Unequal Provinces But Equal Families?

An Analysis of Inequality and Migration in Thailand[1]

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Abstract

In Thailand, gross provincial product is highly unequal while household income exhibits moderate between-province inequality. This paper introduces a dynamic model to analyze the link between migration and cross-province inequality. The wage differential drives rural-to-urban migration and in turn the wage rate at the destination is affected by total amount of migrant labor supply. Migration generates a net income gain for migrants and they share that income gain with household members, remitting cash and goods. Remittances thus help redistribute income toward poor provinces, resulting in a lower level of cross-province inequality in household incomes. Simulations of migration, wages, inequality in production and inequality in income suggest that the benchmark model provides a good approximation to Thai reality. Fixed effects estimation shows a statistically significant effect of migration on income inequality: increasing the mean fraction of out-migrants to Bangkok by 1 percent leads to a .058 reduction in the average ratio of Bangkok's income to all other provinces (an elasticity of -0.11).

1 Introduction

In Thailand, gross provincial product is highly unequal while household income exhibits moderate between-province inequality. This paper introduces a dynamic model to analyze the link between migration and cross-province inequality. The main questions asked in this study are: how do we measure inequality in production and inequality in income? And how do inequality and migration interact with each other?

Previous empirical studies on regional inequality fail to distinguish between inequality in production and inequality in income, which often leads to different evaluations of inequality level and contradictory policy suggestions. This paper makes a contribution by distinguishing between the two concepts both theoretically and empirically. Here cross-province inequality in production is measured by gross provincial product (GPP) and provincial inequality in household income is measured by household income data from Socio-Economic Survey (SES). Evidence shows that in Thailand the former can be several times higher than the latter (see Figure 1).[1] This large differential between production inequality and income inequality presents a puzzle to be explained.

I begin by modeling the cross-province migration decision made by a representative household. The specific form of migration described in this study is temporary rural-urban migration.[2] Every period, a representative household in each agricultural province allocates labor between local and

[1] In the U.S., the Theil-L index measure of gross state product is very close to that of personal income by state, although inequality in gross state product is slightly higher than cross-state income inequality.

[2] In Thailand, rural-urban migration is characterized by its seasonal or circular nature. For instance, lots of rural laborers migrate into Bangkok during dry seasons and migrate out of Bangkok during wet seasons. Guest (1998) records a 10 percent population difference in Bangkok between the dry and wet seasons. Also see Table 2.4 for more facts.

migrant activities to maximize its expected income. Lagged wage differentials and distance to destination are used as major independent variables to explain the dependent variable, current-period proportion of out-of-province migrant laborers. Other factors that affect the migration decision include regional and time dummy variables. The Community Development Department (CDD) migration data, lagged wage differentials computed from GPP, railway distance and other regional and time information are used to pin down the parameters which capture the convexity of migration cost, as well as regional and time effects on migration.

Next I estimate the Cobb-Douglas production function on the urban side. Per capita outputs, capital inputs, nonmigrant and migrant labor inputs are used to pin down the elasticity of output with respect to capital and labor, respectively. Combining these two parts we have a dynamic model in which migration and wage rates at the destination are endogenously determined, i.e., lagged wage differentials drive current rural-urban migration, and current wage rate at the destination is in turn affected by total amount of migrant labor supply; current-period wage differentials then determine next-period out-migrants fraction and destination wage. Thus a dynamic sequence of out-migrants fraction and wages will be formed.

In the following step, I choose the initial condition of wage differentials and simulate the fraction of out-migrants by province and the wage rate at the destination in a dynamic context. The parameters used in the simulation are assumed to take the values from previous estimation.

Assuming migrants and their household members who remain in the countryside equally share the income gain from migration, I simulate the flow of remittances from the destination to the origin of migrants. Income inequality is defined as the ratio of simulated wage in Bangkok relative to per capita income of the origin province (the sum of wage earnings and the simulated remittances). Production inequality is defined as the ratio of simulated per capita GPP in Bangkok relative to that of the origin province. The inclusion of remittances reduces income inequality but does not affect production inequality, resulting in a substantive differential between the two inequality measures.[3]

The simulations of migration, the wage rate at the destination, inequality in production and inequality in income show that the benchmark model approximates reality well, in particular, simulated Theil-L indexes of production and income inequality explain more than half of the differential between the GPP inequality and the SES income inequality. The simulation results remain robust if the parameter values deviate within certain range.[4] It is not true, however, that the simulated data always mechanically converge to the real data. If the key parameter values (mainly the share of capital and the convexity of migration cost) deviate significantly from the benchmark values, the simulation results vary substantively from those of the benchmark case.

Empirical tests provide further evidence of the negative association between rural-urban migration and income inequality. Fixed effects estimation shows that increasing the mean fraction of

[3]Concentrating on remittances does not exclude the other possible channels of income redistribution. In SES dataset, household membership applies to a person who lives "away from home temporarily for less than three months", or who lives "away from home for more three months but without permanent residence". Temporary migrants studied in this paper can fall into either category. They may share their income gain with family members by bringing back cash or goods when they return home. This will not be categorized as remittances in the source of income.

[4]For example, if we vary the benchmark parameter values within 10% deviation, the key simulation results remain similar to those of the benchmark case.

out-migrants to Bangkok by 1 percent decreases income inequality by .058 (an elasticity of -0.11).

This paper connects the studies of growth and inequality with the research on migration. Kuznets (1955) conjectures that income inequality widens while labor force shifts from agricultural sector to nonagricultural sector during the early stages of economic development. For most developing countries, one main channel of realizing labor force shift is rural-urban migration. Despite the enormous number of studies of economic growth and inequality, the effects of growth-related migration dynamics on cross-province inequality is largely unexplained.[5] This paper fills the gap by modeling a possible link between labor force shift and cross-province inequality.

In the migration literature, many efforts have been devoted to study the incentives and consequences of migration (Borjas 1999). This paper identifies the differential in wage rates as one major factor that drives cross-province migration. A major obstacle to migration is identified from the data as the distance to destination.[6] As for the consequences of migration, there exists a considerable amount of confusion and debate. Migration researchers agree more on the positive effects that migration brings to individuals but are less sure about the effects of migration on households and communities. Much of the literature at the macrolevel claims that migration causes urban congestion and deprives rural area of the most productive laborers thus causes negative consequences in both areas. In a related research on China's rural-urban migration, I report that migration

[5] Jeong (2002) uses SES data to show that growth and income inequality are closely linked through factors like occupation, financial intermediation and education, but he leaves geographic factors undiscussed. Jeong and Townsend (2002) examine the micro underpinnings of two models on growth and inequality. Again cross-province inequality is left out of the picture.

[6] Paulson (2000) has pointed out that insurance motives are also important in affecting migration decisions. This paper assumes away uncertainty, but is able to explain up to 72 percent of the cross-sectional variation in fraction of out migrants.

enhances the proceeds of household members who do not migrate and has negligibly negative impact on agricultural outputs (see Chapter 1). Previous research has shown evidence of migration's impact on reducing income inequality among rural households in Northeast Thailand (Guest 1998). This study shows that migration helps reduce cross-province inequality in household incomes, and the remittances flow from rich provinces to poor provinces is one main channel to redistribute the income gain from migration.

Understanding inequality in Thailand could have important policy implications. A recent paper by Kakwani (2001) has developed an index to measure the trade-off between inequality and growth in a country. According to his calculation, the "inequality-growth trade-off index" (IGTI) in Thailand has the highest values among four Asian countries (Laos, Philippines, South Korea and Thailand). IGTI is 4.1 for Thailand, as compared to 0.9 for Laos, 1.2 for Korea and 2.3 for the Philippines. In other words, to keep the poverty level in Thailand constant, a reduction of one percent in inequality is equivalent to having a growth rate of 4 percent in Thailand. Faced with slow economic growth after 1997 financial crisis, a government strategy of inequality reduction could generate very high payoffs in battling against poverty. Ironically, the migration policy of the Thai government has been to curb migration flows to Bangkok, although without much success. A deeper understanding of interactions between migration, inequality and growth could help the government revise ineffective policies and better achieve its goals to promote growth and equality. Last but not least, policy makers need to be very careful about their design of poverty-reduction programs. Given the large magnitude of migrant workers and remittance transfers, government programs need to avoid crowding out private remittances and assistance.

The rest of the paper is organized as follows: in section 2 a description on data sources is given. In section 3 a brief overview is given on the association between migration and income redistribution. In section 4 a dynamic model of rural-urban migration is introduced, also calibration and simulation results are discussed. In section 5 empirical tests of major hypotheses are reported. section 6 concludes the paper.

2 Data Description

The two datasets used to measure provincial inequality are macrolevel GPP data and microlevel SES data. The GPP data contain yearly gross provincial product by industry (in constant 1988 prices) during the period 1981 to 2000. The Thai Socio-Economic Survey records socioeconomic data at the household level and is conducted every two years since 1986. The survey includes detailed income and expenditure information for each household in the sample, as well as demographic characteristics, earnings and work experiences for each of the household member. Since the provincial information of household is only available from 1988 on, I will use seven rounds of household surveys from 1988 to 2000. To address the issue of over sampling of urban households, we use adjusted sample weights to obtain the average per capita provincial income based on household income data.

The CDD dataset provides rich information on migration from rural areas. The CDD survey started in 1975 and from 1986 onward is conducted every 2 years (the 1998 survey was postponed to 1999). The CDD dataset records information on the village level, including population and infrastructure, economic activities of households, education and health status of villagers, and information about out-of-village migrant labor. An out-migrant labor can work either within the province or outside the province or even out-of-country. For the purpose of studying provincial income disparity, we'll focus on the migrant laborers that work outside the province and remain inside the country. One limitation of the CDD dataset is its lack of individual information. For example, it records the total number of out-migration laborers, but we only know the destination of the general migrant labor instead of destination of each migrant labor. Therefore, we have to assign all the out-migration laborers in the village to the same destination as the general migrant labor goes.

The Labor Force Survey has been undertaken by the National Statistical Office since 1963. From 1984 to 1997, the survey has been conducted 3 rounds a year. Labor force information in Bangkok over the period 1985 to 1996 will be used later in estimating the production function in Bangkok. Over this period, migrant labor force constitutes 12 to 23 percent of the total labor force in Bangkok.

Table 1 presents summary statistics of the datasets. GPP dataset has 73 provinces in the sample, covering the whole country from 1988 to 1992 and leaving out three small provinces from 1994 to 1999. The average per capita GPP grew fast from 1988 to 1996 but declined in 1999. Bangkok has per capita GPP several times higher than the average per capita GPP of all other provinces, but the gap narrowed after the financial crisis. Bangkok accounts for more than 10 percent of the national population.

