition the population into *income-status groups* can be common sources of growth and income distribution dynamics. Thus we may in general call these dynamic effects of compositional changes in socioeconomic characteristics on growth and income distribution as "Kuznets dynamics." One of the main goals of this paper is to assess the empirical importance of the Kuznets dynamics, by identifying, *from many possibilities*, which are the crucial characteristics associated with this nonlinear relationship between growth and income distribution dynamics, by applying comprehensive decomposition analyses to the micro data from Thailand. The classified array of data allows us to infer another source of inequality dynamics related to growth process. The differential income levels across income-status groups may diverge or converge along with growth. We also attempt to identify the channels through which this factor affects inequality dynamics.

The decomposition of growth using micro data also sheds a new light on our understanding of growth accounting. Standard growth accounting exercise using macro data decomposes output growth into the factor accumulation and a residual, the so called "total factor productivity" growth at aggregate level. The latter includes any sources of growth other than the factor accumulation. Thus sorting the growth due to compositional changes in population out of total growth provides us with an alternative way of identifying this residual.

The paper proceeds as follows. Section I introduces a model which provides a framework for the decomposition analysis. Section II describes the data. We first describe the measurements of variables and then study the features of growth and income distribution dynamics in Thailand. In Section III, these features are decomposed by constructing nonparametric counterfactual distributions and by index decomposition in order to assess the relationship between growth and inequality. Section IV concludes the paper.

I Model

Consider an economy populated by agents, indexed by i, who are supposed to choose a category among K mutually exclusive alternatives of a socioeconomic characteristic, associated with income-generating attributes, at each discrete date t. Let d_{it}^k indicate an agent i's choice at date t on the characteristic so that $d_{it}^k = 1$ if agent i chooses category k at date t and $d_{it}^k = 0$ otherwise. Given the characteristic choice of category k at date t, agent i gets an income

$$y_{it}^k = \mu_t^k + \varepsilon_{it}^k, \tag{1}$$

where μ_t^k indicates an average component and ε_{it}^k a zero-mean idiosyncratic component of category k income at date t. Agent i chooses a sequence of characteristic categories $((d_{is}^k)_{k=1}^K)_{s\geq t}$ at date t to maximize the expected value of the discounted life-time utility

$$E[\sum_{s=t}^{T} \beta^{s-t} u(y_{is}) \mid \Omega_{it}], \tag{2}$$

where T denotes the span of life time, β the discounted factor, u the current-period indirect utility function, Ω_{it} the information set of the relevant state of nature, and y_{is} the income level such that

$$y_{is} = \sum_{k=1}^{K} d_{is}^k(\mu_s^k + \varepsilon_{is}^k). \tag{3}$$

There may exist an admissible set Γ_{it} that restricts agent i's characteristic choice at date t.

Thus, optimal characteristic choice $((d_{is}^{k*})_{k=1}^K)_{s\geq t}$ of agent i at date t is determined by

$$((d_{is}^{k*})_{k=1}^K)_{s\geq t} \in \arg\max\{E[\sum_{s=t}^{T} \beta^{s-t} u(\sum_{k=1}^{K} d_{is}^k(\mu_s^k + \varepsilon_{is}^k)) \mid \Omega_{it}] \ s.t. \ ((d_{is}^k)_{k=1}^K)_{s\geq t} \in \Gamma_{it}\}. \tag{4}$$

The characteristic choice would be a function of the underlying fundamentals such as state variables in Ω_{it}, admissible set Γ_{it}, and parameters of preference and expectation. We do not pursue any detailed characterization of this choice in terms of these underlying fundamentals but describe this model at very abstract level only to illustrate the clear dependence of the observed aggregate income distribution on the individual self-selection of socioeconomic characteristics and hence on the compositional contents of them.

The population fraction of agents who choose the category k at date t is $p_t^k = \sum_{i=1}^{n_t} d_{it}^{k*}/n_t$, where n_t denotes the population size at date t and $p_t = (p_t^k)_{k=1}^K$ determines the distribution of characteristic at date t. Let F be the aggregate distribution function of income y_t at date t, F^k be the subgroup distribution function of category k, and the associated density functions be f and f^k, respectively. Then, the law of probability suggests the following decomposition formula for the income distribution

$$F(y_t, p_t, t) = \sum_{k=1}^{K} p_t^k F^k(y_t, p_t, t) \tag{5}$$

with respect to distribution functions, or

$$f(y_t, p_t, t) = \sum_{k=1}^{K} p_t^k f^k(y_t, p_t, t) \tag{6}$$

with respect to density functions.

This illustrates how the compositional changes in socioeconomic characteristics of population (more fundamentally through the features of individual self-selection) can affect the aggregate shape of the income distribution. Note that the above decomposition formulae are indeed accounting identities, which helps us to identify the possible sources of income distribution dynamics in an accounting sense without specifying the structures of the model. According to these decomposition formulae, the changes in the income distribution are either due to changes in the composition of the characteristics $(p_t^k)_{k=1}^K$ or due to changes in the subgroup distributions $(f^k)_{k=1}^K$. The latter factor can further be decomposed into two sources. One source is the changes in distributional distances *across* subgroups, i.e., changes in income premia schedules across income-status groups $(\mu_t^k)_{k=1}^K$, due to the differential growth rates across them. The other is the distributional change *within* subgroups, i.e., the changes in the distributions of the idiosyncratic components $(\varepsilon_{it}^k)_{k=1}^K$.

Bringing this accounting framework to the micro data from Thailand, we decompose the growth of average income, change in income inequality and poverty at aggregate level into these factors over various socioeconomic characteristics that partition the population into income-status groups. Comparison of the quantitative importance of these factors over various characteristics allows us to infer through which, if any, characteristics the growth and income distribution dynamics are linked.

II Data

We use the Socio-Economic Survey (SES), a nationally representative household survey conducted by the National Statistical Office (NSO) in Thailand, to study the evolution of income distribution in Thailand over two decades between 1976 (when the compatible data collection began) and 1996 (prior to the 1997 Asian financial crisis which began in Thailand). During this period, eight rounds of cross-section data were collected in 1976, 1981, 1986, 1988, 1990, 1992, 1994, and 1996. The sampling scheme of the SES is a clustered random sample stratified by geographic regions over the whole country. The sampling unit is a household, defined as a group of persons who make common provision for food and other living essentials with the general criteria for membership of common housekeeping arrangements, sharing of principal meals, common financial arrangements for supplying basic living essentials, and recognition of one member as head. The sample size of each round varies from 10,897 to 25,208 depending on year with fairly high rates of survey response at 80 to 97 percent.[1]

A Measurements

A.1 Income

The original income figure 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*,* which includes wages, net profits from farming and non-farm business, property income, transfer payments, rental value of owner-occupied dwellings, other money receipts, and income in kind. 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 public transfer symmetrically.

This SES household income figure is adjusted in two ways. First, it is deflated into real terms with the numeraire of 1990 baht applying the *differential consumer price indices across regions* to reflect the regional variation in general price levels and changes. Second, it is scaled by *adult-male equivalent household size* to compare the household income in terms of equivalent welfare units. Even though it is hard to find *the* right equivalence scales, this adjustment helps the comparison of income figures over households with different demographic structures.[2] In summary, "income" in this paper refers to the adult-male equivalence scaled post-tax post-transfer monthly household income including both cash income and in-kind income in 1990 Thai baht value.

A.2 Household Characteristics

Among the various socioeconomic characteristics, we consider seven household characteristics: age, gender, community type of residence, employed production sector, occupation, financial participation, and education. For person-specific characteristics like age, gender, employed production sector, occupation, and education, the characteristics of the household head are used. According to the SES, the average contribution shares of the head to the total household earnings are 83 to 90 percent, depending on survey year. Therefore, using head's characteristics seems a reasonable approximation to represent the household characteristics for the purpose of analyzing household income.

Age groups are partitioned by five categories: 30 or less, 31-40, 41-50, 51-60, 61 or more. Gender groups are dichotomous: male and female. Production sector has nine categories: agriculture, mining, manufacturing, electricity-gas-water, construction, trade-commerce, transport-communication, service, and economically inactive. For occupation groups, there are four broad categories: farmer, wageworker, non-farm entrepreneur, and the inactive. Each of these broad categories of occupation has sub-categories based on earning capacity such as land size, working status, or skill level. There are three sub-categories of farmer: small farmer, big farmer, and other farmer. Small farmers include the farm operators owning less than 40 rai of land and all farmers renting land.[3] Other farming activities include fishing, 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 five types of wageworkers according to 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. Thus there are thirteen occupation groups. Education has five categories based on the level of final attainment: no formal, primary, secondary, vocational, and university or higher.

Community type of residence and financial participation are genuinely defined at household level. There are three community types: urban area, sanitary district, and rural area. Sanitary district is an area in planned transition from rural area to urban area. Financial participation has two categories: participant and non-participant, the classification of which is based on the changes in household assets and liabilities with various formal financial institutions. If any member of the household transacted with any of the formal financial institutions such as commercial banks, savings banks, Bank of Agriculture & Agricultural Cooperative (BAAC), government housing banks, financial companies, or credit financiers, the household is categorized as participant.

B Features of Growth and Income Distribution in Thailand

In a classified array of the SES data according to the above measurements, we describe the features of growth and income distribution dynamics in Thailand between 1976 and 1996, first at aggregate level, and then at subgroup levels, followed by description of the compositional changes in the above household characteristics.

B.1 Aggregate Dynamics

The Thai economy developed rapidly between 1976 and 1996. According to our income measure, the average income of the Thai economy increased by 5.0 percent each year.[4] Applying the Purchasing Power Parity (PPP) of 8.2 baht in 1985 dollar from the Penn World Tables in Summers and Heston (1991), this growth implies that the annual per capita income increased from $1,210 in 1976 to $3,210 in 1996, in 1985 value. This rapid growth alleviated poverty remarkably. In 1976, nearly half of the population, 48 percent, earned less than $2 a day in 1985 value. By 1996, this had fallen to 13 percent. Income inequality, however, increased sharply over this period. Already in 1976, the income Gini coefficient of Thailand at 0.436 was much higher than the average income Gini coefficient of East Asia and Pacific Rim countries at 0.362 and close to the average income Gini coefficient of Sub-Saharan African countries at 0.441.[5] This high income inequality became even higher after two decades of growth. By 1996, the income Gini coefficient of Thailand increased to 0.515 even exceeding the average income Gini coefficient in Latin American and Caribbean countries at 0.502.

Figure 1 displays the changes in the income distributions between 1976 and 1996, by comparing the estimated density functions of income in logarithmic scale. In each year, the density at income level x is estimated by the nonparametric kernel method given by

$$\widehat{f}(x) = \frac{1}{h}\sum_{i=1}^{n} w_i K\left(\frac{x - y_i}{h}\right)$$

where $(y_1, \cdots, y_n)$ is the sampled income prospect, h the bandwidth, n the sample size, w_i the sampling probability weight for the observation y_i such that $\sum_{i=1}^{n} w_i = 1$, and $K(\cdot)$ the kernel function that assigns the relative weight for the observed sample points near x over the chosen band.[6]

Two vertical lines in Figure 1 indicate the average income levels in both years; the left one for 1976 and right one for 1996. The distance between them represents the growth of average income. The support of the income distribution shifted strictly to the right, but with range being widened. Figure 2 plots the Lorenz curves for both years, showing that the 1996 Lorenz curve lies strictly below the 1976 Lorenz curve, which suggests inequality clearly increased between 1976 and 1996 by Lorenz ordering, and hence by any inequality indices obeying Pigou-Dalton's *principle of transfer,* such as coefficient of variation, Gini coefficient, Atkinson indices, and generalized entropy indices.[7]

Figure 3 plots the cumulative distribution functions for both years, showing that the 1996 cumulative distribution function strictly lies below the 1976 one, i.e. the 1996 distribution stochastically dominates the 1976 distribution by the *first order*.[8] According to Foster and Shorrocks (1988), the first-order stochastic dominance is equivalent to the poverty ordering by head-count ratio, which implies a poverty reduction, measured by *any* Foster-Greer-Thorbecke (FGT) poverty indices with *any* poverty line.

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, which is robust to the choice of numeric indices of inequality and poverty as well as to the choice of poverty line.

Taking the Theil-L index as an inequality measure, Figure 4 compares the dynamic path of income inequality with that of average income over the entire period, which shows that there were two turning points for the Thai economy. We observe a sustained growth in average income with a noticeable acceleration after 1986 at a rate of 8.0 percent per annum, which is a turning point for the Thai growth. The 1992 is another turning point for the Thai economy in terms of inequality: except for a modest decrease between 1986 and 1988, the inequality monotonically increased until 1992, but substantially dropped thereafter. Figure 5 shows that the same patterns of inequality dynamics are observed using other inequality measures such as Theil-T index, Gini coefficient, Atkinson index, and Foster-Wolfson polarization index. With the poverty line of $2 a day per person in 1985 value, Figure 6 plots various poverty indices, showing a uniform pattern of poverty reduction except during the slight recession period between 1981 and 1986.[9] This suggests that the poverty trend was driven by growth rather than by inequality change in Thailand.

Based on these turning points, we divide the overall two-decade period into three sub-periods: Stage 1 (1976-1986), the period of slow growth with increasing inequality; Stage 2 (1986-1992), the period of fast growth with increasing inequality; and Stage 3 (1992-1996), the period of fast growth with decreasing inequality.

