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Household inequality and remittances in rural Thailand: a life-cycle perspective

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Abstract

This article studies the dynamics of income inequality among a panel of rural households in Thailand. In contrast to the many cross-section studies of income inequality, the article exploits a long panel data set to examine lifetime trajectories of household inequality. It finds that income inequality is decreasing over time within cohorts delineated by decennial birth dates of heads of household. This decline in inequality primarily arises from differences in receipt of remittances from adult children of the head of household who live outside the village of origin. On average, poorer households receive remittances from a larger number of children, the annual amount remitted per child is a greater proportion of household income than in richer households, and the importance of remittances in household incomes grows as the head of household ages.

JEL classifications: D15, D31, O15

1. Introduction

This article studies the dynamics of lifetime income and consumption inequality within a panel of rural households in Thailand using high-quality panel data made available by the Townsend Thai Project (Townsend, 2011). In contrast to earlier studies using household cohort data—albeit largely within industrialized economies—it finds that income and consumption inequality decreased over a significant period (1997–2011) within groups of households headed by people from the same birth cohort. It rejects the hypothesis that declining inequality over time is driven by convergence in individual incomes across households over the lifetime: as in most studies of this type, the article finds that inequality of individual incomes does not decrease with age and indeed increases from some income

sources. Nor can declining inequality be explained by the changing composition of incomes within the resident household over the life cycle. Rather, it shows that changes in receipt of remittances from adult migrant children of the head of household living outside the household account statistically for much of the observed convergence in the distribution of gross incomes of households in the sample period.

By way of background, unlike major international migrant-exporting countries in Asia such as Bangladesh and the Philippines, migration in Thailand is largely an internal phenomenon. Jampaklay (2020) observes that migrants in Thailand are typically relatively young with migration propensities peaking at the age of 20 years for males and 21 years for females. Thailand is rapidly transitioning from a rural to an urban society with more than half its population currently living in cities, with Bangkok being a main destination. Indeed, Thailand is a major migration destination from other South and Southeast Asian countries. As the International Organisation for Migration (IOM-Thailand, 2022) observes, '[Given] Its position as a middle-income country, sharing four land borders with Myanmar, Laos, Cambodia, and Malaysia, [this] openness to two-way exchange of international investment, trade, and tourism with other countries has resulted in large flows of international migration, including that of refugees, displaced persons, professional migrants, and labour migrants.'

Returning to our main findings, three characteristics of the distribution of remittances from adult children of the household living outside the village generate falling lifetime income inequality among households. First, external remittances have increased as a share of household income over time for all households. Mean real remittances in the data roughly doubled between 1997 and 2011.[1] Secondly, within each cohort of household heads, remittances become an increasingly important component of household income later on in the life cycle of the head of household. Thirdly, remittances from adult children constitute a larger proportion of the incomes of relatively poor households, not just because poorer households have a larger number of children who reside outside the village of origin and remit back to their parent's households, but also because the average annual amount remitted by each child from a relatively poor household is a greater proportion of household income than that remitted by their richer peers. We demonstrate that these findings are not primarily driven by differences in the propensity to receive remittances between villages, and that they are robust to a variety of different measures of inequality.

This article therefore contributes to three established literatures. First, it augments studies on the life-cycle dynamics of household income and consumption inequality by providing evidence from a developing country. Furthermore, where earlier papers have established that observed increases in lifetime income inequality can be transmitted to consumption inequality (e.g., Blundell and Preston, 1998; Blundell *et al.*, 2008; Jappelli and Pistaferri, 2010), this article presents comparable evidence that *decreases* in inequality can also be transmitted from income to consumption spending.

A second literature that this article addresses links household inequality (say, at the village level) to the receipt of remittances, stemming back to at least Lipton (1980). Much of this literature is based on cross-section data or short panels (Adams, 1989; McKenzie and Rapoport, 2007; Zhu and Luo, 2010; Bang *et al.*, 2016) and does not utilize a lifetime (cohort) perspective.

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1   Mean annual remittances (in 2011 prices) were 10,436 baht in 1997, then fell below this level to 2001 before rising to reach an average of around 21,000 baht in the 2007–2011 period. (In 2001, 1 Baht was approx. US $0.03.) See Table A1 in the Appendix.