Between 7580 and 24583 households are sampled in the SES household data. The average monthly per capita household income grew monotonically throughout the period, though the growth rate slows down from 1996 to 1999. Bangkok has higher per capita income than the rest of the country, but the gap is smaller than that in GPP data. On the average, around 23 to 34 percent of the households in the sample receive remittances from household members that work away from home. Among those who receive remittances, the amount of money they receive as remittances accounted for more than 23 percent of the household total income, which establishes remittances as an important source of income.

The sample size in CDD dataset ranges from 56744 to 63239 villages, covering basically every village in Thailand. The last four rows in Table 1 present the trend of rural-urban migration in Thailand. Fraction of migrant households and fraction of migrant labor force had been continuously growing until 1996, the year before the 1997 financial crisis. Fraction of households with at least one out-of-village migrant increased from 22.8 percent in 1988 to 32.4 percent in 1996. Out-of-village migrant laborers as a fraction of total village population rose by 50 percent from 1988 to 1996. Out-of-province domestic migrant laborers accounted for 5.4 percent of total village population in 1988 and accounted for 8.2 percent of village population in 1996. Migrant laborers who went to Bangkok accounted for 3.7 percent of village population in 1988 and accounted for 6.7 percent in 1996. From the last three rows we can conclude that the majority of the migrant laborers work at places outside their home provinces, and the majority of out-of-province migrants migrate to

Bangkok. All the four measures of migration declined after financial crisis in 1997 because the worsening economic prospects in destination localities discouraged out-migration from rural areas.

3 Overview on the Link between Inequality and Migration

This section gives a brief overview on cross-province inequality and rural-urban migration in Thailand. It also presents some evidence on the possible association between inequality and migration.

I begin by examining the trend of cross-province inequality in per capita GPP and in per capita household income. Figure 1 presents the trend measured by Theil-L index, which is a conventional inequality index within the class of subgroup-decomposable indices. For GPP data, within-province inequality is suppressed since only provincial level data are available; for SES data, only between-province inequality is recorded for comparison with the between-inequality measured in GPP data. Theil-L index exhibits a roughly inverted-U shape for both datasets from 1988 to 1996, with 1992 as the turning point. The change from 1992 to 1996 is steeper for income inequality than for GPP inequality. Recalling from Table 1, out-migration increased sharply from 1992 to 1996, which suggests there might exist a negative association between migration and income inequality.

To address the issue of sampling error, I examine the trend of cross-province inequality for agricultural sector using GPP and SES data.[7] As shown in Table 2, cross-province inequality in SES individual farmer's earnings (wage and profit from farming) matches the scale of inequality in GPP

[7] It is possible a survey which under samples the richest households will lead to a lower cross-province inequality than that of an unbiased sample.

agriculture sector.[8] This implies that SES data do not underestimate cross-province inequality in a systematic way. Within SES data, however, the cross-province inequality in individual earnings is several times higher than that in household income.[9] Household income includes remittances while individual earnings do not. This seems to suggest there exists some income pooling for agricultural households, possibly pooling with migrant laborers that work outside their original villages.

Recalling the earlier conjecture that migration helps redistribute income toward households in poor provinces, it follows that poor provinces tend to have higher per capita SES income relative to their per capita GPP. Further, the differential between per capita SES income and per capita GPP is more positive in provinces with larger migrants outflow and remittances inflow. Figure 2.a shows that SES-GPP differential and fraction of out-migrants are positively correlated.[10] A positive association between SES-GPP differential and remittances inflow is confirmed in the scatter plots of Figure 2.b. The positive relationship is especially strong for provinces in the northeastern region.

Now I will provide additional evidence on the positive impacts of migration on provincial income distribution. Table 3 reports the cross-sectional estimates of the association between SES-GPP differential and measures of migration. The dependent variable is SES-GPP differential, which is a proxy for the income redistribution. The independent variable is percentage of households with migrant laborers, percentage of out-of-village migrant laborers and percentage of out-of-province domestic migrants separately. The first two regressions in panel A and B are listed here for com-

[8] An individual selected here is a person whose major occupation is farming.

[9] A selected household here is one whose head is engaged in farming.

[10] The SES-GPP differential is defined as SES yearly per capita household income (monthly income multiplied by 12) minus per capita GPP in a given year.

parison with results in panel C. It is expected that regressions in Panels A and B do not yield any systematic and significant estimates, because measures of migration in A and B include both within-province migrants and out-of-province migrants. Panel C is consistent with the hypothesis that provinces which receive net income inflows are provinces with higher fraction of out-of-province migrant laborers. The cross-sectional OLS regression for all three years yields positive and statistically significant coefficients on the percentage of out-of-province migrants. For robustness check, I replace the above dependent variable with the difference between money income of SES households and GPP data. It generates similar results, confirming the positive correlation between income inflow and out-of-province migration.

Table 4 presents some basic statistics on the patterns of rural-urban migration by gender. For both female and male migrants, their top destination is Bangkok. For both genders, distribution of migrants' length of stay is alike. Thirty percent of the laborers that work outside the village commute daily between home and work. Twenty percent of migrants move to urban areas during dry seasons and return in wet seasons. Forty percent of migrants stay at their destination for longer than 3 months.

4 A Model of Rural-Urban Migration

As discussed above, out-migration from rural areas is positively correlated with the differential between income and GPP. Similarly, remittances have a positive relationship with that differential. In this section I set up a model to establish the link between migration and remittances and explore their impacts on inequality. Twofold consequences of rural-urban migration are examined in the model: first, the income redistribution impact of migration in a setting where rural-urban migrants maintain ties to their families by sending remittances; second, the effect of migration on the labor market in destination regions. Below I will focus on the cross-province rural migration to Bangkok.[11]

The main feature of this model is that both migration and the Bangkok wage rate are endogenously determined. The economy in the model is a monocentric economy, Bangkok being the center. Capital and labor are required as inputs to produce a consumption good in Bangkok. All other provinces scattering around Bangkok have different distances from the center. They live on subsistence-level agricultural economies in which labor is the only input and wage is exogenously determined. A representative rural household chooses the proportion of laborers who will migrate to Bangkok for jobs based on lagged wage differentials between Bangkok and the home province. In turn, the wage rate in Bangkok is affected by the total number of migrant laborers from all other provinces. Full employment is assumed in both Bangkok and all other provinces.

4.1 Migrant Labor Supply Decision of Rural Households

A representative household in the rural areas of home province j ($j = 1, 2, ..., s$) allocates its total labor supply into two activities: agricultural and migrant activities, to maximize its expected

[11] Bangkok is the dominant destination of rural-urban migration in Thailand: in the SES data, about 30 percent of remittances received are from Bangkok; in the CDD data, about 69 to 82 percent of the out-of-province migrants go to Bangkok. Bangkok accounts for one third of Thai GDP and has more than 10 percent of the nation's population. In terms of per capita GPP, Bangkok ranks one of the highest among all provinces.

household income:

$$Y_{j,t} = \max_{m_{j,t}} \{(1 - \theta m_{j,t}) W_{j,t-1} + \theta m_{j,t} * W_{bkk,t-1} - C(\theta m_{j,t})\}, \tag{1}$$

where $Y_{j,t}$ denotes the expected household income at province j at the beginning of year t. Total labor supply of a household is normalized to unit one, and $m_{j,t}$ denotes the proportion of laborers who migrate to Bangkok. θ represents the mean work duration of an average migrant at Bangkok. In other words, $\theta m_{j,t}$ is the realized migrant labor supply, while $m_{j,t}$ is the observed incidence of migrants departing in year t. The relevant information set on wage differentials is the wage rates from the previous period. $W_{bkk,t-1}$ denotes lagged wage in Bangkok. $\theta m_{j,t} * W_{bkk,t-1}$ refers to the expected wage earned by an average migrant household. $W_{j,t-1}$ is the alternative wage earned in home province j. $C(\theta m_{j,t})$ is a convex function of migration cost. Assume $C(\theta m_{j,t})$ has the functional form of $Ce^{\gamma_2 d_2 + \gamma_3 d_3} D_j^{\gamma_1} (\theta m_{j,t})^{\sigma}$, where C is a scalar, d_2 is the dummy variable indicating northern region and d_3 is the dummy variable indicating northeastern region, D_j is the railway distance between Bangkok and home province j. $C(\theta m_{j,t})$ is convex in migrant labor supply, i.e., $\sigma > 1$.[12] C, γ_1, γ_2, γ_3 and σ are parameter values to be determined.

Rewriting equation (1) we have:

$$Y_{j,t} = \max_{m_{j,t}} \left\{(1 - \theta m_{j,t}) W_{j,t-1} + \theta m_{j,t} * W_{bkk,t-1} - Ce^{\gamma_2 d_2 + \gamma_3 d_3} D_j^{\gamma_1} (\theta m_{j,t})^{\sigma}\right\} \tag{2}$$

[12] Convex migration cost is widely used in regional economics literature. The convexity can arise from different sources such as increasing rents in the urban areas, or increasing opportunity cost when more laborers leave the rural areas, or increasing unwillingness to migrate for household members who remain in the countryside.

Therefore the optimal amount of $m_{j,t}$ will be determined by the following equation:

$$m_{i,t}^{*\sigma-1} = \frac{(W_{bkk,t-1} - W_{j,t-1})}{\theta^{\sigma-1}\sigma C e^{\gamma_2 d_2 + \gamma_3 d_3} D_j^{\gamma_1}} \tag{3}$$

Rewriting equation (3) in logarithmic form we have:

$$\begin{aligned} \ln m_{j,t}^{*} &= -\ln\theta - \frac{1}{\sigma-1}\ln\sigma C + \frac{1}{\sigma-1}\ln(W_{bkk,t-1} - W_{j,t-1}) \\ &\quad -\frac{\gamma_1}{\sigma-1}\ln D_j - \frac{\gamma_2}{\sigma-1}d_2 - \frac{\gamma_3}{\sigma-1}d_3 \end{aligned} \tag{4}$$

4.2 Wage Determination in Bangkok

Assume output in Bangkok is determined by a Cobb-Douglas production function:

$$Y_{bkk,t} = e^{\delta+\lambda t} K_{bkk,t}^{\alpha} L_{bkk,t}^{1-\alpha}, \tag{5}$$

where $Y_{bkk,t}$ denotes output of the consumption good, $K_{bkk,t}$ denotes capital input, $L_{bbk,t}$ denotes total labor input, α is the share of capital and λ is a technology shifter over time. As we discussed above, $L_{bbk,t}$ is the sum of labor supply from Bangkok natives and migrant labor supply summing over all other provinces, i.e., $L_{bkk,t} = N_{bkk,t} + \theta \sum_j m_{j,t} N_{j,t}$, where $N_{bkk,t}$ is the stock of native labor supply in Bangkok and $N_{j,t}$ is population in province j. $\theta m_{j,t}$ is the realized fraction of migrant labor supply from province j.[13]