B.2 Compositional Changes

Over the two-decade period between 1976 and 1996, the Thai economy went through substantial changes in the composition of socioeconomic characteristics that partition the population into income-status groups, i.e. the intertemporal changes in $(p_t^k)_{k=1}^K$ in terms of the model in Section I. Here, we recapitulate the salient features of these changes.

The Thai demography changed substantially. 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 to 74. 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, who live on either transfer income or property income, increased from 10 percent to 16 percent.

Agriculture has been a dominant sector of the Thai economy for a long time in employment share and income share alike. However, the relative importance of agriculture has fallen from 61 percent to 42 percent with respect to employment share, and 46 percent to 25 percent with respect to income share between 1976 and

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, it is construction and manufacturing sectors that expanded the fastest. Employment share of two sectors increased from 5.5 percent in 1976 to 12.9 percent in 1996.

Along with this rapid industrialization, urban ratio rose from 15 percent to 24 percent, and the major occupation was switched from farmer to wageworker. The proportion of farmers decreased from 53 percent to 27 percent while that of wageworkers increased from 28 percent to 44 percent. In particular, among wageworkers, the proportion of unskilled workers decreased while the skilled workers in industrial and service sectors increased. For example, the population fraction of general workers dropped from 5.3 percent to 3.1 percent while that of industrial production workers increased from 5.9 percent to 15.2 percent. Ironically, along with this fast and continual industrialization, the proportion of non-farm entrepreneurs was stable around 14 percent until 1992, and then slightly increased to 16 percent by 1996, which suggests that there might be an *entry barrier to becoming an industrial entrepreneur* so that the labor force released from the agricultural sector is absorbed in industrial sectors as wageworkers rather than as entrepreneurs.

The working population attained more education. Average years of schooling increased from four to six. The proportion of households whose heads attained 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 five for university or higher education (from 0.9 percent to 5.1 percent). Thus the *speed* of educational expansion for higher education was comparable to the neighboring East Asian countries. However, the general *level* of formal education in Thailand is still very low compared with other countries.[10] A vast majority of the Thai households, *92* percent in 1976 and still *80* percent in 1996, do not pursue education beyond the primary level. There seems to exist a *bottleneck to attain secondary level education.*

The financial sector was deepened in the sense that the fraction of households using the formal financial intermediaries increased from 6 percent to 26 percent. Each year one additional percent of households used the formal financial institutions. In terms of the order of magnitude of change, compositional change in financial participation is the most remarkable among other characteristics.

B.3 Subgroup Dynamics

Another factor of income distribution dynamics is related to the changes in the prospect of subgroup distributions $(f^k)_{k=1}^K$, which can be either from the changes in distributional distances *across* subgroups, measured by the changes in the schedule of average income levels across subgroups $(\mu_t^k)_{k=1}^K$, or from the distributional changes *within* subgroups related to the idiosyncratic components $(\varepsilon_{it}^k)_{k=1}^K$. Here, we describe these subgroup factors with respect to the above seven characteristics.

Figure 7 plots the subgroup average income levels $(\mu_t^k)_{k=1}^K$ between 1976 and 1996 for each given characteristic, showing that each of the seven characteristics that we consider indeed partitions the Thai population into income-status groups.[11] Figure 7 also shows that every subgroup grew as the entire economy grew. There were no losing groups by absolute standard. Figure 8 plots growth rates of subgroup average income levels relative to its own 1976 level, indicating the differential growth rates across subgroups. Figures 7 and 8, combined together, suggest that higher-income groups grew overall faster than the lower-income groups during the entire period, and hence the income gaps across income-status groups were widened. This *divergence* would overall tend to increase inequality, but with varying order of magnitude over characteristics depending both on the prevailing income gaps across subgroups and the population fractions of subgroups.

Focusing on Stage 3 (1992-1996), however, we observe opposite growth patterns. Over this period, the growth of higher-income groups slowed down while that of lower-income groups accelerated, except among age groups and gender groups. For example, agricultural sector grew the fastest at 9.3 percent among other sectors. Related, rural areas grew at 9.1 percent, exceeding the growth rate of urban areas at 3.2 percent. The primary-level education group grew at 7.7 percent much faster than the university education group at 1.5 percent. Also the growth rate of the non-participants of financial intermediaries was much higher at 8.2 percent than the participants at 2.3 percent. As a result of this *catch-up growth*, we observe *convergence* among income-status groups between 1992 and 1996, which may explain the decrease in inequality in Stage 3.

The remaining source of income distribution dynamics comes from the *intra-group* distributional changes, reflecting the intertemporal changes in the distributions of $(\varepsilon_{it}^k)_{k=1}^K$. Figures 9 and 10 plot the levels of inequality and poverty, respectively, within each subgroup, showing that inequality increased and poverty was reduced for every subgroup as for the aggregate economy. Another interesting observation from Figure 9 is that there exists a rough inequality ordering among income-status groups: inequality levels are higher for higher-income groups than for lower-income groups, except among educational groups and community-type groups. Hence, the above population shifts from lower-income groups to higher-income groups would tend to increase the overall inequality.

III Decomposition

In Section II, we observed the patterns of growth and income distribution dynamics at aggregate levels as well as their building-block factors: intertemporal changes in characteristics composition, differential income levels across income-status groups, and intra-group distributions. In this section, we evaluate the quantitative contributions of those building-block factors to growth and income distribution dynamics at aggregate levels through extensive decomposition analyses, based on which we assess the relationship between growth and income distribution dynamics.

A Nonparametric Counterfactual Decomposition

A.1 Method

In Section I, we had the following decomposition *identity*:

$$f(y_t, p_t, t) = \sum_{k=1}^{K} p_t^k f^k(y_t, p_t, t)$$

with respect to the density function of income, which indicates a potential dependence of subgroup distributions on the characteristics distribution p_t and the time t itself. Here, we adopt Kuznets' own restriction that the shapes of subgroup distributions are *independent* of p_t, making this identity into equation. Indeed, the inverted-U shaped inequality dynamics in Kuznets (1955) was originally illustrated by experimenting various numerical examples under this assumption. Thus this independence assumption not only makes the decomposition tractable but also allows us to have a consistent framework with the one from which the inverted-U shape was derived. Under this assumption, the above decomposition formula becomes

$$f(y_t, p_t, t) = \sum_{k=1}^{K} p_t^k f^k(y_t, t), \tag{7}$$

which allows us to construct a *counterfactual* income distribution that reflects only the compositional changes in characteristics as follows.

Suppose that income distribution has changed between dates s and t, accompanied by a change in characteristics distribution from $p_t = (p_t^k)_{k=1}^K$ to $p_s = (p_s^k)_{k=1}^K$. We would like to consider a counterfactual distribution that reflects only the compositional changes in characteristics from p_t to p_s. This counterfactual distribution can be constructed by replacing p_t with p_s, maintaining the subgroup income distributions at date t. In terms of the decomposition formula in (7), it is given by

$$f(y_t, p_s, t) = \sum_{k=1}^{K} p_s^k f^k(y_t, t). \tag{8}$$

Had a panel data, we could have simply switched the characteristic choice $(d_{it}^k)_{k=1}^K$ with $(d_{is}^k)_{k=1}^K$ for each individual agent maintaining his or her income level y_{it} at date t to get this counterfactual density. Using two sets of cross-sectional data, however, it seems difficult to estimate this counterfactual distribution with the present form since it mixes distributional information at two distinct dates, characteristic distribution at date s and income distribution at date t.

However, we can restate the counterfactual density in (8) such that

$$f(y_t, p_s, t) = \sum_{k=1}^{K} p_t^k [\rho_{s,t}^k f^k(y_t, t)], \tag{9}$$

where $(\rho_{s,t}^k)_{k=1}^K$ are re-weighting factors given by

$$\rho_{s,t}^k \equiv p_s^k / p_t^k, \ for\ k = 1, \cdots, K. \tag{10}$$

Now note that the counterfactual density in (9) is expressed with respect to the characteristic distribution and income distribution both at date t, with the income distribution at date t being *re-weighted* by $(\rho^k_{s,t})^K_{k=1}$.

We can estimate this counterfactual density applying the same nonparametric kernel method as we did for the actual distributions. Only difference here is that we introduce re-weighting factors in the estimation such that the counterfactual density $f(y_t, p_s, t)$, denoted by $f_{s,t}$, at income level x is estimated by

$$\widehat{f}_{s,t}(x) = \sum_{k=1}^{K} \sum_{i=1}^{n} \frac{w_{it}}{h} d^k_{it} \rho^k_{s,t} K(\frac{x - y_{it}}{h}). \tag{11}$$

where $(y_{it})^n_{i=1}$ is the sampled income distribution, $(w_{it})^n_{i=1}$ the associated sampling weights, and $((d^k_{it})^K_{k=1})^n_{i=1}$ the characteristic choice vector at date t.[12]

Comparison of the actual distribution with this counterfactual distribution allows us to infer the pure effects of compositional changes in household characteristics on income distribution. We can compare the entire distributions using distributional ordering such as Lorenz ordering or poverty ordering. Applying to any distributional indices, we can also numerically sort out the compositional effects on income distribution.

Let $\vartheta\{f\}$ be *any* generic distributional index for distribution f, which can be mean, any inequality index, or any poverty index. Then, the total change of that distributional index $\vartheta\{f\}$ between dates t and s can be decomposed as follows:

$$\vartheta\{f_s\} - \vartheta\{f_t\} = [\vartheta\{f_s\} - \vartheta\{f_{s,t}\}] + [\vartheta\{f_{s,t}\} - \vartheta\{f_t\}], \tag{12}$$

where f_s and f_t denote the actual distributions at dates s and t, respectively, and $f_{s,t}$ the counterfactual distribution at date t with respect to the date s characteristic distribution. The term $[\vartheta\{f_{s,t}\} - \vartheta\{f_t\}]$ in (12) represents the effect of compositional change on the distributional index. Switching the reference date from t to s, decomposition formula would be

$$\vartheta\{f_s\} - \vartheta\{f_t\} = [\vartheta\{f_s\} - \vartheta\{f_{t,s}\}] + [\vartheta\{f_{t,s}\} - \vartheta\{f_t\}], \tag{13}$$

where now the term $[\vartheta\{f_s\} - \vartheta\{f_{t,s}\}]$ in (13) represents the composition effect.

A.2 Results

We apply the above decomposition formulae (12) and (13) to several distributional indices such as mean as a central tendency measure, Theil-L index, Theil-T index, and Gini coefficient as inequality measures, and FGT indices of head-count ratio P_0, poverty gap index P_1, and poverty severity index P_2 as poverty measures, over the seven household characteristics. We take the average of the two versions of composition effects as our composition effect. Table 1 reports the percentage shares of these composition effects out of total change for each of the seven characteristics .

The results in Table 1 identify *occupation, financial participation, and education* as the three most important characteristics that contributed to growth through compositional changes. Each of these three factors accounts for 20 to 25 percent of average income growth. These three characteristics have significant composition effects on distributional changes as well. Financial deepening and educational expansion account for 38 to 39 percent and 37 to 41 percent, respectively, of the total increase in inequality indices. The occupational transformation does not show much composition effect on inequality change, but it does show the most significant composition effect on poverty reduction among others, accounting for 20 to 23 percent of total poverty alleviation. The joint compositional change in all three characteristics accounts for 40 percent of average income growth, 53 to 57 percent of increase in inequality, and 29 to 33 percent of poverty reduction. Thus we observe the *Kuznets dynamics* in Thailand in a substantial order through occupational transformation, financial deepening, and educational expansion. This also suggests that significant part of the residual TFP growth from the usual growth accounting at aggregate level would be related to the compositional changes of the heterogeneous agents in the economy. Even dropping educational expansion, which the macro growth accounting used to capture through the human capital accumulation, the joint compositional change only in financial participation and occupation accounts for 32 percent of total growth and also 32 percent of total inequality change in terms of Theil-L index.

The composition effect of industrialization does report significant contributions to growth (16 percent) and poverty reduction (15 to 16 percent) but not much to inequality change (-3 to 2 percent). Thus, though Kuznets original example of industrialization is indeed a significant engine of growth but only weakly valid in explaining the inequality trend in Thailand. The migration between rural areas and urban areas did not contribute much both to growth and distributional changes. Negligible are the Kuznets dynamics via demographic transformation, which contrasts the findings of Mookherjee and Shorrocks (1982) and Lindert (1986). They report the importance of compositional changes in age groups in U.K. in explaining the changes in income inequality and wealth inequality, respectively.

Focusing on the above three most important characteristics, Figure 11 overlays the counterfactual density in 1976 estimated by (11) with respect to the 1996 joint distribution of occupation, financial participation, and education on the actual distributions in 1976 and 1996, showing that the compositional changes shifted the aggregate income distribution to the right with the upper tail being more weighed. Thus we would expect that the compositional changes would induce average income growth and poverty reduction but increase in inequality. Three vertical lines in Figure 11 represent the average income levels for the 1976 actual distribution, the 1976 counterfactual distribution, and the 1996 actual distribution, respectively from left to right. The distance between the left two lines represents the average income growth due to the compositional changes. Figure 12 compares the Lorenz curve of the counterfactual distribution with those of actual distributions, showing the Lorenz dominance of the 1976 actual distribution over the 1976 counterfactual distribution. Figure 13 similarly plots the cumulative distribution functions, showing the first-order stochastic dominance of 1976 counterfactual distribution over the 1976 actual distribution. These comparisons by the distributional ordering evidently suggest that the inequality increased and poverty was reduced purely due to the compositional changes, which is robust to the choice of distributional indices and poverty line.