Thirdly, the article contributes to the literature on the role of intergenerational, intra-family transfers by documenting the importance of the earnings of children in the household for the life-cycle incomes of their parents. Authors such as Willis (1979), Kotlikoff and Spivak (1981), Deaton (1989), and Deaton and Paxson (1995) find that cohabitation of adult children with parents insures the household against the dip in life-cycle earnings associated with the age-related decline in the productivity of the household head. This article confirms that remittances from adult children who live outside the family home also serve this purpose. It suggests that the extent of insurance offered by remittances from children is sufficient to reverse the potential increase in inequality in individual incomes and consumption that is typically observed over the course of the life cycle in other studies and that is also observed in the Thai data for some (but not all) household income data sources. It is therefore an interesting counterpoint to studies that have found that the reverse transfers (i.e. from earlier generations to later ones) typically tend to perpetuate or even increase inequality (Becker and Tomes, 1979; Piketty, 2013, among others).

The remainder of the article is organized as follows. Section 2 reviews previous theory and evidence, while Section 3 describes the data. Section 4 establishes that inequality in household income is decreasing, not only in the balanced panel of households, but also within year of birth cohorts of household heads. It also demonstrates that decreasing income inequality is transmitted to decreasing consumption inequality over the life cycle. Section 5 shows that differences in the receipt of remittances from the children of household heads explain most of the observed reduction of within-cohort income inequality. It does so by matching households with high remittances to similar households with zero or low remittances and shows that the decline in household inequality over the lifetime is significantly larger in the presence of remittances. It also shows that differences in migration rates between villages are not a primary cause of this decrease in inequality. Section 6 summarizes the main conclusions of the article. In Supplementary Appendix to the article, further sensitivity tests are conducted, confirming that the standard pattern of rising individual income inequality with age is observed between households for some categories of household income such as income from agricultural sources, that changes in household composition do not affect the overall findings, and that results are robust to a range of different measures of inequality.

2. Theory and previous evidence

2.1 The dynamics of inequality and the permanent income hypothesis

A robust prediction of the permanent income hypothesis (Friedman, 1957, ch 3) is that individual income inequality will be increasing over time in any fixed membership group such as a date-of-birth cohort. The theory behind this result is simple: suppose that innovations to individual incomes consist of a permanent component (typically, modelled as a random walk) and a transitory component. Then to the extent that permanent shocks are not correlated between individuals, the distribution of incomes within any group of individuals will diverge. Indeed, since permanent shocks affect not just contemporaneous but permanent income, under the permanent income hypothesis, consumption inequality too would increase over time. In general, any statistical process by which the effect of autocorrelation in the evolution of individual incomes over time outweighs 'regression to the mean' will also exhibit this feature (Creedy and Hart, 1979).

Deaton and Paxson (1994) demonstrate that these (and other) predictions of the permanent income hypothesis hold in repeated cross-sectional data in countries as diverse as Taiwan, the USA and the UK. Recent papers have reported similar findings from Australia (Chatterjee et al., 2015), Germany (Bonke et al., 2015), Italy (Rosati, 2003; Jappelli and Pistaferri, 2010), and Japan (Yamada, 2009).

2.2 Developing countries may have different inequality dynamics

The studies cited above rely almost exclusively on data from industrialized countries, possibly reflecting a lack of reliable sources of annual income and consumption long-run panel data from developing countries. One important difference between household income processes in developed and developing countries is that in poorer countries income tends to include a larger share of small-holder agriculture. Two aspects of volatility in the income stream in communities which are heavily dependent on agriculture, such as rural Thailand (where 91% of households in the balanced panel receive at least some part of their income from agriculture), are particularly salient to a discussion of the evolution of inequality: the covariate nature of shocks to income and their lack of persistence.[2]

The literature has documented a number of instances where agricultural shocks have been demonstrated to include a strong covariate component (Rosenzweig and Wolpin, 1993; Morduch, 1994; Townsend, 1994; Udry, 1994; Dercon, 2006, amongst others). Deaton (1989, 1991) observes that in agricultural contexts, where income risk is very much driven by weather, innovations to income will be predominantly temporary, rather than persistent, lending plausibility to models where income is a mean-reverting process. If we make the extreme assumption that all shocks to household income are transient, a positive shock to a household in one period will on average be offset by a negative shock in a future period, leaving the distribution of income (and so permanent income and thus consumption) unchanged. But even the highly stylized case where all shocks to household income are covariate across households or where income dynamics are wholly mean-reverting cannot account for the *reduction* in inequality of household incomes over time that this article will document.