Per capita GPP is given by:

$$y_{bkk,t} = \frac{Y_{bkk,t}}{L_{bkk,t}} = e^{\delta+\lambda t} K_{bkk,t}^{\alpha} (N_{bkk,t} + \theta \sum_{j} m_{j,t} N_{j,t})^{-\alpha} \tag{6}$$

Wage rate is given by:

$$W_{bkk,t} = \frac{\partial Y_{bkk,t}}{\partial L_{bkk,t}} = (1-\alpha) e^{\delta+\lambda t} K_{bkk,t}^{\alpha} (N_{bkk,t} + \theta \sum_{j} m_{j,t} N_{j,t})^{-\alpha} \tag{7}$$

Therefore, wage rate is proportionate to per capita GPP in Bangkok, i.e.,

$$W_{bkk,t} = (1-\alpha) y_{bkk,t} \tag{8}$$

Rewriting equations (6) and (7) in logarithmic form we have:

$$\ln y_{bkk,t} = \delta + \alpha\{\ln K_{bkk,t} - \ln(N_{bkk,t} + \theta \sum_{j} m_{j,t} N_{j,t})\} + \lambda t \tag{9}$$

$$\ln W_{bkk,t} = \delta + \ln(1-\alpha) + \alpha\{\ln K_{bkk,t} - \ln(N_{bkk,t} + \theta \sum_{j} m_{j,t} N_{j,t})\} + \lambda t \tag{10}$$

[13] In CDD surveys, each village reports the number of laborers who at certain point during the survey year work in Bangkok. Therefore, $m_{j,t}$ represents the incidence of migrants working in Bangkok but contains no information on the actual length of a migrant's stay. The realized amount of migrant labor supply need to be discounted by θ, the fraction of the year that an average migrant stays in Bangkok.

4.3 Modeling the Impact of Remittances on Income Inequality

From equation (2), we can derive the realized net income gain from migration for the entire household:

$$(1-\theta m^*_{j,t})W_{j,t} + \theta m^*_{j,t} * W_{bkk,t} - Ce^{\gamma_2 d_2 + \gamma_3 d_3} D_j^{\gamma_1} (\theta m^*_{j,t})^{\sigma} - W_{j,t}$$

$$= \theta(W_{bkk,t} - W_{j,t}) m^*_{j,t} - Ce^{\gamma_2 d_2 + \gamma_3 d_3} D_j^{\gamma_1} (\theta m^*_{j,t})^{\sigma}, \qquad (11)$$

where $m^*_{j,t}$ is the optimal level of migrants from province j, and $W_{j,t}$ and $W_{bkk,t}$ are the current wage rates for home province j and for Bangkok in year t respectively.

Substituting equation (3) into equation (11) we can derive the net income gain in terms of $W_{bkk,t}$, $W_{j,t}$ and $m^*_{j,t}$:

$$\theta(W_{bkk,t} - W_{j,t}) m^*_{j,t} - \frac{\theta}{\sigma}(W_{bkk,t-1} - W_{j,t-1}) m^*_{j,t}$$

$$= \theta m^*_{j,t}[(W_{bkk,t} - W_{j,t}) - \frac{1}{\sigma}(W_{bkk,t-1} - W_{j,t-1})] \qquad (12)$$

Let μ be an indicator that measures the tendency of migrant laborers to share the benefit with nonmigrant household members. $\mu = 1$ means migrants and nonmigrant members equally share migration gain, $\mu = 0$ represents the selfish case, i.e., migrants keep all the gain to themselves, and $\mu > 1$ represents the altruistic case, i.e., migrants remit more than they gain from migration.

Define income inequality as the ratio of simulated wage in Bangkok relative to per capita income of province j with simulated remittances, which is the counterpart of SES income inequality ratio[14]:

$$R_{j,t} = \frac{W_{bkk,t}}{W_{j,t} + \mu\theta m^*_{j,t}[(W_{bkk,t} - W_{j,t}) - \frac{1}{\sigma}(W_{bkk,t-1} - W_{j,t-1})]} \tag{13}$$

Define production inequality as the ratio of simulated per capita GPP in Bangkok relative to that of province j [15], which is the counterpart of per capita GPP inequality ratio in the data:

$$R^{gpp}_{j,t} = \frac{W_{bkk,t}/(1-\alpha)}{W_{j,t}} \tag{14}$$

4.4 Calibration and Simulation

This section describes the steps and results of calibration and simulation. First the parameter values are estimated using equation (4) and equation (9) respectively. Based on equation (4), parameters C, γ_1, γ_2, γ_3 and σ are calibrated. Based on equation (9), parameters α, λ and δ are estimated. Second, given an initial condition on the lagged wage differential between Bangkok and other provinces, calibrated parameter values are substituted into the dynamic model to generate migration and wage rates over six time periods.

Data on per capita GPP of Bangkok, capital and labor inputs are used to estimate parameters in equation (9). The data series of per capita GPP, $y_{bkk,t}$, is constructed from the NESDB GPP

[14] The relative income inequality ratio is in essence the same as the Theil-L inequality index, which is the weighted log sum of income ratio relative to the national average.

[15] Note that in provinces other than Bangkok, wage rate and per capita GPP are the same because labor is assumed to be the only input in their agricultural economies.

dataset. The series of capital input, $K_{bkk,t}$, is constructed from Regional Gross Fixed Capital Formation Series released also by NESDB.[16] Labor input series, $L_{bkk,t}$, is constructed by combining the number of employed nonmigrant laborers and number of employed migrants from Reports of Labor Force Survey.[17] Twelve years of data over the period 1985 to 1996 are used in the estimation. The estimated share of capital, α, is 0.40 from the sample. The coefficient on time trend, λ, is estimated to be .04, which can be interpreted as an annual productivity growth rate of 4 percent. θ is not identified from the estimation because the whole term $\theta \sum_j m_{j,t} N_{j,t}$ is proxied by the number of employed migrants.[18] In the analysis below θ is assumed to be 0.5, i.e., an average migrant works half a year in Bangkok.[19]

In equation (4), the proportion of migrant laborers $m_{j,t}$ is measured by the percentage of rural-to-Bangkok migrants in rural population by province. Five rounds of CDD survey data, every other year over the period 1988 to 1996, are used in the estimation. Wage differentials are measured by wage rate in Bangkok (per capita GPP in Bangkok multiplied by the share of labor) minus per capita GPP of other provinces assumingly living on agricultural economies. The

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[16] The flow of capital input is used to estimate equation (9) due to limited data availability. It is, therefore, implicitly assumed that the flow of capital is proportionate to the stock of capital in all years over the period 1985 to 1996, so that equation (9) still yields an unbiased estimate of parameter value α.

[17] Labor Force Survey is conducted three rounds a year over the period 1985 to 1996. The number of employed laborers used in the estimation is the average of different rounds.

[18] θ has neutral effects on the realized migrant supply and Bangkok wage. In other words, varying θ does not affect the term $\theta m_{j,t}$ since households always respond by changing $m_{j,t}$ when θ varies. Therefore, Bangkok wage is not affected by θ either.

[19] Table 4 exhibits the distribution of migrants' length of stay in their destination. The first category "daily" is ignored since it is unlikely that a migrant can commute between Bangkok and her own province on a daily basis. Assume "dry season" corresponds to six months of stay, the mean of "< 3 months" corresponds to one and a half months and the mean of "> 3 months" corresponds to seven and a half months. Averaging these three categories yields the mean length of stay to be around 5 months.

estimated parameter values are: $\sigma = 2.15$, $\gamma_1 = 1.4$, $\gamma_2 = -3.1$ and $\gamma_3 = -3.9$. These values imply that migration cost is convex in the proportion of emigrants and increasing in the distance from Bangkok. A household in the northern or northeastern region has lower migration cost compared with a household in the southern or central region, ceteris paribus.

In the simulation, all parameters are assumed to take the values from the estimation. The initial condition is wage differential between Bangkok and all other provinces in year 1986. Assume each period consists of two years.[20] Given the lagged wage differential and the migration cost function, a representative rural household chooses the proportion of migrants in 1988. Consequently the wage rate in Bangkok is determined by the capital input and total number of employed laborers of year 1988. The wage differentials between Bangkok and other provinces in 1988 generate the incentive for rural laborers to migrate in the next period. Hence rural-to-Bangkok migration and wage rate at Bangkok are endogenously determined in a dynamic manner. In year 1998, an exogenous negative shock is imposed upon Bangkok productivity to simulate the downturn during the Asian Financial Crisis.

Table 5 presents the aggregate level comparison of simulated migrant population and wage rates in Bangkok with those from the sample data.[21] Overall, simulated results are a good approximation to the sample estimates. The simulated migrants population is close to the reported migrants population in the CDD dataset, although in four out of five years, the simulated migrants population

[20] The CDD survey is undertaken every two years over the period 1988 to 1996.

[21] Simuated data on migrant population and Bangkok wage rate in 1998 are not listed in this table because no comparable CDD data are available in 1998.

is slightly larger than the CDD figures. The LFS reports a much smaller migrant population compared with both the CDD estimates and the simulated results. The disparity arises mainly from the methodological difference in measuring the number of migrants. The LFS measures the stock of migrants in Bangkok at different points of the year while CDD as well as simulated migrants data measures the flow of migrants to Bangkok within a certain year. In terms of wage approximation, simulated Bangkok wage matches the dynamic pattern of the data but is systematically lower than the data.

Figures 3.a, b and c present the mapping of simulated results versus their counterparts from the sample data on the provincial level. Figure 3.a plots the simulated out-migrants fraction against the fraction measured by the CDD data by province. In both years, the dots in the scatter plots are clustering around the 45-degree line, i.e., simulated results are a close match to the CDD migrants data on the provincial level. The correlation between simulated migrants fraction and the data is 0.43 in year 1988 and 0.78 in year 1996. Figure 3.b shows that simulated province-wise income inequality ratio also approximates the SES income inequality well. The correlation between simulated income inequality ratio and the SES inequality is 0.75 in 1988 and in 1996. Figure 3.c plots the province-wise match between simulated production inequality ratio and GPP inequality measure. The dots are all on a straight line close to the 45-degree line, which follows naturally from the fact that simulated Bangkok per capita GPP is close to the real per capita GPP and the assumption that per capita GPP of all other provinces are exogenously given. It follows that the correlation between simulated production inequality and GPP inequality is one.

Figure 4 plots the simulated Theil-L indexes against Theil-L indexes measured from GPP and SES data over the period 1988 to 1998. Similar to the pattern displayed in Figure 1, a large gap exists between the simulated Theil-L index of production inequality and the simulated income inequality. This gap is explained by rural-urban migration and concentration of capital in Bangkok. Figure 4 also shows that the simulated production and income inequality possess similar time pattern as their counterparts from the data, respectively. The model, however, does not explain the entire gap between GPP inequality and SES income inequality. Compared with the data, simulated cross-province production inequality is lower and simulated cross-province income inequality is higher.[22] Given the current set of parameter values, the simulation results explain more than half the gap between GPP inequality and SES income inequality.[23]

Previous figures show that the benchmark model approximates the economic reality well. Figures 5 and 6 illustrate how simulations of migrant population, Bangkok wage, income inequality and production inequality differ when the key parameters α and σ change.