B Index Decomposition of Growth and Inequality Change

The nonparametric decomposition method helps us to identify through which channels the compositional changes have effects on growth and income distribution dynamics in a way that does not depend on a particular choice of numeric indices. We noted in Section II that other remaining source of change in income distribution than the compositional changes involves two factors: distributional changes *across* subgroups and distributional changes *within* subgroups. The nonparametric method does not allow us to further decompose the remaining source of distributional changes into these two factors. The distributional changes across subgroups are related to the changes in average income levels across subgroups, which we may interpret as intertemporal changes in income premia of the income-generating attributes associated with the characteristics, for example, the occupational skill premia or the educational premia. Thus sorting out this factor of across-group distributional change would help us to infer through which channels the convergence or divergence across subgroups had effects, if any, on inequality change. To perform this further decomposition, we use a particular inequality measure, the Theil-L entropy index, which is decomposable into population subgroups in a compatible way with the previous decomposition formula (7) and also separates explicitly this across-group distributional distance.

We first decompose the mean income growth and then the inequality change using the Theil-L entropy index. Here, we decompose them for each sub-period of the three Stages that we classified in Section II as well as for the overall period between 1976 and 1996. The series of decomposition analyses over different sub-periods would help us to observe the transition patterns of income distribution dynamics due separately to each factor.

B.1 Method

The mean income μ is an index representing central tendency of the distribution, which is additively decomposable into subgroup mean incomes μ^k's weighted by subgroup population shares p^k's such that

$$\mu = \sum_{k=1}^{K} p^k \mu^k.$$

Due to the additivity, the income growth, measured by the change of mean income, is decomposed into two parts such that

$$\Delta\mu = \sum_{k=1}^{K} \overline{p^k} \Delta\mu^k + \sum_{k=1}^{K} \overline{\mu^k} \Delta p^k, \tag{14}$$

where Δ denotes the difference operator over time and upper bar the average over time. This is simply a discrete version of chain rule. The first term in (14) captures the growth within subgroups and the second term the growth due to the compositional changes in population.

Theil (1967) proposed an index, the Theil-L entropy, measuring inequality level of a given distribution $y = (y_1, \cdots, y_n)$ according to the following formula:

$$I(y) = \frac{1}{n} \sum_{i=1}^{n} \ln \frac{\mu}{y_i},$$

where n denotes the population size and μ the mean of y.[13] Note that this index can be re-written to be decomposed into subgroup indices in a compatible way with the original decomposition formula (6) such that

$$I = \sum_{k=1}^{K} p^k \{I^k + \ln \frac{\mu}{\mu^k}\}, \tag{15}$$

where I^k denotes the inequality level, using the same Theil-L index, within subgroup k. Here, the distributional factors related to subgroups are clearly decomposed into two parts: intra-group distributions by $(I^k)_{k=1}^K$, and inter-group distributions by $(\ln \frac{\mu}{\mu^k})_{k=1}^K$. The distributional distance across subgroups, which is implicit in (6), is now explicitly separated and expressed in terms of the schedule of relative income levels across subgroups.

Then, the total inequality I is additively decomposed into two components, the *within-group inequality* WI and the *across-group inequality* AI, each of which is again additively decomposable into subgroups, such that

$$I = WI + AI, \tag{16}$$

$$WI = \sum_{k=1}^{K} p^k I^k, \quad \textit{and} \quad AI = \sum_{k=1}^{K} p^k \ln \frac{\mu}{\mu^k}. \tag{17}$$

The within-group inequality WI is the sum of *intra-group* inequality levels while the across-group inequality AI summarizes *inter-group* distributions. Both are weighted by the population shares of subgroups and hence are affected by the compositional changes in population.

Due to the additive nature of the Theil-L index, we can similarly apply the discrete chain rule to decompose the total change in inequality such that[14]

$$\Delta I = \Delta WI + \Delta AI, \tag{18}$$

$$\Delta WI = \sum_k \overline{p^k} \Delta I^k + \sum_k \overline{I^k} \Delta p^k, \tag{19}$$

$$\Delta AI = \sum_k \overline{p^k} \left[\frac{\overline{\mu^k}}{\mu} - 1 \right] \Delta \ln \mu^k + \sum_k \left[\frac{\overline{\mu^k}}{\mu} - \overline{\ln \frac{\mu^k}{\mu}} \right] \Delta p^k. \tag{20}$$

The change in WI comes either from the changes in intra-group inequality levels or from the compositional changes in population according to the decomposition equation (19). The change in AI involves two components: inter-group effect and composition effect, the first term and second term in the decomposition equation (20), respectively. The inter-group effect captures the effect of divergence or convergence of income levels across subgroups on inequality, which is related to the differential growth rates across subgroups. When higher-income groups grow faster than lower-income groups, the income levels across income-status groups diverge and hence inequality increases, and vice versa. Note that $\Delta \ln \mu^k$ approximates the growth rate of average income of subgroup k, and hence the first term in (20) captures the inequality change due to this effect. The second term in (20) captures the effect of compositional changes on AI, *exactly* through which the Kuznets curve tends to have the *inverted-U shape* as was presented by the tabulation of numerical experiments in Kuznets (1955).[15] The explanation for this specific nonlinear dynamics is set aside to Appendix.[16]

B.2 Results

We apply the decomposition formula (14) to the average income growth with respect to the seven household characteristics, where Table 2 reports the contribution shares of composition effects to total average income growth. Annual average rate of total growth for each period is included at the bottom row of Table 2. Comparing the index decomposition results for growth during the overall period in Table 2 with the nonparametric decomposition results for growth in Table 1, we can tell that both methods report virtually the same order of magnitudes of composition effects on growth for every characteristic. Again the three most important characteristics are occupation, financial participation, and education, and the joint compositional change in these characteristics accounts for 39 percent of total growth for overall period, 38 percent both for Stages 2 and 3, and remarkable 66 percent for Stage 1. In other words, the average income grew at the rate of approximately 2 percent each year purely due to the compositional changes in occupation, financial participation, and education for two decades. The single most important characteristic for compositional growth varies depending on period, education (45 percent) in Stage 1, financial participation (27 percent) in Stage 2, and occupation (30 percent) in Stage 3.

Applying the decomposition formulae (19) and (20), Table 3 gathers the decomposition results for inequality change. Each sub-table, Table 3.1 to Table 3.4, includes the contribution shares of four component factors to inequality change for each relevant period with total change per annum being reported beside table title in parentheses. There are two composition effects, headed by "Composition" in each sub-table of Table 3, one for the within-group inequality change and the other for the across-group inequality change. The results in Table 3 indicate that the composition effect via within-group inequality is much smaller than the composition effect via across-group inequality for every characteristic and for every period. Thus composition effects for inequality change are mostly related to re-weighting the distributional distances across subgroups, which is in fact the source of the inverted-U shape of the Kuznets curve.

They also suggest that the three most important characteristics for compositional growth also played important roles in changing inequality, not only for the overall period but also for every sub-period. Again negligible are the composition effects on inequality through changes in demographic factors of age and gender, and relatively small effects through changes in structural factors such as industrialization and migration. The compositional changes tend to have effects through the "self selective" characteristics such as occupation, financial participation, and education not only on growth but also on inequality change.

For the overall period, joint compositional change of these characteristics accounts for 53 percent of total inequality change. In particular, the expansion of financial intermediation or education alone accounts for 39 or 40 percent of total inequality change for the overall period while occupational transformation alone accounts for only 9 percent. Interestingly, the single most important characteristics for compositional inequality change in each sub-period coincide with those for compositional growth: education (22 percent) in Stage 1, financial participation (48 percent) in Stage 2, and occupation (11 percent) in Stage 3. Note that the compositional changes of all three characteristics contributed to increasing inequality as well as to growth before 1992. However, after 1992, the turning point of the Thai inequality, occupational transformation, though in small amount, in fact *reduced* the inequality while the expansion of financial intermediation and education continued to contribute to increase in inequality.[17] Thus we may expect to observe a moderately inverted-U shaped Kuznets curve via occupational transformation while the major composition effects on inequality came through financial participation and education.

The column headed by "Inter-group"in the sub-tables of Table 3 indicates the divergence effect, i.e., the contribution shares of diverging or converging income gaps across subgroups (the first term in (20)) to the total inequality change. The divergence effect is the largest through occupation, not only for the overall period (32 percent) but also *both* for the inequality-increasing periods (46 percent in Stage 1 and 54 percent in Stage 2) and the inequality-decreasing period (85 percent in Stage 3). Here, we see an interesting contrast between divergence effect and composition effect over the characteristics. Overall divergence effects via financial participation and education are tiny at 2 percent and 5 percent, respectively, while their composition effects are quite large at 39 percent and 40 percent, respectively. Though levels of the income premia from higher education or from formal financial intermediation were high, the *changes* in those premia were not as important in explaining the increase in inequality as the rise in skill premium across occupation groups, which is reminiscent of the finding of Juhn, Murphy, and Pierce (1993) for the United States though they consider *wage* inequality rather than income inequality.

In Stage 3, the inequality-decreasing period, the divergence effects dominate the composition effects. The income gaps across income-status groups, partitioned by whatever single characteristic, were either remarkably narrowed or remained as stable due to the *catch-up growth* that we described in Section II. In fact, *99 percent* of the decrease in inequality in Stage 3 is due to this *convergence* in income levels across subgroups with respect to the joint partitioning by occupation, financial participation, and education. Thus, the down-turn of the Thai income inequality path is generated mainly from the divergence effects rather than from the composition effects though the occupational transformation also contributed to this down-turn.

The remaining source of inequality change should come from the distributional changes within subgroups, the contributions shares of which are reported in the column headed by "Intra-group"in Table 3. Focusing on the above three characteristics, we observe that quite large part of inequality change for overall period, 54 to 59 percent, comes from the intra-group inequality changes if partitioning the population by a single characteristic. The contribution share of intra-group effect goes down to 28 percent when partitioning the population jointly by these three characteristics. Thus, major part of the inequality dynamics can be accounted for by the factors related to compositional dynamics and divergence dynamics over the heterogeneous population, partitioned by these three income-status characteristics. But, on the other hand, a significant portion of inequality dynamics still remains in the data to be explained by some driving forces within subgroups.

C Index Decomposition of Poverty Change

Poverty is another facet of income distribution, which is affected both by growth and inequality. Holding the inequality level constant, growth tends to alleviate poverty while holding the average income constant, increasing inequality worsens poverty. Thus, for a growing economy with increasing inequality, both effects counteract each other on poverty change. We already observed that the Thai poverty was reduced between 1976 and 1996 as a net effect. This poverty reduction is decomposed into growth component and inequality component following Datt and Ravallion (1992). We extend their methodology to sort out the pure effect of compositional changes on poverty dynamics from each of these decomposed components, which is ascribed solely to the Kuznets dynamics.

C.1 Method

Datt and Ravallion (1992) showed that three FGT poverty indices of head-count ratio, poverty gap index, and poverty severity index can be characterized in a parametric way such that $P = P(\frac{z}{\mu}, L)$, where z denotes the poverty line, μ the average income, and L the parameters of elliptical form of Lorenz curve suggested by Villasenor and Arnold (1989), the details of which are explained in Appendix. This parametrization allows us to decompose the total change in poverty index ΔP between dates t and s into growth component G and inequality component D with residual term such that

$$\Delta P = G + D + residual, \tag{21}$$

$$G = \left[P(\frac{z}{\mu_s}, L_t) - P(\frac{z}{\mu_t}, L_t)\right] : \textit{Growth component}, \tag{22}$$

$$D = \left[P(\frac{z}{\mu_t}, L_s) - P(\frac{z}{\mu_t}, L_t)\right] : \textit{Inequality component}, \tag{23}$$

where the growth component G is obtained by changing only the average income holding the Lorenz curve parameters constant while the inequality component D is obtained by changing only the Lorenz curve parameters holding average income constant.

This methodology is good for decomposing poverty change into growth effect and inequality effect *at aggregate level*. We also attempt to separate the *composition effect*, common source of growth and inequality change, on poverty dynamics for each of the components G and D. To pursue this further decomposition, we construct a counterfactual distribution in terms of parametric Lorenz curve L_t^* and mean income μ_t^*. Basic idea of this construction of counterfactual distribution is the same as that of nonparametric counterfactual density but now the counterfactual distribution is estimated in a parametric way in terms of Lorenz curve by applying *weighted least square method* using the re-weighting factors in (10) as weights.

Given the parameter estimates of actual and counterfactual Lorenz curves, the growth component G and inequality component D can be further decomposed such that

$$G = \left[P(\frac{z}{\mu_s}, L_t) - P(\frac{z}{\mu_t^*}, L_t)\right] + \left[P(\frac{z}{\mu_t^*}, L_t) - P(\frac{z}{\mu_t}, L_t)\right], \tag{24}$$

$$(25) \qquad D = \left[P(\frac{z}{\mu_t}, L_s) - P(\frac{z}{\mu_t}, L_t^*)\right] + \left[P(\frac{z}{\mu_t}, L_t^*) - P(\frac{z}{\mu_t}, L_t)\right].$$

The second term $\left[P(\frac{z}{\mu_t^*}, L_t) - P(\frac{z}{\mu_t}, L_t)\right]$ in (24) represents the composition effect on poverty change via growth component while the first term $\left[P(\frac{z}{\mu_s}, L_t^*) - P(\frac{z}{\mu_t}, L_t)\right]$ in (25) represents the composition effect on poverty change via inequality component.