Figure 5.a shows the effects of α and σ on aggregate migrant population. A larger α, i.e., a larger share of capital, is associated with a larger simulated migrant population starting from the 2nd simulation period. Given that capital is concentrated in Bangkok, the larger the share of capital

[22] A measurement issue helps explain why simulated production inequality is lower than the GPP inequality in the data. The definition in equation (14) adjusts for the population difference caused by cross-province migration but the GPP data do not. Migrants are treated as part of the population in their home provinces in the population census despite their temporary stay in Bangkok. Therefore, population is underestimated in Bangkok and overestimated in migrants' home provinces. In other words, per capita GPP is overestimated in Bangkok and underestimated in other provinces, thus GPP inequality in the data is upward biased.

[23] Varying the parameter values can change the gap between simulated production inequality and income inequality. For example, increasing the share of capital α, or the tendency to remit μ, implies a larger gap between simulated production inequality and income inequality, thus better explains the differential between GPP and SES inequality.

is in producing the final good, the greater the differential between the wage received in Bangkok and in other provinces and the more migrants coming to Bangkok. A larger σ is associated with a smaller simulated migrant population because it implies higher migration cost. Figure 5.b presents the effects of α and σ on Bangkok wage. A larger α is accompanied by higher wage because capital grows at a higher rate in Bangkok than the labor force. A larger σ is accompanied by higher wage because it deters migrants and reduces the total amount of labor supply in Bangkok.

In Figures 6.a and b, a larger α corresponds to both higher income inequality and higher production inequality. As discussed earlier, a larger share of capital is associated with a greater wage differential given that capital is concentrated in Bangkok, thus it is associated with higher production inequality. Number of migrants increases as a result of widening wage differential, which increases remittances to the agricultural provinces. The effects of widening wage differential, however, dominates the offsetting effects of remittances, therefore the income inequality is still higher when α is larger. A larger σ is also associated with higher income and production inequality. Increasing σ implies increasing migration cost and curbing migration. Production inequality is higher because the market is more segregated. Income inequality is higher because migration is more severely obstructed and the amount of remittances is smaller.

5 Empirical Results

In this section, I report the empirical tests of the major hypotheses concerning migration, remittances and inequality. I start by identifying the major determinants of migration and estimating their effects on the proportion of out-migrants. Then I use cross-province remittances information to verify the link between migration outflow and remittances inflow. Last I estimate the impacts of out-migration on SES income inequality.

5.1 Hypotheses

The major hypotheses I am going to test for the model are:

- Fraction of out-migrants to Bangkok increases with the wage differential and decreases with the distance between Bangkok and home province.
- The poor a provinces is, the more remittances it receives; the more out-migrants a province has, the more remittances it receives.
- SES income inequality ratio decreases with migration to Bangkok.

5.2 Determinants of Migration: Wage Difference and Distance

Table 6 presents the estimates from cross-sectional regressions based on equation (4). Wage differential is measured by the difference between wage rate in Bangkok and that of home province. Migration cost is proxied by the railway distance between Bangkok and each home province. Column 1 includes the time trend and column 2 includes dummy variables that indicate different years. The estimates show that fraction of migrants to Bangkok increases with wage differential and decreases with distance between Bangkok and home province. Increasing lagged wage differential by

10 percent increases the fraction of out-migrants by 8.7 percent. A province whose distance from Bangkok is 10 percent longer than another province has a lower fraction of out-migrants than that of the latter by 12 percent, ceteris paribus. A province in the northern or northeastern region has more migrants to Bangkok compared with a province in the central or southern region. The coefficient on time trend is not statistically significant, which implies that migration cost varies little over time. The coefficients on year dummy variables are not statistically significant either. Both regressions have an R-square higher than 0.7.

5.3 Remittances as a Channel for Income Redistribution

Table 7 and 8 explore the possible channel through which migration alleviates cross-province inequality. Since SES data record detailed remittances information only for year 1988, the following results are based on cross sectional estimation in 1988.[24] Table 7 displays the cross-sectional estimates of the association between remittances received from outside the origin provinces and fraction of out-of-province migrants. The higher the fraction of migrants, the more remittances are received in that province. Column 1 suggests that 1 percent increase in fraction of migrants leads to a 7.5 percent increase in cash remittances received; Column 2 suggests that 1 percent increase in fraction of migrants will generate 7.2 percent in total value of remittances received.

Table 8 presents the cross-sectional estimates of the association between remittances received

[24] In 1988, SES records the direction of remittances based on additional questionnaires, thus we can identify both the location of senders and the location of receivers. In others rounds of SES dataset, only the location of receivers is reported and we can not distinguish between remittances from out-of-province migrants and those from within the receivers' province.

and net income (excluding remittances), using aggregated provincial level data. Both regressions show a negative relationship exists between remittances received and the provincial income net of remittances. This suggests that remittances flow from rich provinces to poor provinces.

In sum, Table 7 and 8 provide some evidence on the possible causal relation between out-migration and remittances and also on the income-redistributing effect of remittances.

5.4 Impacts of Migration on Income Inequality

I begin by using the conventional cross-sectional approach to estimate association between migration and cross-province income inequality. Table 9 presents the estimates of cross-sectional OLS regressions from 1988-1999. The dependent variable, relative income inequality is measured by the ratio of per capita household income in Bangkok relative to that of home province j in the SES dataset, which corresponds to $R_{j,t}$ in equation (13).[25] The regressors are fraction of out-migrants and other controls. Columns 1 to 4 report the coefficients on the fraction of out-migrants with different set of controls.

The results exhibit wide variability in the estimated effects of migration on relative income inequality, both across specification for a given year and across year for a given specification. For example, the estimates from column 1 are positive and significant; however, including region effects has a noticeable effect on the estimates and renders estimates in most years insignificant at conventional levels. For column 3, estimates range from -.005 to .077 and all estimates are

[25] Per capita household income in Bangkok and in all other provinces is a weighted average of per capita household income of all households residing in the specific province.

insignificant except for the 1994 cross-section.

Table 10 presents the fixed effects estimates of the association between migration and income inequality based on the pooled data for the 1990-94, 1994-99, 1992-1996 and 1990-99 periods. The inequality measure is the same as used in Table 9. Column 1 of each pooled regression contains the results unadjusted for per capita GPP growth rate and column 2 of each pooled regression contains the results adjusted for the growth rate. Controlling for growth rate helps eliminate the effect of productivity shocks in the home province j. Including province fixed effects eliminates the bias in the cross-sectional estimates attributable to time-invariant omitted factors that vary across provinces. However, this approach will still be biased if there are unobservable shocks that correlate with both migration and income inequality changes.

For pooled regression 1990-94, there is an insignificant, negative correlation between migration and income inequality. For pooled regression 1994-99, there is an insignificant, positive correlation between migration and income inequality. The estimates for the 1992-96 period are strikingly different. Out-migration percentage now has a statistically significant and substantive effect on relative income inequality, with a 1 percentage increase in out-migrants associated with a .221 reduction in relative income inequality ratio. On the other hand, growth seems to have no association with income inequality during the 1992-96 period.

The final column shows that for the entire 1990-1999 period, the estimated migration coefficient is again significant and negative when controlled for growth rate at home province. However, the magnitude of this estimate is smaller than that of the 1992-96 period. This implies that most of the fixed effects association between out-migration and income inequality is driven by their correlation during the 1992-96 period.

6 Conclusion

This paper introduces a dynamic model to analyze the link between migration and cross-province inequality in Thailand. Cross-province migration is viewed as a labor allocation decision by a representative household based on wage differential and associated migration cost. The wage rate at the destination of migration is in turn affected by total amount of migrant labor supply. Both migration and wage rate at the destination are endogenously determined. As shown earlier, migration generates a net income gain for migrants and they share that income gain with household members who remain in the rural areas through remitting cash or goods. Remittances help redistribute income toward poor provinces, resulting in a lower level of cross-province inequality in household income. The simulation results provide a good approximation to the sample data. In particular, simulated Theil-L indexes of production and income inequality explain more than half of the differential between the GPP production inequality and the SES income inequality.

Empirical tests provide further evidence of the negative association between rural-urban migration and income inequality. Fixed effects estimation shows that increasing the mean fraction of out-migrants to Bangkok by one percent decreases income inequality by .058 (an elasticity of -0.11).

Understanding cross-province inequality could have important policy implications for the Thai government. Thailand has been targeting at reducing poverty and promoting regional economic equality. In the mean while, migration policy in Thailand has been to reduce migration to Bangkok during the past two decades. This study shows that migration plays an important role in reducing regional income inequality. To fulfill the goals of reducing poverty and economic inequality, government should consider revising the policy to accommodate rural-urban migration instead of curbing migration flow.

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Table 1: Summary Statistics, 1988-1999

	1988	1990	1992	1994	1996	1999
GPP dataset						
Number of provinces in sample	73	73	73	73	73	73
Mean pc gpp in baht						
Whole sample (1988 prices)	28710	34864	39840	46605	52727	47135
Bangkok (1988 prices)	98383	125601	141272	159430	169151	135236
Sample w/o Bangkok (1988 prices)	20183	23532	26871	31528	36833	34687
Population of whole sample (1,000 persons)	54330	55839	57294	57514	58780	60549
Population of Bangkok (1,000 persons)	5924	6199	6495	6780	7061	7496
SES dataset						
Number of households in sample	11045	13177	13458	24583	24433	7580
Mean monthly per capita hh income in baht						
Whole sample (1988 prices)	1064	1239	1512	1677	2030	2119
Bangkok (1988 prices)	2506	2922	4162	4081	4673	4794
Sample w/o Bangkok (1988 prices)	876	1007	1179	1378	1661	1731
Fraction of hh's receiving remittances (%)	23.06	22.30	24.46	28.41	29.72	34.47
Share of remittances in household income (%) among hh's with positive remittances	24.55	23.49	23.83	27.05	27.92	27.55
CDD dataset						
Number of villages in sample	56744	57684	59640	60133	61134	63239
Mean % of households w/ migrants laborers	22.8	25.7	28.1	31.2	32.4	23.6
Mean % of out-migrants in population	8.1	9	10.3	11.6	12.1	9.8
Mean % of out-of-province migrants in pop.	5.4	6	7	7.9	8.2	6.2
Mean % of out migrants to Bangkok in pop.	3.7	4.6	5.7	6.5	6.7	4.7

Notes: from 1988 to 1992, population of whole sample in GPP dataset equals population of whole Thailand. From 1994 on, population of whole sample leaves out the part of three new small provinces, Sakaew, Nong Bualamphu and Amnat Charoen. Mean percentage of remittances share (in gross income) is calculated by equally weighting households with different incomes.