C.2 Results

Using head-count ratio as our poverty measure and the same previous poverty line, we apply the decomposition formulae (24) and (25) to the Thai poverty reduction with respect to occupation, financial participation, and education, the three most important channels of the Kuznets dynamics in Thailand.[18] The parameter estimates of the actual and counterfactual distributions for this decomposition are reported in Appendix. Table 4 gathers the decomposition results for each relevant period in sub-tables Table 4.1 to 4.4, where the contribution shares of decomposed factors to total poverty change are reported. The column headed by "Growth" in each sub-table reports the poverty change due to the growth component, the one headed by "Inequality" due to the inequality component, and the "Total" the total inequality change. The difference between the sum of the "Growth" and "Inequality" and the "Total" in each row comes from the residual term. The bottom row labeled as "Aggregate" in each sub-table reports the decomposed *amount* of poverty change in annual terms at aggregate level, applying the formulae (22) and (23) while other rows report the contribution *shares* of composition effects of respective characteristics on aggregate poverty change.

Table 4.1 suggests that aggregate growth between 1976 and 1996 reduced the fraction of poor Thai households by 2.28 percent each year, but the increase in inequality raised poverty by 0.36 percent each year. Combining these two effects together with the residual term, overall poverty declined by 1.71 percent each year, showing the dominance of growth component over inequality component for aggregate poverty change. Comparison over the sub-period decomposition results suggests that poverty reduction was substantial after 1986, i.e., the fast-growth era. The amount of poverty reduction increased from 0.37 percent in Stage 1 to 2.9 percent in Stage 2 and even larger to 3.27 percent in Stage 3. In particular in Stage 3, due to the decrease in inequality, even the inequality component contributed to poverty alleviation by 0.89 percent.

The dominance of growth component over inequality component is observed for the *composition effects* as well for every period. During the overall period, 62 percent of poverty reduction was due to the compositional change in the joint three characteristics via growth component while it was only 12 percent via inequality component. Net effects, including the residual terms, of compositional changes in occupation, financial participation, and education jointly contributed to the Thai poverty reduction by 39 percent for the overall period, 33 percent both in Stages 2 and 3, and remarkable 92 percent in Stage 1.

The composition effect of each single characteristic reduced poverty, but most significantly through occupational transformation in every Stage. In particular, occupational transformation alone accounts for the 73 percent of poverty reduction in Stage 1. In Stages 2 and 3, occupational transformation *reduced* poverty even via inequality component, though small portion, while the inequality components of financial deepening and educational expansion continued to increase poverty. Over the two decades, 29 percent of poverty reduction came from occupational transformation alone while financial deepening and educational expansion contributed by 14 and 18 percents, respectively. In summary, the most significant Thai poverty reduction associated with the Kuznets dynamics came from *occupational transformation*.

D Assessment of Kuznets Curve

The central theme of Kuznets (1955) is to study the factors determining the secular level and trend of income inequality in the course of a country's economic growth. His initial puzzle was the down-turns or constancy of income inequality among then developed countries, given the apparent inequality-increasing forces along growth process such as cumulative effects of concentrated savings in the upper-income brackets. Various potential factors are discussed as counteracting forces related to growth process and the population shift across income-status groups is one of them. Controlling for the income level gap and inequality level gap between income-status groups as constant over time, Kuznets displayed the well-known inverted-U shaped inequality path along growth, so called *Kuznets curve*, via population shift from agriculture sector to non-agriculture sector, and hence the tendency to declining inequality after economy has developed into a mature enough stage.[19]

The essential message from Kuznets is that this "long swing in income inequality must be viewed as part of a wider process of economic growth," rather than the inverted-U shape itself. Previous decomposition analyses indicated that the more than half of inequality change and 39 percent of poverty change over the two-decade period share the source of substantial part (39 percent) of growth in common, i.e., the population shifts across-income status groups partitioned by occupation, financial participation, and education. Thus, the relationship between growth and income distribution dynamics and hence the essential message of Kuznets are indeed confirmed by the micro data from Thailand.

Graphic representation of the sub-period decomposition results in Tables 3 and 4 allows us to verify the shape of the relationship as well. Combining the contribution share of each effect with the total change in each sub-table in Table 3, the *amount* of inequality change due to that effect can be recovered for a given sub-period. Repeating this procedure over sub-periods, the counterfactual path of inequality purely owing to that effect can be constructed. This way, using Tables 3.2 to 3.4, aggregate inequality trend is decomposed into three trends, which are displayed in Figure 14, labeled as "Composition," "Inter-group," and "Intra-group" due respectively to compositional changes, divergent or convergent income levels across subgroups, and inequality change within subgroups. Note that these trends are drawn on the mean income level rather than on time so that they may display the genuine inequality dynamics over the level of development.[20] Figure 14 includes four panels of Figures 14.1 to 14.4 for occupation, financial participation, education, and joint three characteristics, respectively. Applying the same method to Tables 4.2 to 4.4, the aggregate poverty trend is decomposed into the composition-effect trend and the intra-group-effect trend, which are displayed in Figure 15 in the same way as in Figure 14.

Overall comparison over these two sets of figures shows a clear pattern that inequality dynamics, both at aggregate and decomposed levels, are *nonlinear* along growth while the poverty dynamics, again both at aggregate and decomposed levels, are virtually linear along growth. Furthermore, the aggregate inequality path is indeed *inverted-U shaped* along growth, which verifies the shape of the Kuznets curve.

Figure 15 suggests that poverty reduction is driven by the compositional change in the beginning stage of development but it is over-taken by the intra-group poverty reduction as economy further develops. This pattern of poverty dynamics is common for every characteristic. However, the shapes of inequality paths due to compositional changes, the genuine "Kuznets dynamics" in a narrow sense, contrast over characteristics. The Figures 14.1 to 14.3 illustrate that the inequality trend due to financial deepening or educational expansion is monotone increasing in a large order of magnitude while we observe an inverted-U shaped, though moderate, inequality trend via occupational transformation.[21] Combining three factors together in Figure 14.4, we observe an inverted-U shaped curve with large order of magnitude, which confirms the Kuznets curve even in a narrow sense, where main contributing factors to increasing inequality are financial deepening and educational expansion but the nonlinearity of inequality path is generated through occupational transformation.

However, Figure 14 suggests that it is the divergence-convergence dynamics, labeled as "Inter-group," i.e., the changing income levels across income-status groups that induce the inverted-U shape of the aggregate Kuznets curve. The differential income levels across income-status groups first widened as economy develops but they began to converge due to the overtaking catch-up growth of lower-income groups after some level of development. This effect is the most salient with respect to occupation-group partitioning, which we interpret as an importance of the rise and fall in occupational skill premium on inequality. Overall the occupational premia diverged between 1976 and 1996 and contributed to 32 percent of total increase in inequality. Similar divergence-convergence patterns are observed with respect to financial participation and education, but over the two-decade period, the increase in inequality due to the increase in income premia associated with higher education or participation in formal financial sectors was virtually offset by the subsequent catch-up growth of lower-education groups or non-participants.

The intra-group inequality trend also played an important role in shaping the inverted-U shape. In fact, it was the largest factor contributing to levels of aggregate inequality with respect to the financial-participation or education partitioning, in particular in the initial stage of development. With respect to the joint categorization of population by all three characteristics in Figure 14.4, the intra-group inequality stays almost constant except the increase during the initial stage of development while the inequality trends due to population shift dynamics and divergence-convergence dynamics show inverted-U shaped patterns, moderately for the former and remarkably for the latter.

It is interesting to note that the down-turn of inequality came earlier with larger order of magnitude via the changes in income levels across income-status groups, which Kuznets controlled as constant in his numerical example, than via the population shifts across them, which was the driving force of the inverted-U curve in his own example.

IV Concluding Remarks

Applying comprehensive decomposition analyses to the micro data from Thailand, this paper shows that crucial channels linking income distribution dynamics with growth are occupation, financial intermediation, and education. The compositional changes in these characteristics among the Thai population account for 39 percent of average income growth as well as of poverty alleviation, and remarkable 53 percent of increase in inequality in Thailand, which validates the empirical importance of Kuznets dynamics through these characteristics. The orders of magnitudes of the compositional effects on growth are similar over these three characteristics but their effects on income distribution dynamics sharply contrast. It was the expansion of financial intermediation and education that mainly contributed to inequality increase while occupational transformation mainly contributed to poverty reduction. We confirm, though moderate, the inverted-U shape of the Kuznets curve via occupational transformation. Diverging and then converging income levels across occupation groups, which we interpret as rise and fall in skill premia, along growth was another important factor in shaping the inequality dynamics as inverted-U. It turns out that migration from rural areas to urban areas and labor force shifts across production sectors are less important than the these three factors, and negligible are the compositional changes in demographic characteristics of age and gender.

Kuznets (1955) concludes his seminal paper by saying "This paper is perhaps 5 per cent empirical information and 95 per cent speculation, some of it possibly tainted by wishful thinking," calling for a more adequate knowledge and a more cogent view of the whole field. This paper attempts to provide an adequate empirical information, clarifying some parts of his speculation and wishful thinking. Though this paper does not aim to directly provide the "cogent view," its empirical knowledge leads to another suggestive *speculation* on this cogent view, which again calls for further investigation.

The decomposition results suggest that appropriate realm of the search for the specification of the relationship between growth and inequality can be found with respect to three particular characteristics of occupation, financial participation, and education and thus support some models that explicitly consider the heterogeneous self-selection and wealth constraints such as Banerjee and Newman (1993) and Lloyd-Ellis and Bernhardt (2000) via occupation, Greenwood and Jovanovic (1990) via financial participation, and Galor and Zeira (1993) via education. These models are indeed substantive for a real economy like Thailand. The importance of skill premium across occupation groups along growth indicates the relevance of the capital-skill complementarity model postulated by Krusell, Ohanian, Ríos-Rull, and Violante (2000). Though these models should pass through formal empirical evaluation to see whether their structures are indeed well-specified, the wealth-constrained self-selection of income-status characteristics and the nature of the technological complementarity seem to be promising micro underpinnings of growth and inequality.

Another message of our findings is that various factors contribute, maybe interactively, to income distribution dynamics along growth with different order of magnitude at different timing. For example, Kuznets' numerical example illustrated the inverted-U shaped inequality dynamics only via population shift between income-status groups controlling for average income levels and inequality levels between them. However, the data suggest that the latter two controlled factors can be important in shaping the aggregate dynamics of inequality, perhaps interactively with the former factor. We indeed observe the precedence as well as prevalence of divergence-convergence dynamics over population shift dynamics in shaping the nonlinear pattern of inequality dynamics at aggregate levels, which insinuates the desirability of explicit consideration of general equilibrium interactions for an appropriate appreciation of the relationship between growth and inequality.

The results also suggest the scope of potential policies for growth and inequality in Thailand. Substantial amount of Thai growth is associated with the population shift across income-status groups with respect to three particular "self-selective" characteristics of occupation, financial participation, and education. As is postulated in the inverted-U curve that is confirmed by the data, the population shift toward higher-income groups would eventually reduce inequality. This effect took place in Thailand just recently and only moderately through occupational transformation. Thus, any policies that enhance the upward mobility across the income-status groups in particular with respect to financial participation and education would deliver growth with less inequality and poverty in Thailand. Focusing on the policy reform that would lower the entry barrier to higher education (in particular toward secondary level), for example, by correcting the current reversed educational subsidy policy rather than on the direct redistributive policy related to regional disparity itself, equity-enhancing growth is more likely to happen in Thailand though precise welfare evaluation of these policies may well depend on the dynamic interaction between incentives and constraints in response to them, which is beyond the limit of our decomposition analysis.

For an economy where increase in inequality accompanies growth like Thailand, the apparently worsening income distribution may directly related to the features of growth process either through population dynamics across income-status groups or through divergence-convergence dynamics related to differential growth patterns across them. This increase in inequality may or may not be transitory depending on underlying economic environments and impediments to trade since the causal direction from inequality to growth may be as good as that from growth to inequality as many theories argue. To implement more precise prediction and welfare evaluation of policy alternatives for an economy where growth and inequality are interwound, we may well consider the models that explicitly specify the dynamic interactions between incentives and constraints in key factors. However, the "key factors" may vary over space and time and thus need to be identified from the data before considering the model specification. This study thus lays a cornerstone on the works searching for the relevant specifications of underlying mechanisms of growth and inequality and the scope of potential policies for equity-enhancing growth.[22]

Appendix

A. Composition Effect and Inverted-U Shape of Kuznets Curve

Using Theil-L index as inequality measure, we can explicitly show how compositional change across income-status groups implies the inverted-U shaped Kuznets curve. For simplicity of illustration, consider an economy with dichotomous income-status groups, indexed by $k \in \{\, l,\, h\}$, where the mean income μ^l of group l is lower than that μ^h of group h. We assume that the intra-group mean income and inequality levels remain constant over time, i.e., $\Delta I^k = \Delta\mu^k = 0$ for each subgroup k, as Kuznets (1955) did in his original numerical illustration of the Kuznets curve so that we focus only on the compositional effects. Then, growth comes only from the population shift from the low-income group l to the high-income group h and the level of development is identified by the level of p^h the population share of the high-income group and economy grows when $\Delta p^h > 0$. Now the decomposition equations (19) and (20) are simplified such that

(26) $$\Delta WI = (\overline{I^h} - \overline{I^l})\Delta p^h,$$

(27) $$\Delta AI = (\overline{\lambda^h} - \overline{\lambda^l} - \overline{\ln \frac{\lambda^h}{\lambda^l}})\Delta p^h,$$

where $\lambda^k \equiv \frac{\mu^k}{\mu}$ is the relative income of subgroup k.