Table 2: Cross-Province Inequality (Theil-L Index) in Agriculture

Data Source	1988	1990	1992	1994	1996	1998	2000
GPP	0.159	0.125	0.164	0.189	0.187	0.197	0.202
SES individual earnings [a]	0.152	0.248	0.192	0.265	0.248	0.232	0.216
SES household income [b]	0.048	0.084	0.059	0.079	0.064	0.065	0.061

Notes: a. Earnings measured as the sum of wage and farm profit, excluding remittances. b. Income measured as total monthly per capita income, including remittances.

Table 3: Cross-Sectional Estimates of Association between Migration and Provincial Income Redistribution

Dependent variable: differential b/w SES average per capita income and per capita GPP (1,000 baht)

Panel A.

	1988	1996	1999
Percentage of households with migrant laborers	-.437 (.195)	-.380 (.334)	-.345 (.588)
Constant	Yes	Yes	Yes

Panel B.

	1988	1996	1999
Percentage of out-of-village migrant laborers	-.990 (.400)	-1.395 (.764)	-2.527 (1.169)
Constant	Yes	Yes	Yes

Panel C.

	1988	1996	1999
Percentage of out-of-province domestic migrants	1.297 (.470)	2.602 (.685)	3.360 (1.239)
Constant	Yes	Yes	Yes

Notes: SES average per capita income is a weighted mean of per capita household income of all households residing in a specific province. Standard errors are in parentheses.

Table 4: Patterns of Rural-Urban Migration in Thailand

	1990		1996	
	Female	Male	Female	Male
Distribution of destination				
Within amphoe [a]	13.7	12.1	13.8	11.4
Within province	18.0	18.8	17.7	18.3
Within region	7.3	8.9	5.9	6.1
Other regions	6.0	8.8	4.7	6.4
Bangkok	53.7	49.2	54.0	52.2
Abroad	0.9	1.8	0.8	2.3
Distribution of length of stay				
Daily	29.2	27.5	30.7	27.8
Dry season	21.5	23.3	18.5	20.2
< 3 months	8.1	9.8	7.0	7.9
> 3 months	40.6	39.0	40.2	40.5

Notes: a. An amphoe is an administrative district similar to a U.S. county. The source of this table is CDD dataset.

Table 5: Comparison of Simulated Results vs. Sample Data

	1988	1990	1992	1994	1996
Simulated migrants population (1,000 persons)	1242.6	1359.7	1748.9	1971.4	2277.0
CDD-estimated migrant population	1287.8	1596.6	1951.5	2191.2	2348.1
LFS-estimated migrant population	400.6	433.5	624.6	509.5	718.4
Simulated Bangkok wage (1,000 baht)	51.90	67.33	77.67	86.90	92.98
Bangkok wage [a]	59.04	75.36	84.78	95.64	101.52
Bangkok pcgpp	98.40	125.60	141.30	159.40	169.20

Notes: a. Bangkok wage is calculated by multiplying per capita GPP of Bangkok by the share of labor, which is set to be 0.6 for the benchmark case.

Table 6: Pooled-Regression Estimates of the Impacts of Wage Gap and Migration Cost on Migration

	Percentage of out-migrants from source province to Bangkok	
	(1)	(2)
Lagged wage differential	**.867**	**.803**
	(.260)	**(.265)**
Distance	**-1.201**	**-1.188**
	(.141)	**(.142)**
Dummy_central	.316	.340
	(.342)	(.340)
Dummy_north	**2.711**	**2.736**
	(.225)	**(.226)**
Dummy_northeast	**3.419**	**3.451**
	(.217)	**(.217)**
Time trend	Yes	-
Year dummies	-	Yes
R^2	0.728	0.729

Notes: Dependent variable, lagged wage differential and distance are in logarithmic forms. For robustness check, I run the same regressions using percentage of migrants in total labor force and find similar results.

Table 7: Cross-Sectional Estimates of Association between Remittances Received by Province and Fraction of Out-of-province Migrants, 1988
(Estimated standard errors in parentheses)

	Cash value of remittances received by province		Cash and goods value of remittances received by province	
	(1)	(2)	(3)	(4)
Fraction of out-of-province migrants	**7.546**	**7.546**	**7.191**	**7.191**
	(2.782)	**(2.867)**	**(2.653)**	**(2.751)**
Region effects	No	Yes	No	Yes
Constant	Yes	Yes	Yes	Yes
Sample size	69	69	69	69

Table 8: Cross-Sectional Estimates of Association between Remittances Received by Province and Provincial Income excluding Remittances, 1988

	Cash value of remittances received	Cash and goods value of remittances received
Log per capita provincial money income before remittances	**-.9014**	-
	(.3358)	
Log per capita provincial gross income before remittances	-	**-.8737**
		(.4597)
Distance to Bangkok	-.0009	-.0008
	(.0003)	(.0003)
Elementary school enrolment	-6.640	-3.196
	(5.921)	(6.039)
Constant	Yes	Yes
Sample Size	70	70

Notes: Results are from cross-sectional OLS regression using province-level average household income and transfer data from 1988 SES data. Dependent variable is logarithm of cash value of remittances received by province. Estimated standard errors are in parentheses.

Table 9: Cross-Sectional Estimates of the Association between Migration and Income Inequality
(Estimated standard errors in parentheses)

	Relative income inequality ratio			
	(1)	(2)	(3)	(4)
1988 Cross-section	.130	.026	.026	.027
	(.028)	(.026)	(.024)	(.024)
1990 Cross-section	.215	.101	.067	.002
	(.031)	(.046)	(.041)	(.001)
1992 Cross-section	.215	.113	.077	.081
	(.028)	(.044)	(.047)	(.048)
1994 Cross-section	.140	.119	.070	.070
	(.016)	(.029)	(.029)	(.029)
1996 Cross-section	.095	.027	-.005	-.006
	(.013)	(.019)	(.017)	(.018)
1999 Cross-section	.155	.078	.045	.054
	(.028)	(.056)	(.062)	(.062)
Distance to Bangkok	Y	Y	Y	Y
Region effects	N	Y	Y	Y
Share of agriculture in GPP	N	N	Y	Y
Share of BIRE in GPP	N	N	N	Y

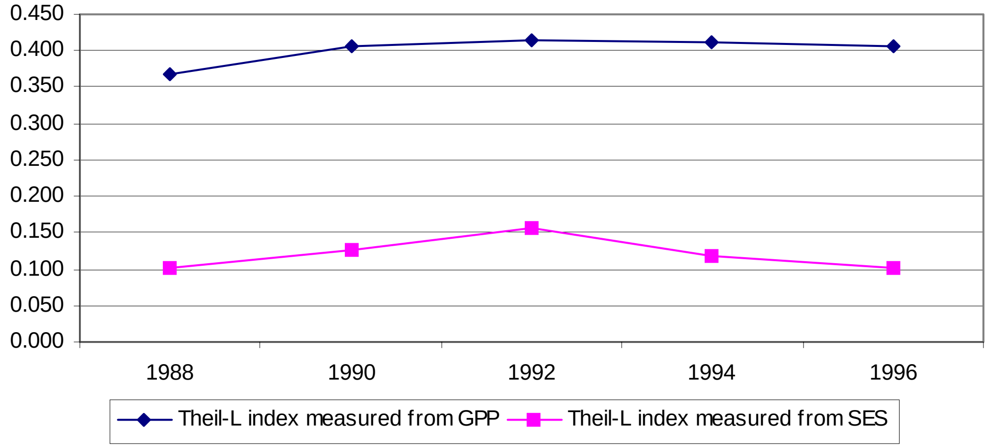
Notes: Dependent variable is the ratio of per capita household income of Bangkok relative to that of source province in the SES dataset. Remittances are included in this measure of household income. The reported estimates are coefficients on the fraction of out-migrants. BIRE refers to banking, insurance and real estate sector.

Table 10: Fixed Effects Estimates of Association between Migration and
Cross-Province Household Income Inequality
(Estimated standard errors in parentheses)

	Relative income inequality ratio							
	1990-1994 pooled		1994-1999 pooled		1992-1996 pooled		1990-1999 pooled	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
% of migrants to Bangkok	-.040	-.043	.003	.028	**-.230**	**-.221**	-.045	**-.058**
	(.043)	(.044)	(.027)	(.033)	**(.051)**	**(.051)**	(.027)	**(.028)**
Growth of pc GPP		-.007		-.011		-.020		.013
		(.013)		(.008)		(.015)		(.007)
Province fixed effects	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.65	0.65	0.71	0.71	0.60	0.60	0.60	0.61
Depend. var. mean	3.27	3.27	2.88	2.88	3.14	3.14	3.09	3.09
Sample size	216	216	216	216	216	216	360	360

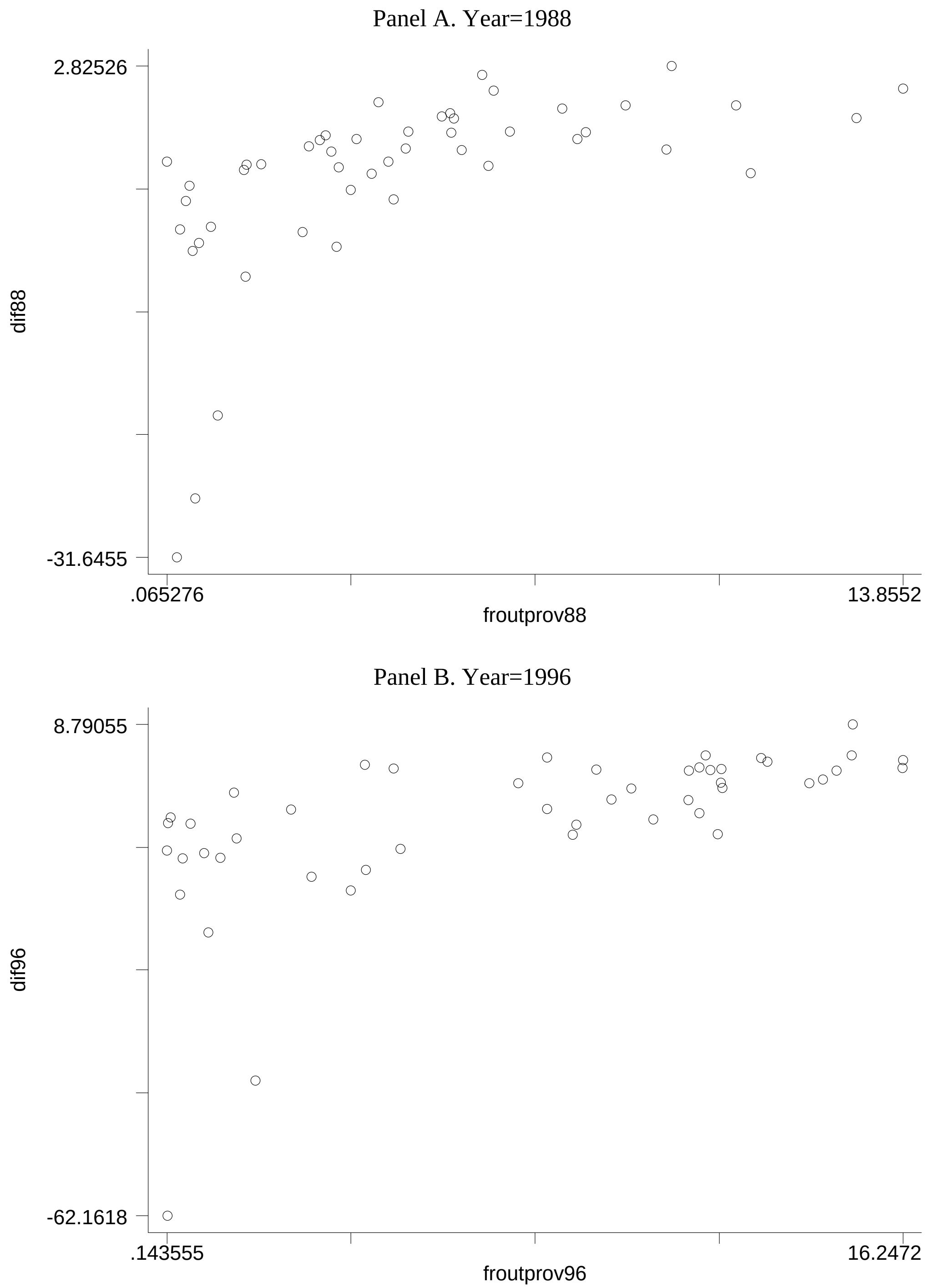
Notes: Regressions are based on the pooled data for the referenced years and include province dummies as controls. Dependent variable is the ratio of per capita household income of Bangkok relative to that of source province in the SES dataset. Remittances are included in this measure of household income.

Figure 1: Cross-Province Inequality Measured from GPP and SES Data



Notes: Theil-L index is calculated using the following formula: $I = \sum_{j=1}^{n} p_j \left\{ I^j + \ln \frac{\mu}{\mu_j} \right\}$, where n is total number of provinces, I^j is the within-province inequality in province j, μ is per capita gross domestic product (GDP), μ_j is per capita gross provincial product (GPP) of province j, and p_j is the ratio of population in province j relative to sample population. For GPP data, I^j is zero since only provincial data are available. For SES data, only between-province inequality is reported in the above figure.

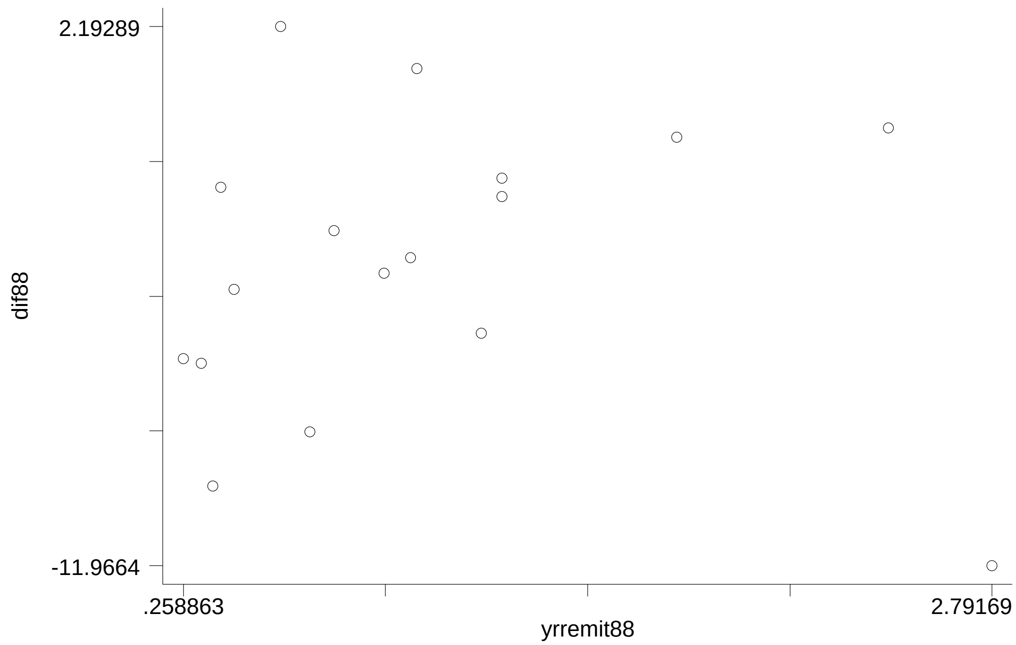
Figure 2.a: Differential between SES and GPP vs. Fraction of Out-of-Province Migrants, 1988 & 1996



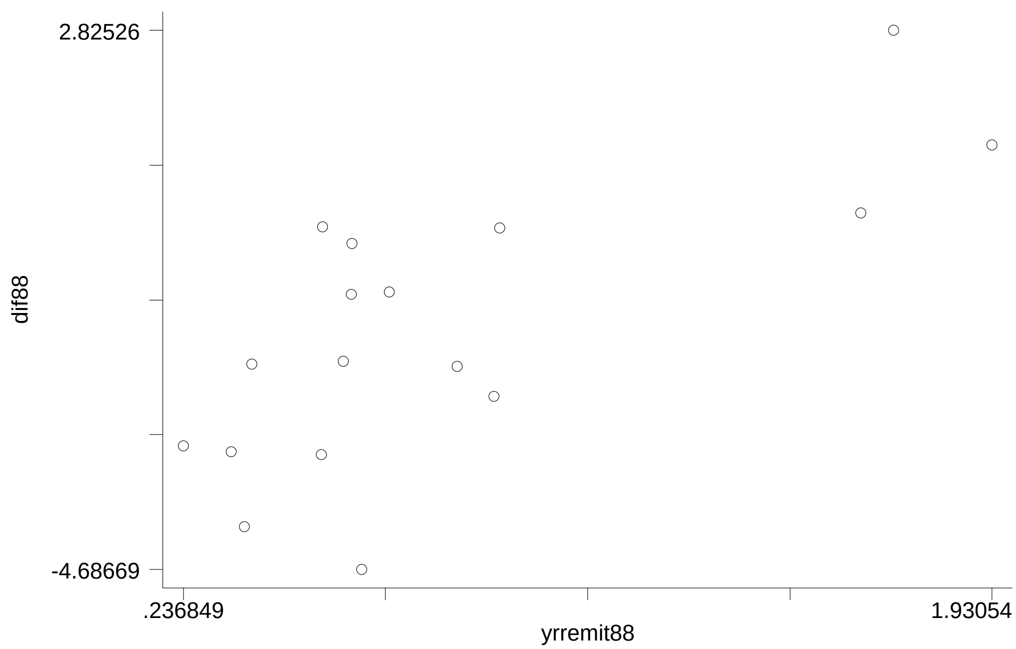
Notes: the unit for y-axis is thousands of baht and the unit for x-axis is percentage. Provinces in the central region are excluded from the scatter plots.

Figure 2.b: Differential between SES and GPP vs. Remittances Received by Province, 1988