The composition effect on within-group inequality, $(\overline{I^h} - \overline{I^l})\Delta p^h$, depends on the inequality ordering between subgroups. If the high-income group has a higher level of inequality, i.e. $\overline{I^h} > \overline{I^l}$, again as Kuznets assumed, population shift from l to h would increase inequality through WI. Thus, as long as there exists a stable inequality ordering between subgroups, the composition effect on WI is monotonic and hence cannot imply the inverted-U shaped inequality path along growth.

The composition effect on across-group inequality AI depends on the sign of $(\overline{\lambda^h} - \overline{\lambda^l} - \overline{\ln \frac{\lambda^h}{\lambda^l}})$, which is not a priori determined. We can rewrite this coefficient as a function of p^h such that $\frac{\Delta AI}{\Delta p^h} = \left(\lambda^h - \lambda^l - \ln \frac{\lambda^h}{\lambda^l}\right) = f(p^h) \equiv \left(\frac{\mu^h - \mu^l}{p^h\mu^h + (1-p^h)\mu^l} - \ln \frac{\mu^h}{\mu^l}\right)$, which is continuous and strictly monotone decreasing in p^h with the derivative given by

$$\frac{df}{dp^h} = -\left(\frac{\mu^h - \mu^l}{\mu}\right)^2 < 0.$$

The limit values of this coefficient are strictly positive at the neighborhood of $p^h = 0$ while strictly negative at the neighborhood of $p^h = 1$ such that

$$\lim_{p^h \to 0} f(p^h) = r^h - 1 - \ln r^h > 0$$

$$\lim_{p^h \to 1} f(p^h) = -(r^h - 1 - \ln r^h) < 0,$$

where $r^h = \frac{\mu^h}{\mu^l} > 1$ since $x - 1 > \ln x$ for all $x > 1$. Thus, the *intermediate value theorem* guarantees the existence a unique critical value $\widetilde{p^h}$ given by

$$\widetilde{p^h} = \frac{1}{\ln r^h} - \frac{1}{r^h - 1}$$

such that $\frac{dAI}{dp^h} = f(p^h)$ is positive for $p^h \leq \widetilde{p^h}$, and negative for $p^h > \widetilde{p^h}$. Thus, as economy develops with population shift from low-income group to high-income group, inequality initially increases but eventually tends to decline through this composition effect on across-group inequality, which implies the inverted-U shape of the Kuznets curve.

B. Parametrization of Poverty Index Using Elliptical Lorenz Curves

The poverty decomposition methodology depends on the parametric formulation of Lorenz curve. Villasenor and Arnold (1989) suggest an elliptical form as a way of this formulation, which is a special version of the general quadratic form

$$ap^2 + bpL + cL^2 + dp + eL + f = 0,$$

where L is the ordered income share and p is the ordered population share. Since the Lorenz curve must pass through $(0,0)$ and $(1,1)$, we need to impose the following restrictions on the parameters: $f = 0$, and $e = -(a+b+c+d)$. The elliptical Lorenz curve is a special case with $b^2 - 4ac < 0$, $c = 1$, $a+b+d+1 > 0$, $d \geq 0$, and $a + d - 1 \leq 0$. With this specification, three parameters a, b, and d characterize the Lorenz curve such that

$$L\,(1-L) = a(p^2 - L) + bL(p-1) + d(p-L).$$

The FGT poverty indices are defined as

$$P_\alpha = \frac{1}{n}\sum_{y_i<z}[(z-y_i)/z]^\alpha,$$

where $(y_1, \cdots, y_n)$ denotes the income distribution profile, z the poverty line, and α non-negative integer value. Given the parameters a, b, and d, the poverty indices of head-count ratio P_0, poverty gap index P_1, and poverty severity index P_2 can be characterized as follows:

$$\begin{aligned}
(28) \qquad P_0 &= -\left[\beta + r(b+2z/\mu)\left\{(b+2z/\mu)^2 - \alpha\right\}^{-1/2}\right]/2\alpha \\
P_1 &= P_0 - (\mu/z)L(P_0) \\
P_2 &= 2P_1 - P_0 - (\mu/z)^2\left[aP_0 + bL(P_0) - (r/16)\ln\{(1-P_0/s_1)/(1-P_0/s_2)\}\right]
\end{aligned}$$

where $e = -(a+b+d+1)$, $\alpha = b^2 - 4ad$, $\beta = 2be - 4d$, $r = (\beta^2 - 4\alpha e^2)^{1/2}$, $s_1 = (r-\beta)/2\alpha$, $s_2 = -(r+\beta)/2\alpha$, μ the mean income, z the poverty line, $L(x)$ the value of Lorenz curve at x.

The parameters a, b, and d of the elliptical Lorenz curve can be estimated by standard least-square methods. The fitting performance of the elliptical Lorenz curve to the Thai Lorenz curve is remarkable: R^2 is around 0.99 in each given year. Table A.1 reports the estimates of the parameters of the elliptical Lorenz curve and the ratio of poverty line to mean income for the actual income distributions at benchmark years while Tables A.2 to A.5 for the counterfactual income distributions switching the compositions of occupation, financial participation, education, and joint three characteristics, respectively. In Tables A.2 to A.5, the year in parenthesis indicates the year when the composition of characteristics is used. For example, the estimates at the row 1976 (1996) are obtained from the income profile in 1976 using 1996 composition of characteristics.

Table A.1. Estimates for Actual Lorenz Curves

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

Table A.2. Estimates for Lorenz Curves with Counterfactual Composition of Occupation

Year	a	b	d	$\frac{z}{\mu}$
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.3. Estimates for Lorenz Curves with Counterfactual Composition of Financial Participation

Year	a	b	d	$\frac{z}{\mu}$
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.4. Estimates for Lorenz Curves with Counterfactual Composition of Education

Year	a	b	d	$\frac{z}{\mu}$
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.5. Estimates for Lorenz Curves with Counterfactual Joint Composition of Three Characteristics

Year	a	b	d	$\frac{z}{\mu}$
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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Notes

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[1]The response rates of nationally representative household surveys are usually less than 80 percent. For example, the response rate of the 1994-1995 U.K. Family Expenditure Survey was 67 percent and the response rates of the U.S. General Social Survey vary betwen 75 to 80 percent.

[2]The adopted adult-male equivalence scales are 1 for male over age 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.

[3]A rai corresponds to 0.4 acre.

[4]The national income data shows a little higher but close growth rate of real GNP per capita at annual average rate of 5.7 percent. For the latter decade of 1986-1996, the average annual growth rate of Thailand at 9 percent even exceeded those of neighborhood East Asian miracle economies.

[5]Data Source: Deininger and Squire (1996).

[6]For the kernel function, the Epanechinikov kernel is used such that

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

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

$$h = 2.34 \min(\sigma, 0.75 IQR) n^{-1/5},$$

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

[7]See Dasgupta, Sen, and Starrett (1973).

[8]The distribution functions are displayed up to the income level of 4000 baht to take a closer look at the lower ends, which is important for poverty ordering. There is no crossing of the two distribution functions at the range over this income level either.

[9]This poverty line is also adopted in the study of inequality and poverty in East Asian countries by Ahuja et al. (1997). Using the same PPP above, $2 a day in 1985 dollar corresponds to 536 baht per month in 1990 baht value, after adjusting inflation. Note that this poverty line is per capita, but we use equivalent income. Thus different poverty lines apply to households with different demographic structures.

[10]According to Ahuja et al. (1997), *net enrollment rate* for secondary education between 1970 and 1995 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, while from 18 percent to only 35 percent in Thailand.

[11]Here, we use four broader subgroups for the characteristics of age, occupation, production sector, and education for the convenience purpose of display.

[12]DiNardo, Fortin, and Lemieux (1996) applied similar decomposition method to study the compositional change in labor union participation for the U.S. wage inequality but in a semiparametric way. They run probit model to get the re-weighting factors and then estimate the counterfactual distributions in a nonparametric way.

[13]This index was generalized into a broader class of subgroup-decomposable inequality indices by Bourguignon (1979) and Shorrocks (1980).

[14]Mookherjee and Shorrocks (1982) first derived this decomposition method. The decomposition of the across-group inequality change involves an approximation due to the nonlinearity from logarithm. The actual approximation error turns out to be negligible, less than 1 percent of total change, in our decomposition results.

[15]See Table I in Kuznets (1955).

[16]The mechanics of this inverted-U shaped inequality dynamics from population shifts across income-status groups was noticed earlier by Robinson (1976) and later, more extensively, by Anand and Kanbur (1993).

[17]In Stage 3, total inequality *decreased.* Hence, the positive numbers in Table 3.4 indicate the inequality-decreasing factors while negative numbers the inequality-increasing factors.

[18]Using other FGT indices of poverty gap index and poverty severity index, we get similar decomposition results.

[19]He had a premise that the income levels would widen between income-status groups because better opportunities for growth are available among higher-income sector. He had another premise that inequality within higher-income sector would go down because mobility is more likely to be higher within higher-income sector. Each of these premises predicts a monotonic movement in inequality, which do not deliver the long swing of inequality. Thus, he controlled these factors in showing the inverted-U shaped inequality dynamics.

[20]Notice also that we use the decomposition results over three sub-periods capturing the main pattern of growth and inequality at aggregate level. Thus the trend of slight decrease in mean income between 1981 and 1986 is not shown in Figures 14 and 15. Inclusion of this short-run trend does nothing but adding a small wriggle at the left ends of Figures 14 and 15.

[21]The seemingly paradoxical effect of educational expansion on *increase* in inequality is prevalent in many developing countries, though it becomes obvious considering the prevailing wealth constraints toward higher education in those countries. See Park, Ross, and Sabot (1996) for Brazil, Mohan and Sabot (1988) for Columbia, and Knight and Sabot (1983) for East Africa. The literature of this effect, however, focuses the effect of educational expansion only on inequality change without telling its importance on growth and poverty change at the same time.

[22]Jeong and Townsend (2001) provide an example of taking the first step toward further investigation relying on this cornerstone.

Tables

Table 1. Composition Effects from Counterfactual Decomposition (percent)

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

Table 2. Composition Effects on Average Income Growth (percent)

Characteristics	Overall Period	Stage 1	Stage 2	Stage 3
Age	0	3	0	0
Gender	2	5	1	4
Community Type	7	17	2	12
Production Sector	18	33	13	21
Occupation	21	39	17	30
Financial Participation	20	23	27	18
Education	25	45	20	24
Joint Three	39	66	38	38
Total Growth	4.96	1.98	8.78	6.94

Table 3. Decomposition of Inequality Change (percent)

Table 3.1. Overall Period (Total Change per Annum = 0.725)

Characteristics	Within-group Inequality		Across-group Inequality	
	Intra-group	Composition	Inter-group	Composition
Age	101	-2	1	0
Gender	97	0	2	1
Community Type	67	-1	24	10
Production Sector	58	9	25	8
Occupation	59	2	32	7
Financial Participation	59	12	2	27
Education	54	-7	5	47
Joint Three	28	2	19	51

Table 3.2. Stage 1 (Total Change per Annum = 1.160)

Characteristics	Within-group Inequality		Across-group Inequality	
	Intra-group	Composition	Inter-group	Composition
Age	102	-1	-1	0
Gender	95	0	4	1
Community Type	57	-1	37	7
Production Sector	43	7	35	15
Occupation	40	5	46	9
Financial Participation	80	3	7	10
Education	61	-5	17	27
Joint Three	48	4	28	20

Table 3.3. Stage 2 (Total Change per Annum = 1.472)

Characteristics	Within-group Inequality		Across-group Inequality	
	Intra-group	Composition	Inter-group	Composition
Age	98	0	2	0
Gender	103	0	-3	0
Community Type	48	-2	47	7
Production Sector	44	9	50	-3
Occupation	35	5	54	6
Financial Participation	24	13	28	35
Education	38	-3	27	38
Joint Three	2	6	34	58

Table 3.4. Stage 3 (Total Change per Annum = -1.481)

Characteristics	Within-group Inequality		Across-group Inequality	
	Intra-group	Composition	Inter-group	Composition
Age	99	1	0	0
Gender	100	1	0	-1
Community Type	20	-2	91	-9
Production Sector	24	-13	75	14
Occupation	4	-7	85	18
Financial Participation	52	-10	72	-14
Education	46	2	80	-28
Joint Three	-4	-2	99	7

Table 4. Decomposition of Poverty Change (percent)

Table 4.1. Overall Period

Characteristics	Growth	Inequality	Total
Occupation	33	3	29
Financial Participation	30	-10	14
Education	36	-11	18
Joint Three	62	-12	39
Aggregate	-2.28	0.36	-1.71

Table 4.2. Stage 1

Characteristics	Growth	Inequality	Total
Occupation	103	-8	73
Financial Participation	62	-27	24
Education	116	-49	46
Joint Three	186	-59	92
Aggregate	-1.28	0.68	-0.37

Table 4.3. Stage 2

Characteristics	Growth	Inequality	Total
Occupation	21	1	21
Financial Participation	32	-10	20
Education	24	-9	14
Joint Three	48	-12	33
Aggregate	-3.82	0.86	-2.90

Table 4.4. Stage 3

Characteristics	Growth	Inequality	Total
Occupation	28	3	28
Financial Participation	18	-10	6
Education	22	-11	9
Joint Three	35	3	33
Aggregate	-2.72	-0.89	-3.27

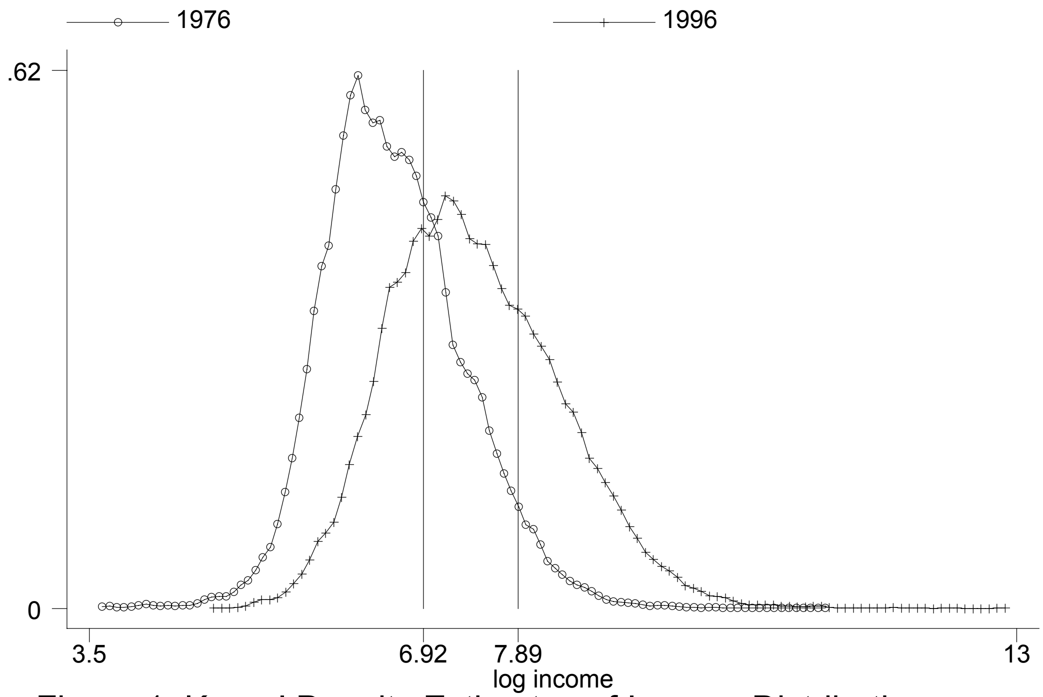

Figure 1. Kernel Density Estimates of Income Distributions

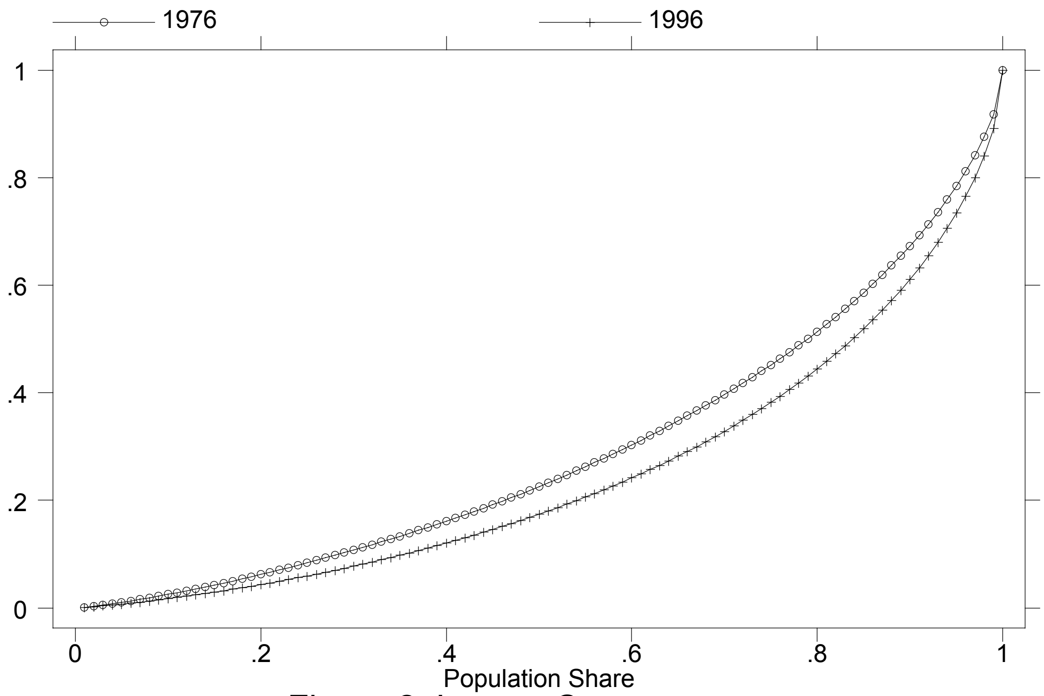

Figure 2. Lorenz Curves

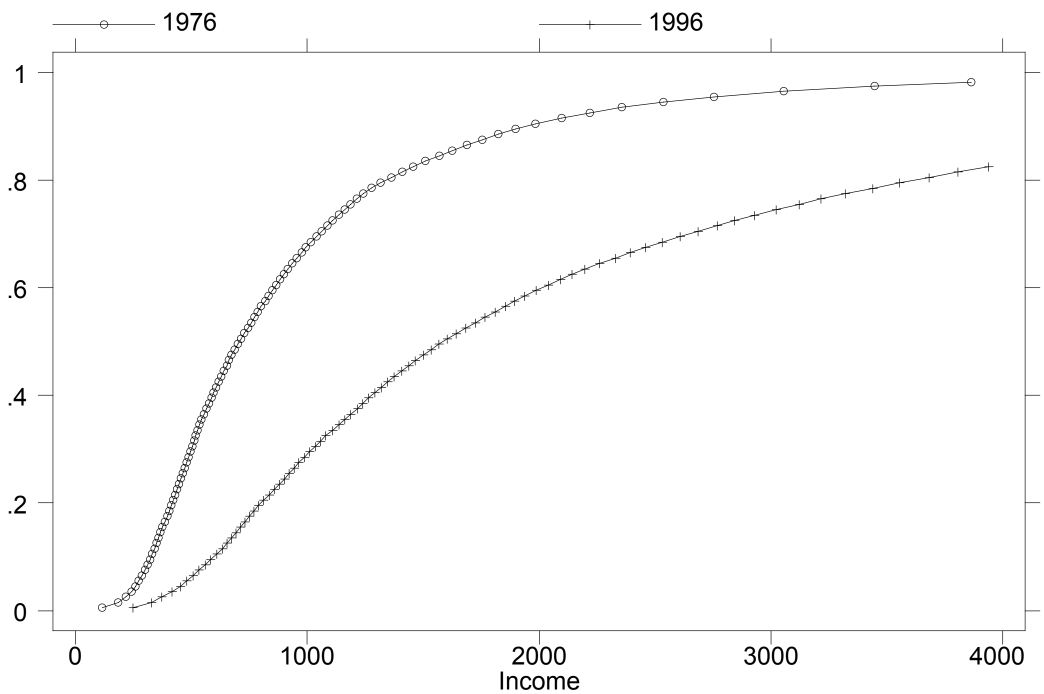

Figure 3. Cumulative Distribution Functions

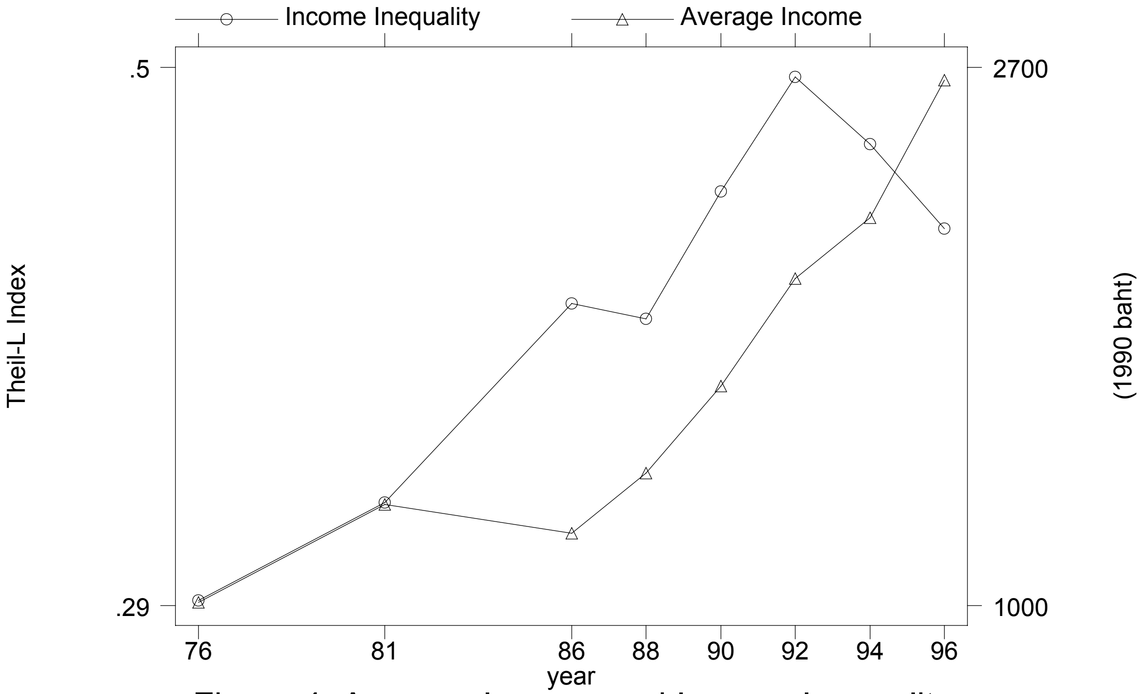

Figure 4. Average Income and Income Inequality