Northern Region

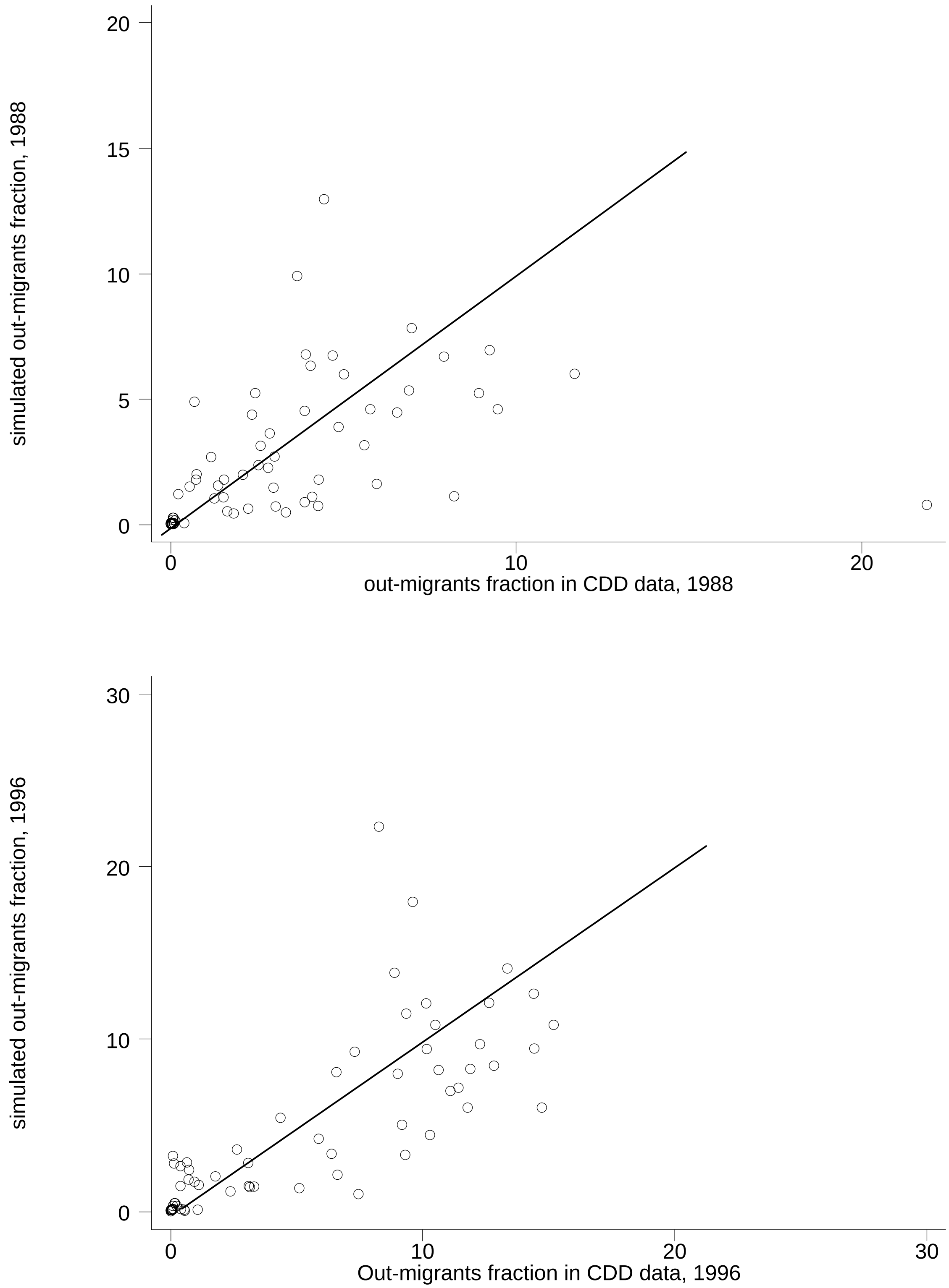


Northeastern Region



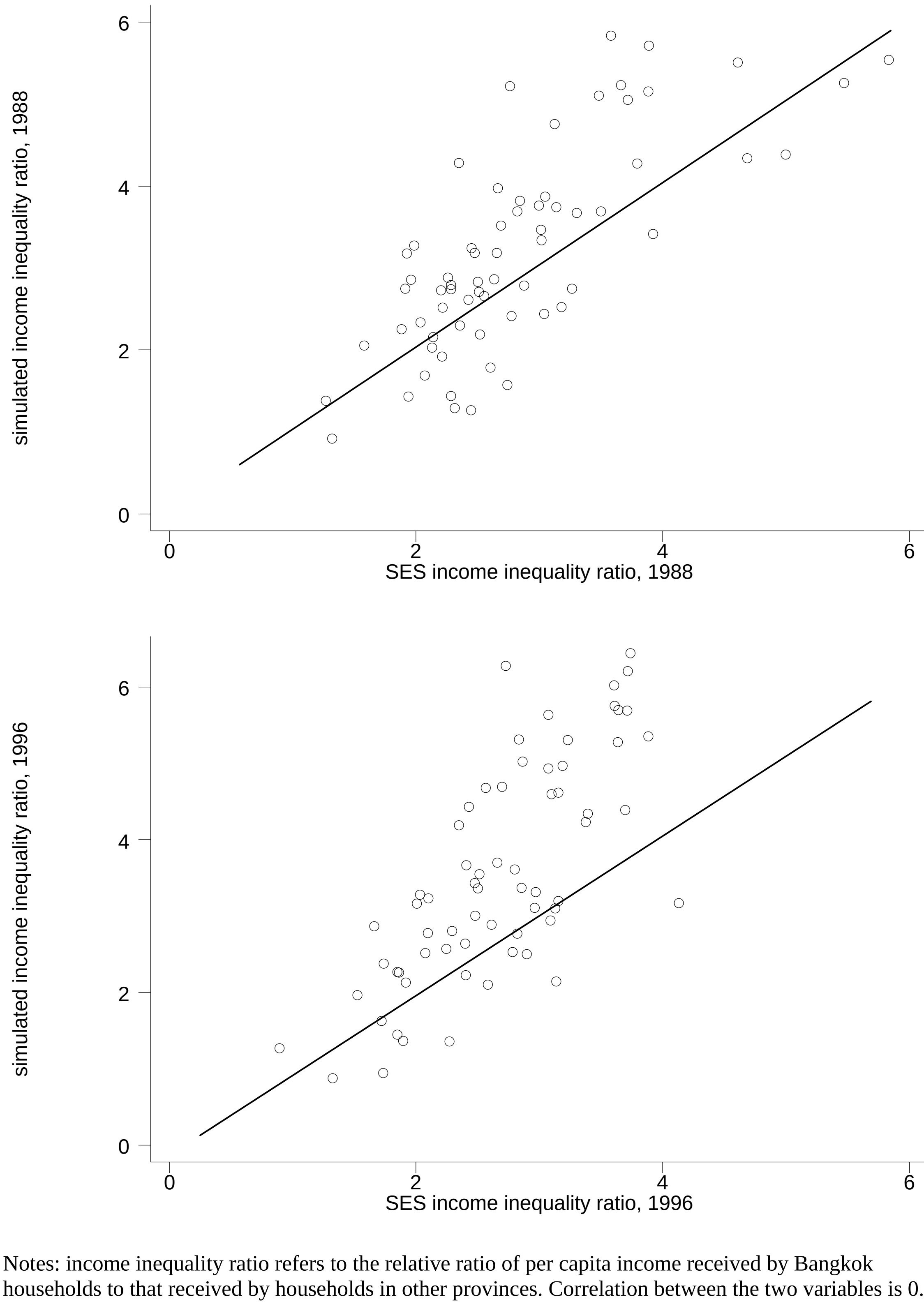
Notes: the unit for both y-axis and x-axis is thousands of baht.

Figure 3.a: Percentage of Out-Migrants by Province: Simulation vs. CDD Data



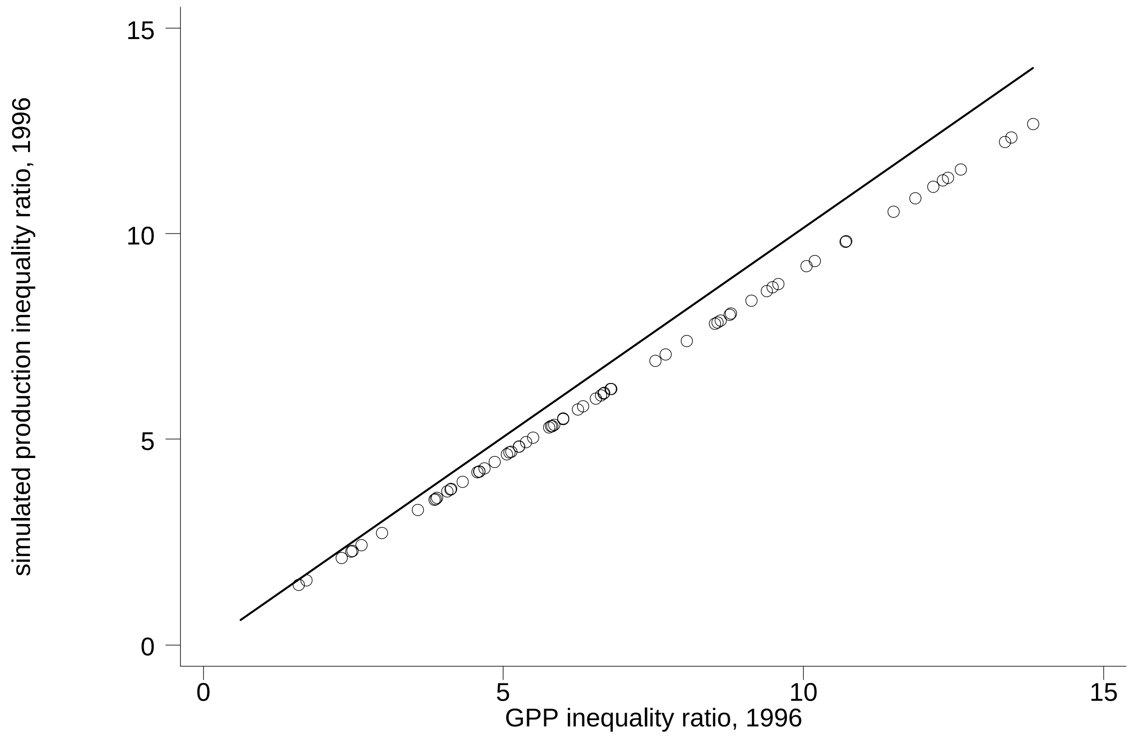
Notes: fraction of out-migrants is in percentage term. Correlation between the two variables is 0.43 in the upper panel, and 0.78 in the lower panel.

Figure 3.b: Income Inequality Ratio: Simulation vs. SES Inequality



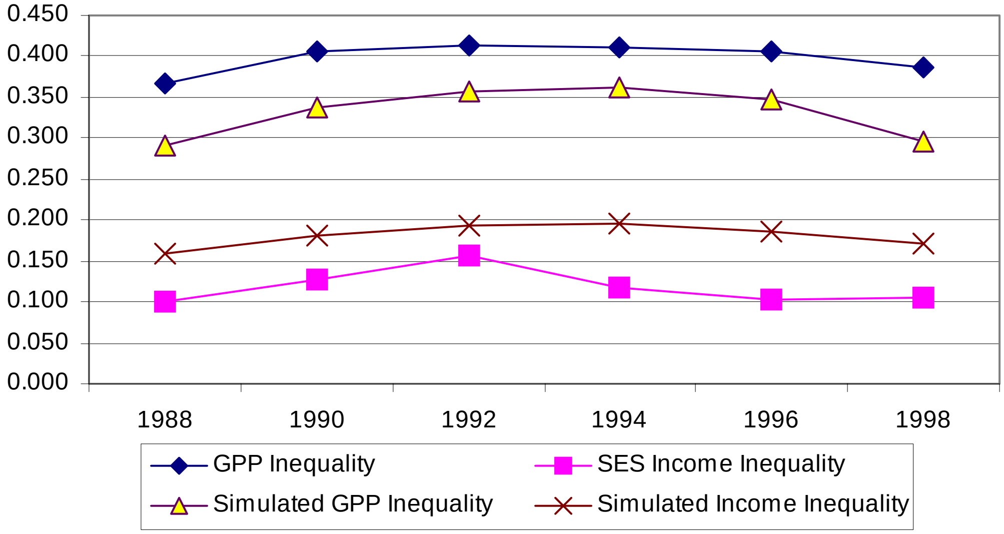
Notes: income inequality ratio refers to the relative ratio of per capita income received by Bangkok households to that received by households in other provinces. Correlation between the two variables is 0.75 in both the upper and the lower panel.

Figure 3.c: Production Inequality Ratio: Simulation vs. GPP Inequality



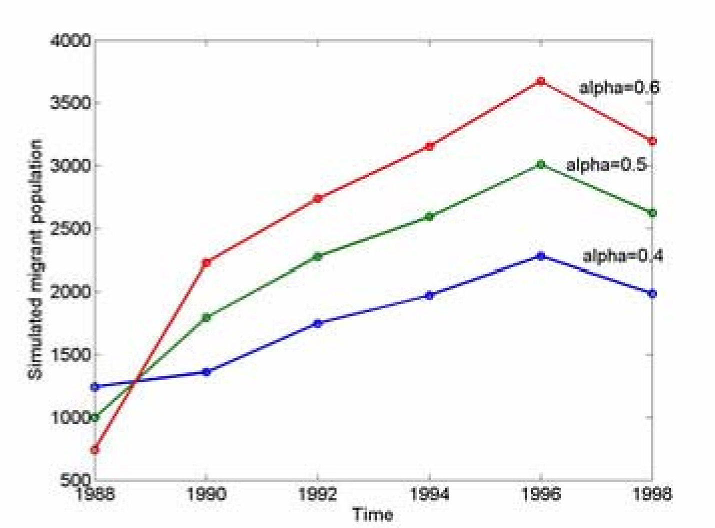
Notes: production inequality ratio refers to the relative ratio of per capita gross provincial product in Bangkok relative to that in other provinces. Correlation between the two variables is 1.