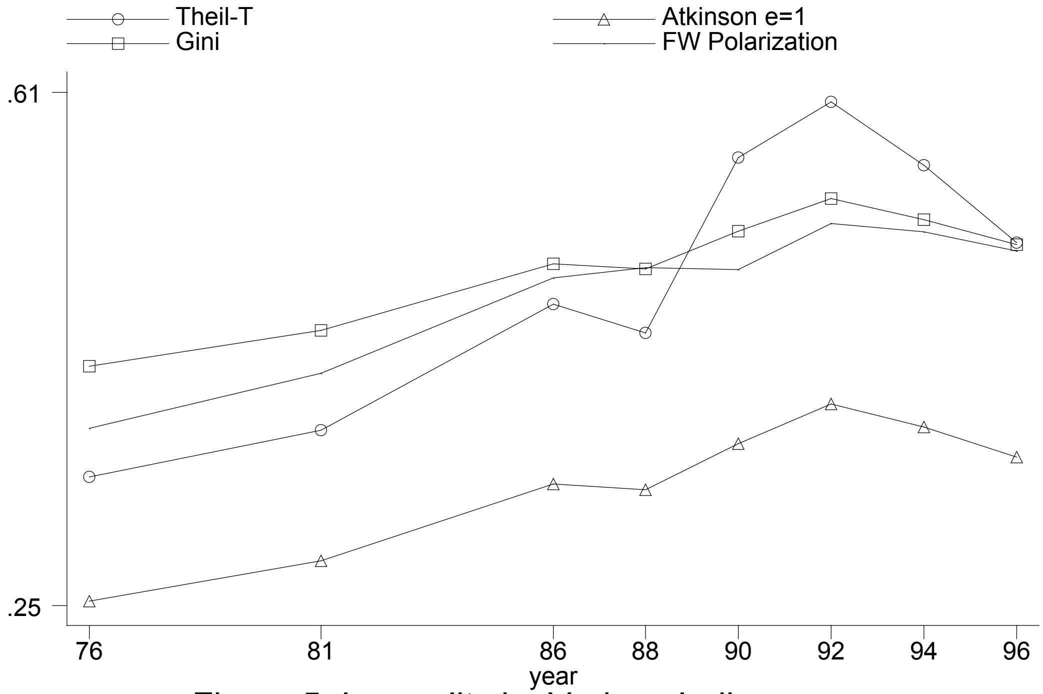

Figure 5. Inequality by Various Indices

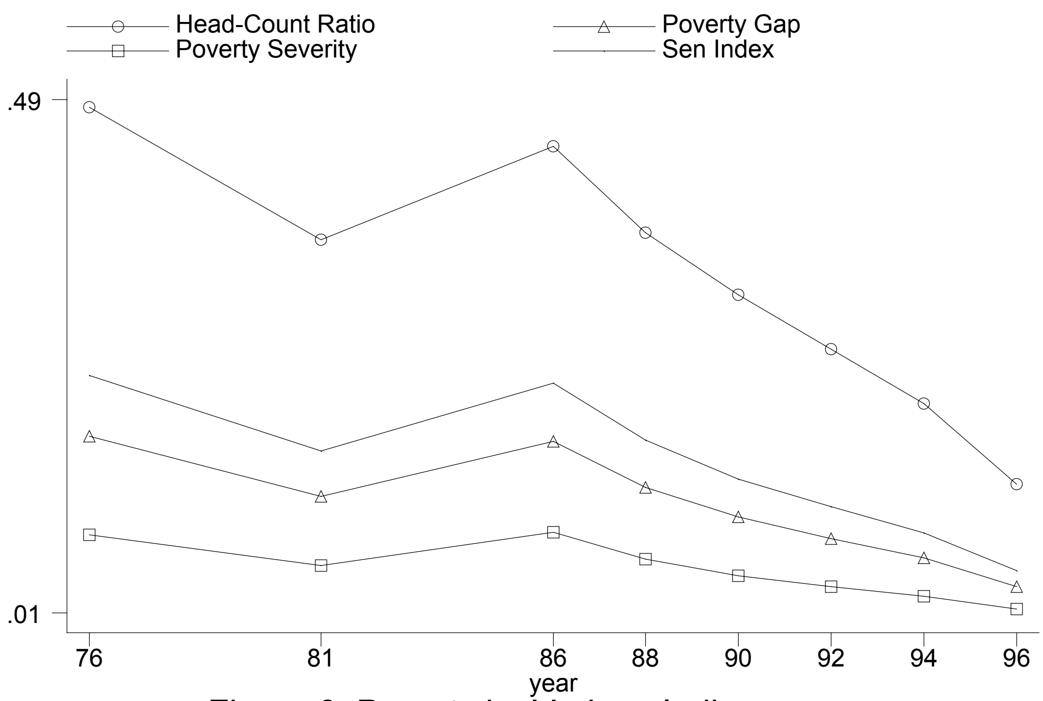

Figure 6. Poverty by Various Indices

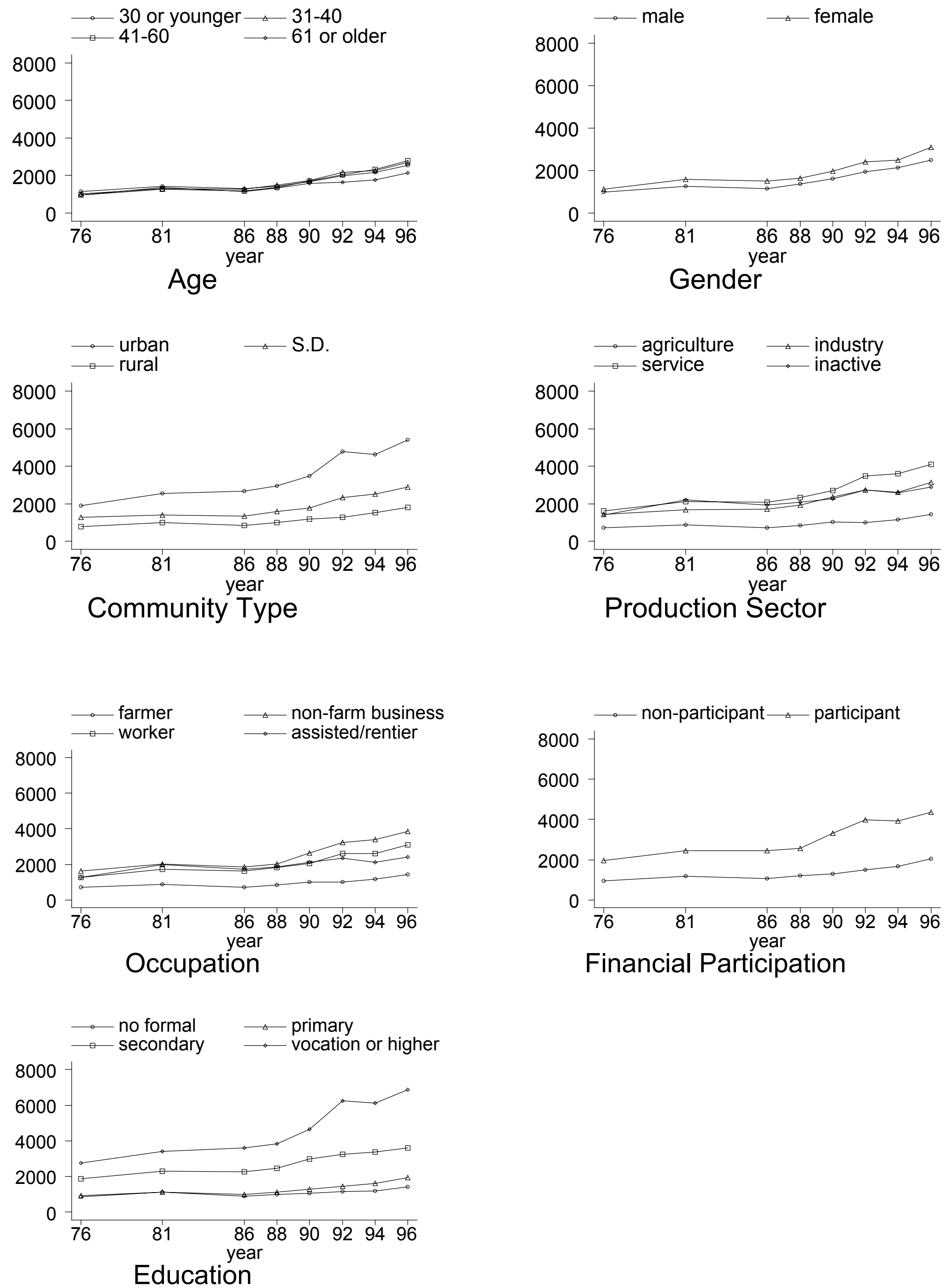

Figure 7. Subgroup Average Income Levels

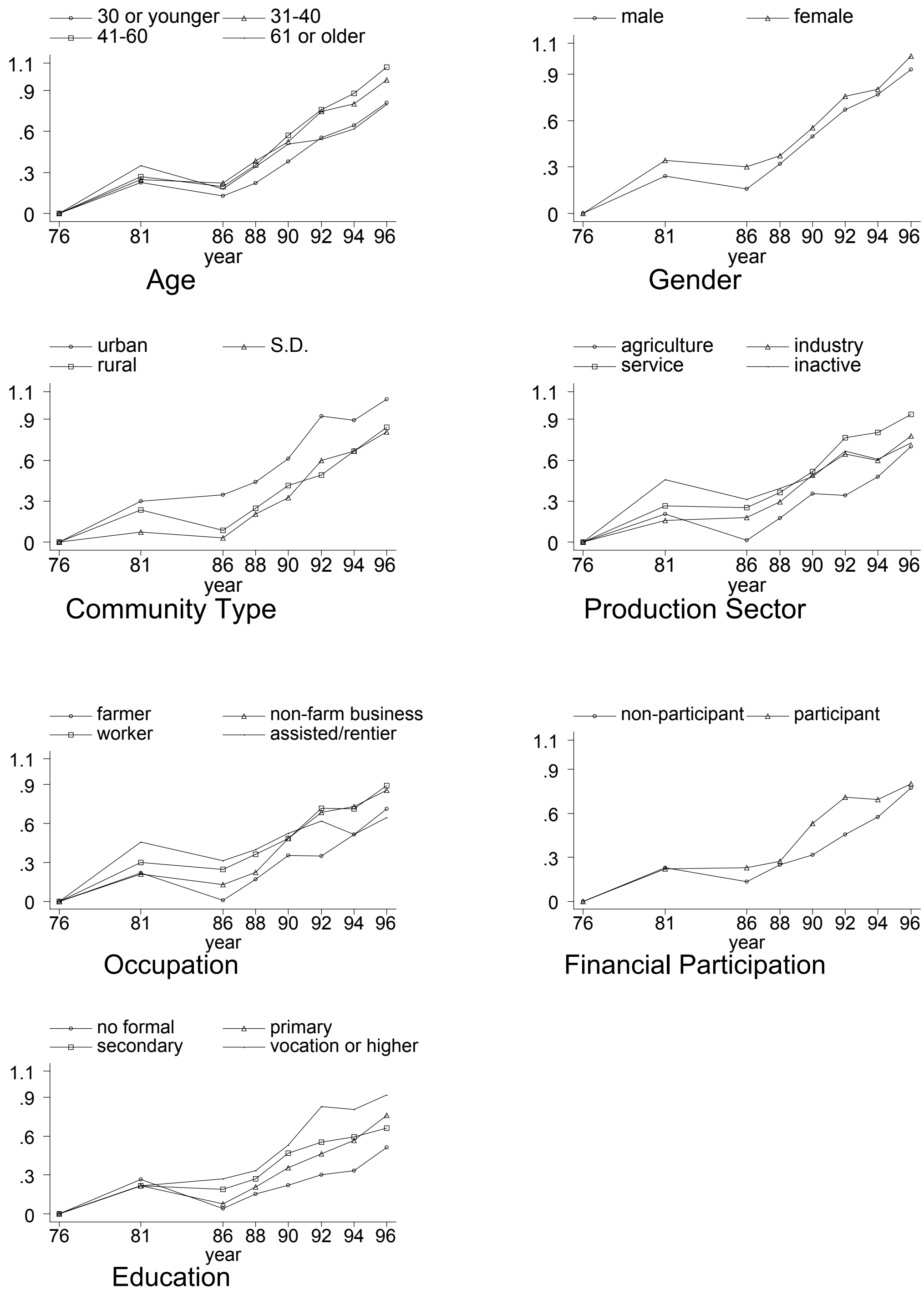

Figure 8. Divergent Patterns of Income Growth Across Subgroups

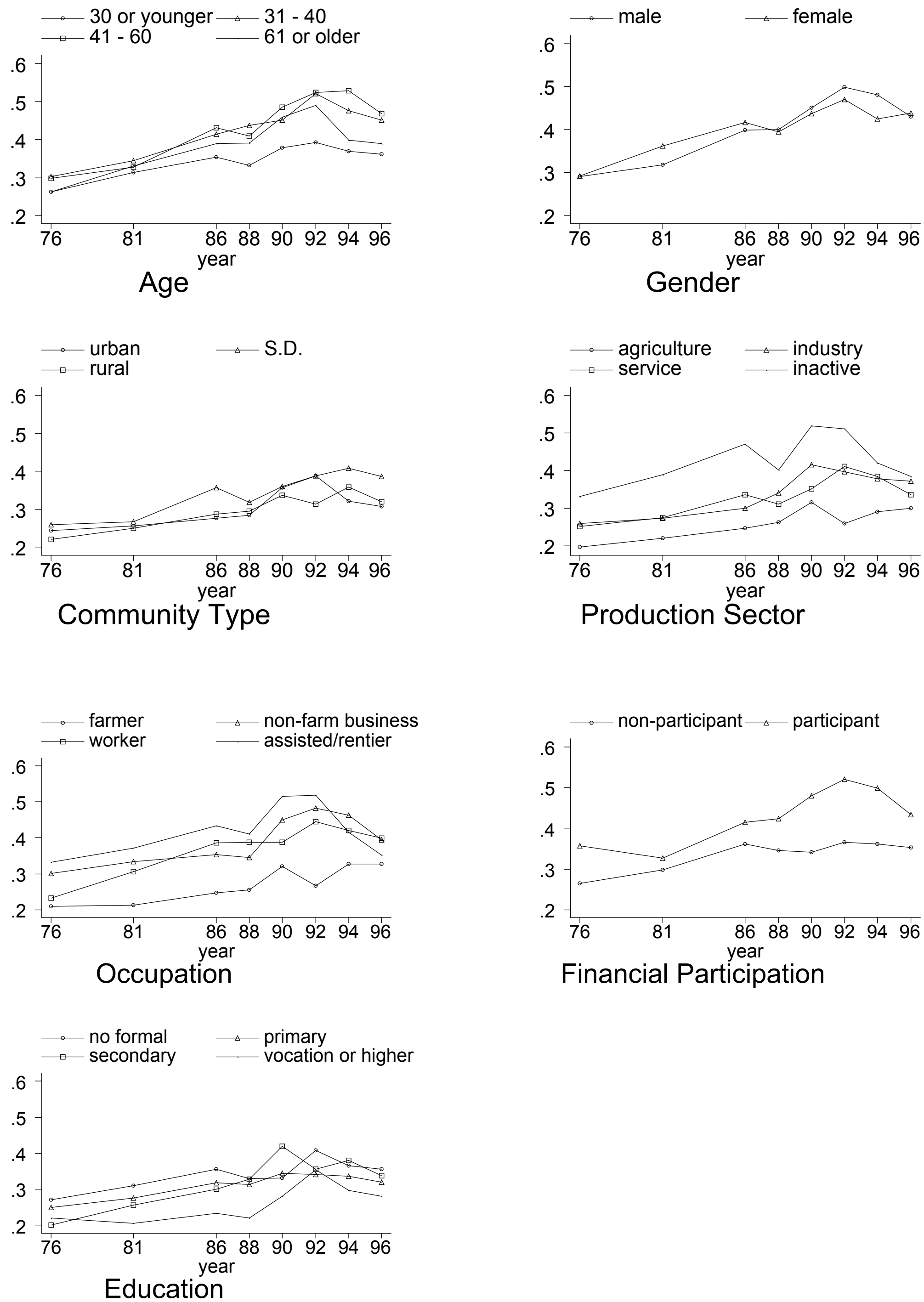

Figure 9. Subgroup Income Inequality Levels

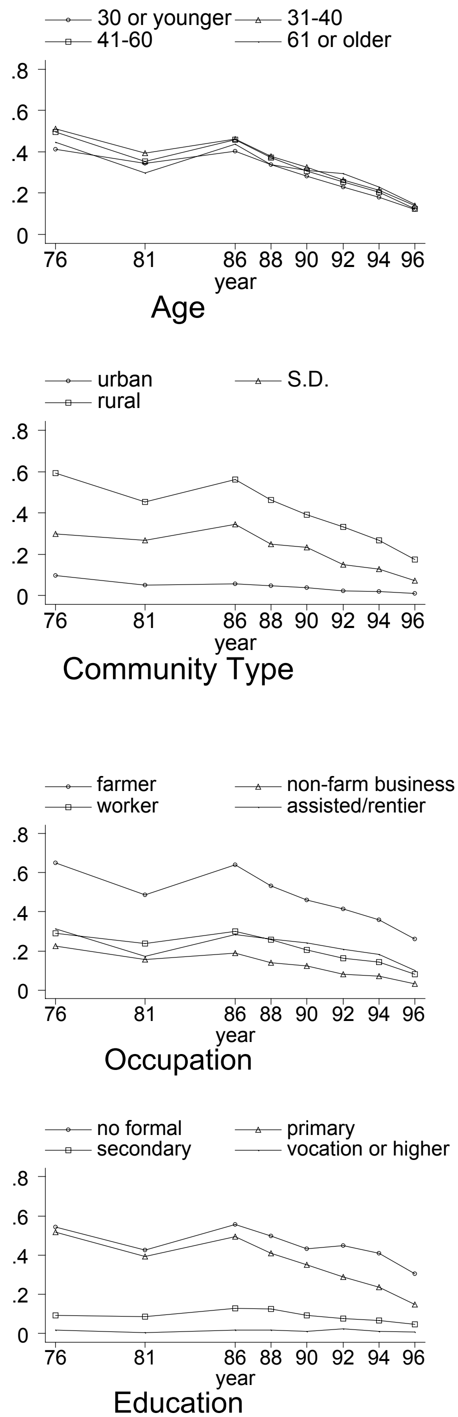

Figure 10. Subgroup Poverty Levels

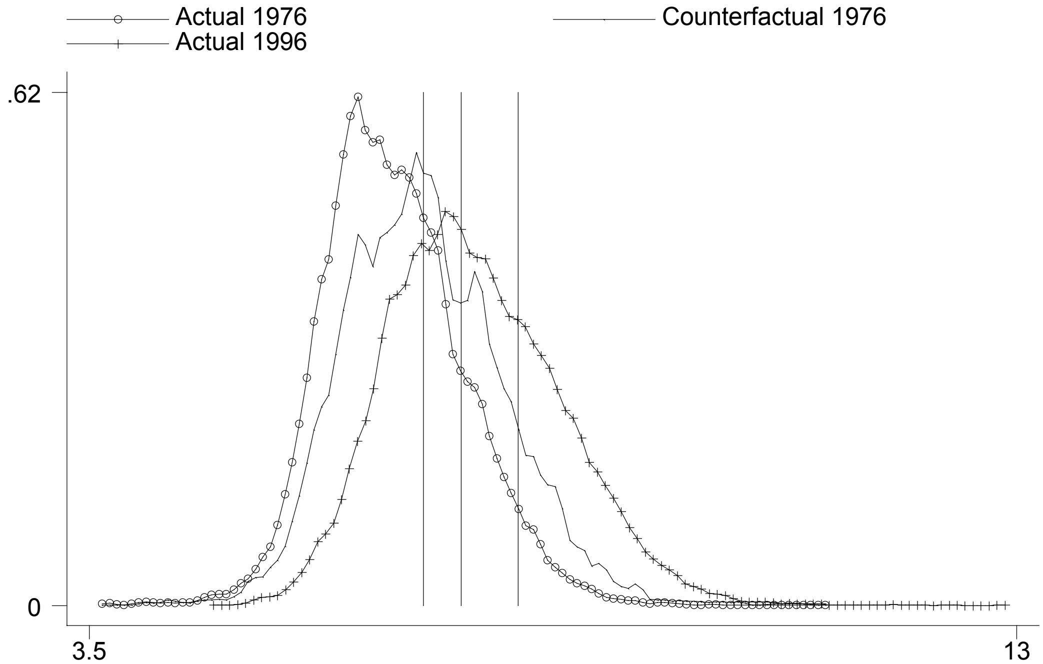

Figure 11. Counterfactual Density

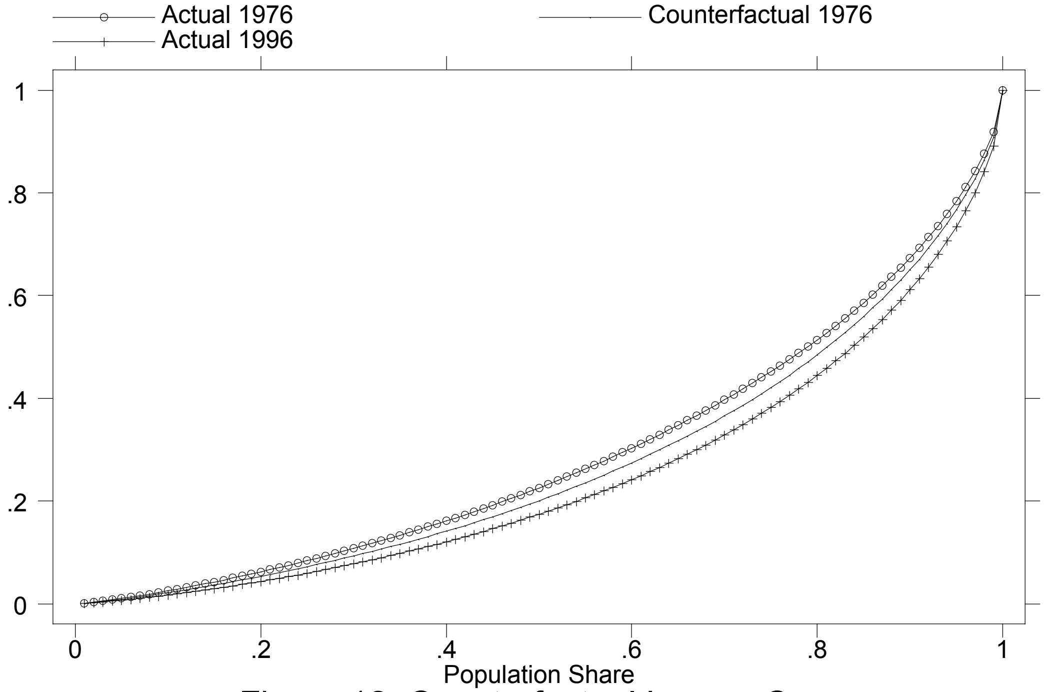

Figure 12. Counterfactual Lorenz Curve