Figure 4: Cross-Province Inequality in Production and Income: Data vs. Simulation Results

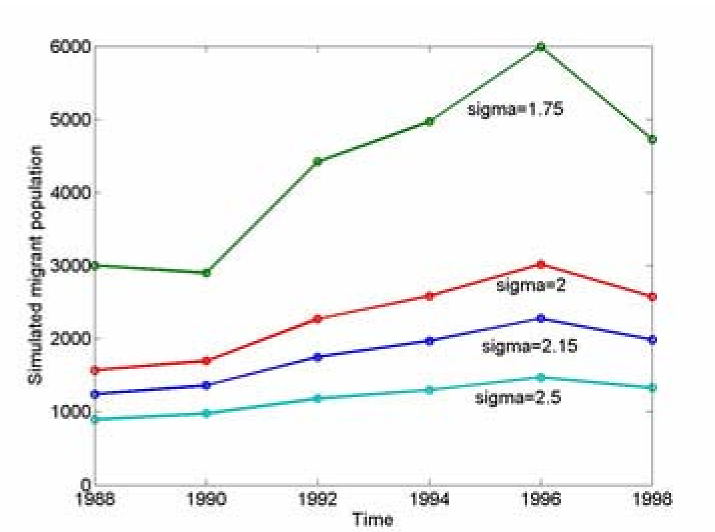


Notes: the calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\alpha = 0.4$, $\sigma = 2.15$. To simulate the Bangkok wage downturn during the financial crisis, it is assumed that productivity in Bangkok incurs a negative 20% shock from 1996 to 1998. Inequality is measured by Theil-L index here. See notes in Figure 1 for more details on calculating Theil-L index.

Figure 5.a: Effects of Factor Share and Migration Cost Convexity on Aggregate Migrant Population

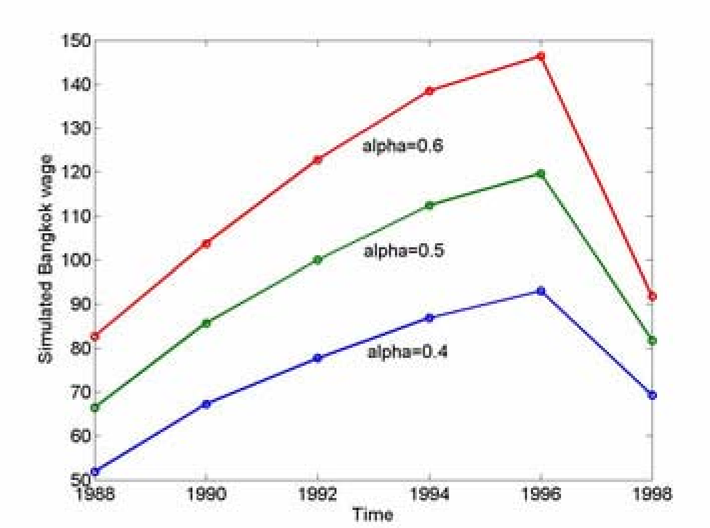


Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\sigma = 2.15$. α denotes the share of capital in production technology. $\alpha = 0.4$ represents the benchmark case.

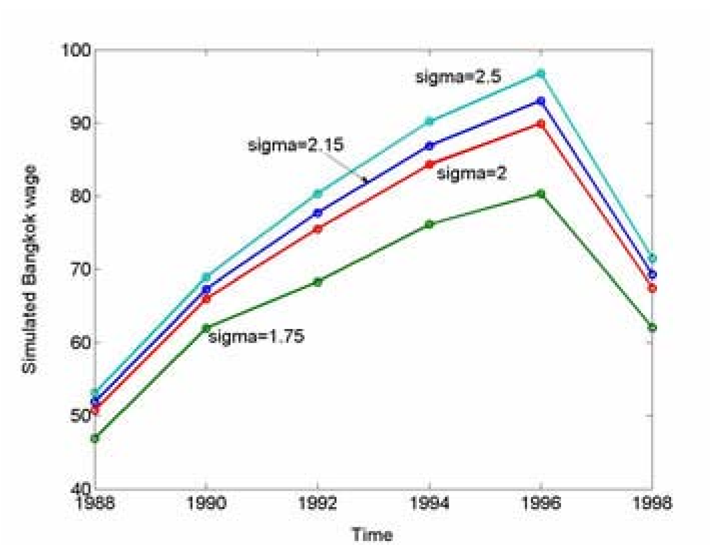


Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\alpha = 0.4$. σ denotes the convexity of migration cost. $\sigma = 2.15$ represents the benchmark case.

Figure 5.b: Effects of Factor Share and Migration Cost Convexity on Bangkok Wage

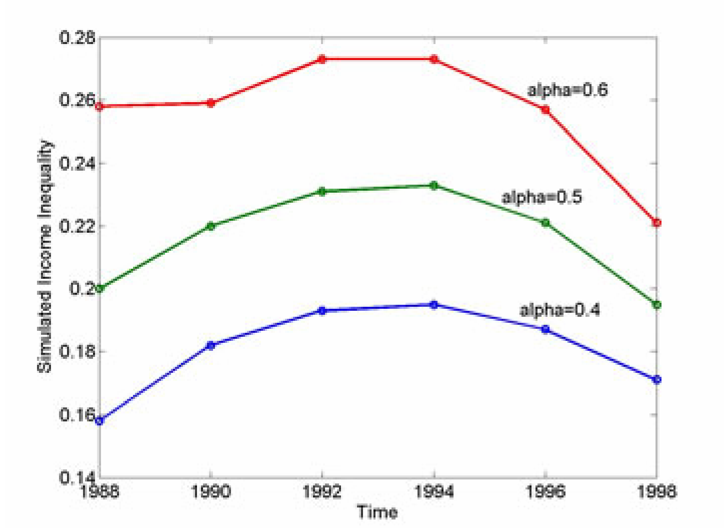


Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\sigma = 2.15$. α denotes the share of capital in production technology. $\alpha = 0.4$ represents the benchmark case.

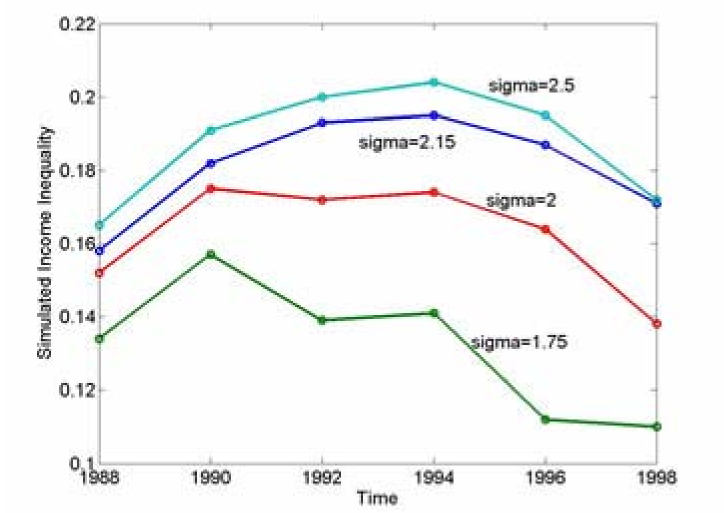


Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\alpha = 0.4$. σ denotes the convexity of migration cost. $\sigma = 2.15$ represents the benchmark case.

Figure 6.a: Effects of Factor Share and Migration Cost Convexity on
Cross-Province Income Inequality

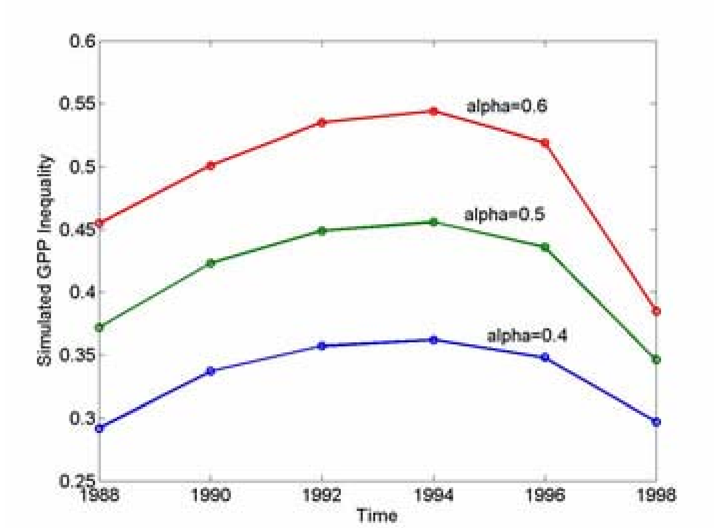


Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\sigma = 2.15$. α denotes the share of capital in production technology. $\alpha = 0.4$ represents the benchmark case.

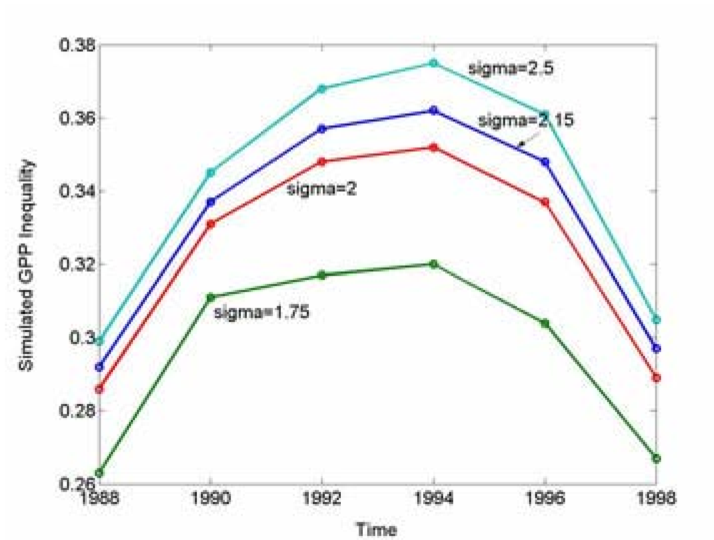


Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\alpha = 0.4$. σ denotes the convexity of migration cost. $\sigma = 2.15$ represents the benchmark case.

Figure 6.b: Effects of Factor Share and Migration Cost Convexity on Cross-Province Production Inequality



Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\sigma = 2.15$. α denotes the share of capital in production technology. $\alpha = 0.4$ represents the benchmark case.



Notes: Other calibrated parameter values for simulation are: $\mu = 1$, $\theta = 0.5$, $\alpha = 0.4$. σ denotes the convexity of migration cost. $\sigma = 2.15$ represents the benchmark case.