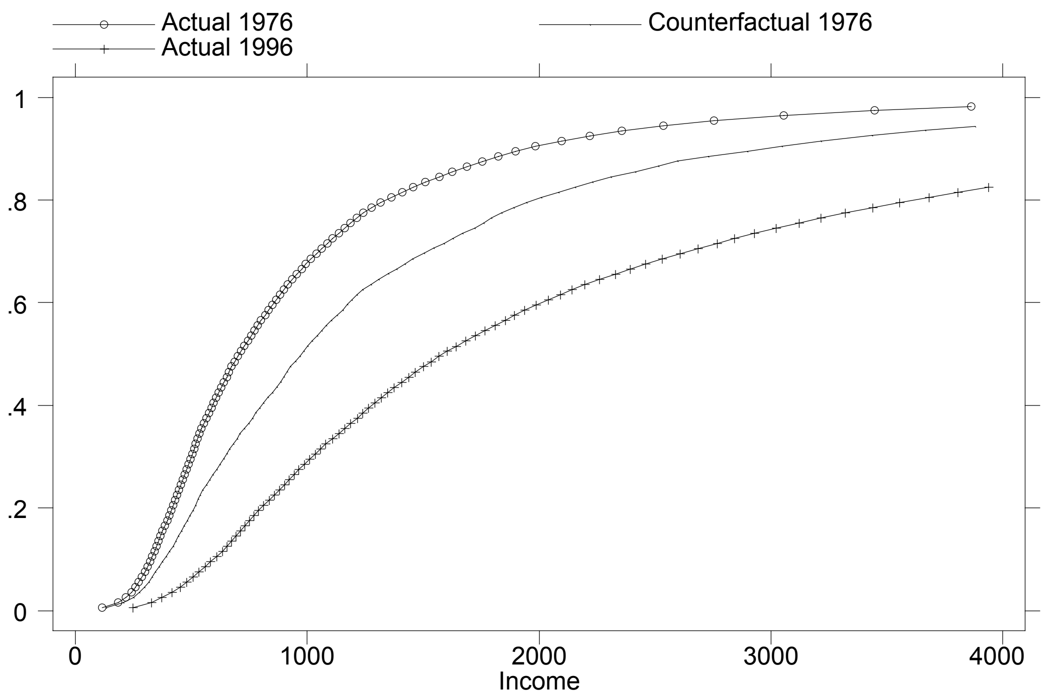

Figure 13. Counterfactual CDF

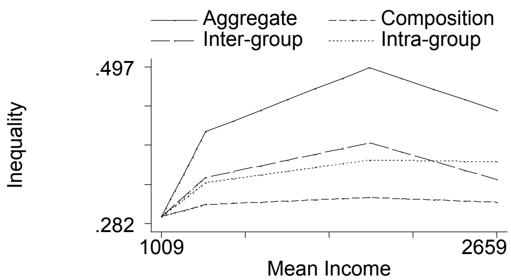

Figure 14.1. Occupation

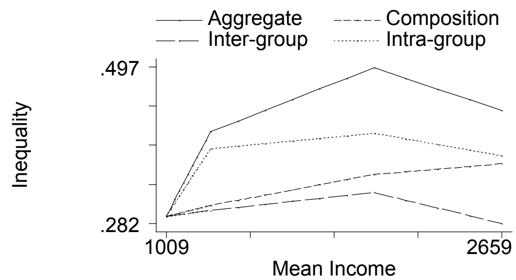

Figure 14.2. Financial Participation

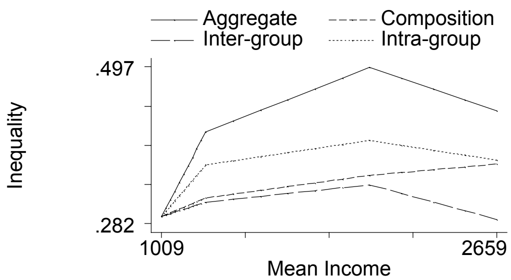

Figure 14.3. Education

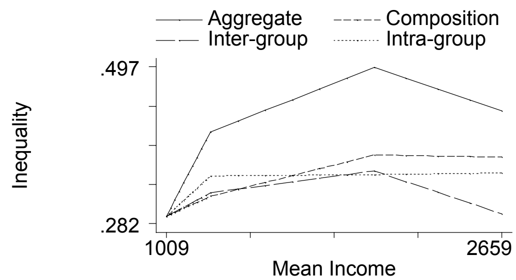

Figure 14.4. Joint Three

Figure 14. Decomposed Inequality Dynamics

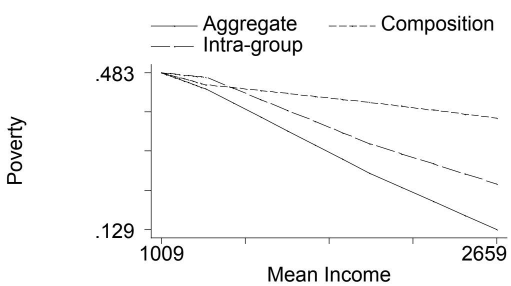

Figure 15.1. Occupation

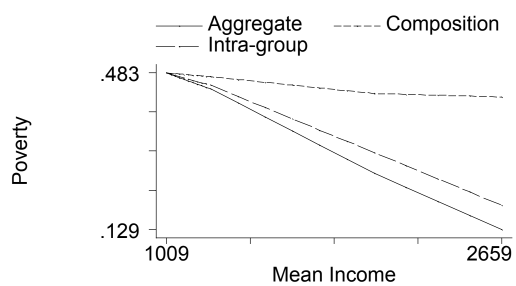

Figure 15.2. Financial Participation

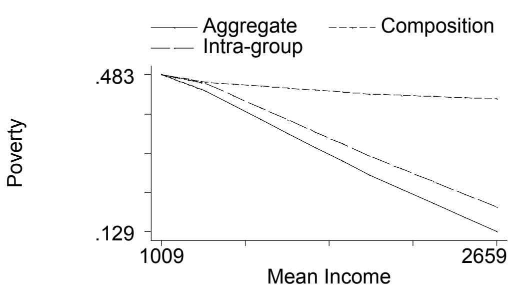

Figure 15.3. Education

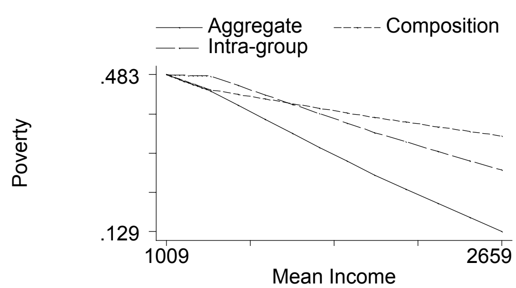

Figure 15.4. Joint Three

Figure 15. Decomposed Poverty Dynamics