If the observed convergence in household income inequality cannot be generated by placing reasonable restrictions on the exogenous stochastic processes that determine household income, then it must be linked to some margin of adjustment within the household. Added worker effects (Mincer, 1962) and the substitution of household labour from farm to non-farm activities in the presence of an agricultural shock (Kochar, 1999) are well-known channels by which households may smooth out temporary fluctuations in income. These forces, however, do not appear to account for the persistent decline in inequality that is documented here.

Another crucial difference between the nature of households in developed and developing countries is the increased likelihood of observing multiple generations of adult members within the same household in the latter. Within the context of the life-cycle model, the literature has understood this type of household structure to internalize an insurance function that would otherwise require hump-shaped life-cycle saving: parents invest in their children when parental productivity is high, and children support their parents later on in the life

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2 Shocks to agricultural productivity such as droughts, floods, and pestilence affect whole villages or areas at a time rather than individual households. As a result, these should change the level of village income but not its cross-sectional variance.

cycle when parents' productivity declines (Deaton, 1989; Ehrlich and Lui, 1991, 1998; Cai et al., 2006; Oliveira, 2016). If the children of relatively poor households are more likely to stay on and cohabit with their parents after entering adulthood, these households would have a larger number of potential breadwinners, possibly explaining the convergence in the distribution of household income noted above. However, the present article finds that differences between richer and poorer households in the rates of cohabitation with adult children of the head of household do not vary in ways that explain the observed reduction in household income inequality.

2.3 Remittances and inequality

Cohabitation with younger generations is only one strategy by which households may insure themselves against low productivity later in the life cycle. Children may attempt to uphold their end of this intergenerational bargain by sending remittances to their parents, even when they no longer cohabit with them. Remittances from the children of the head of household prove to be particularly important in rural Thailand, as the average proportion of household income accounted for by this particular transfer is one-quarter (even more, if we restrict attention to that part of the life cycle where heads are likely to have children of working age, as will be documented later).[3]

The relationship between income inequality and the receipt of remittances has been a rich area of economic research, with mixed results. Lipton (1980) reasoned that migration from rural to urban areas was likely to increase rural income inequality, because available evidence at the time suggested that remittance flows were likely to disproportionately benefit households that were better-off to begin with. Stark et al. (1986) on the other hand, found that Gini coefficients in two Mexican villages calculated with the inclusion of remittance flows were lower than those calculated without them. They hypothesized that the diffusion of information on migration possibilities and early migration outcomes across households in migrant-sending regions reversed the initial increase in income inequality documented by Lipton (1980). However, Adams (1989) noted that simply excluding remittances from income data does not adequately describe the counterfactual of 'no migration', as people who migrate would presumably have been working in their home communities, had they not migrated. By comparing observed income with predicted household income if migrants had stayed, he finds that remittances increase income inequality in three Egyptian villages. Barham and Boucher (1998) and Möllers and Meyer (2014) also find that remittances increase inequality in Nicaragua and Kosovo, respectively. McKenzie and Rapoport (2007) note that migration may impact inequality through a host of other channels such as multiplier effects on goods and services produced in the migrant sending communities and other general equilibrium effects of remittance flows. Attempting to account for these effects, they find that the overall effect of migration among their sample of Mexican villages is to reduce inequality, so long as communities have sufficiently high levels of past migration. We do not consider spillover effects explicitly in this article.[4]

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3   *A priori*, we may expect that retirement compensation also plays an important role in supporting income later in the life cycle. In the balanced panel only 4.67% of households draw a pension, so that their contribution to the income of the average household is very small. However, government transfers increase significantly at the end of the period that we review for the earliest cohort, with the introduction of a national Old Age Allowance for everyone aged $\geq$60 in 2009.

4   For a discussion of these issues, see Bussolo and Medvedev (2008) and Gibson et al. (2011).

More recent studies of developing countries have found evidence that remittances are associated with reduced inequality. Gubert *et al.* (2010) find that remittances are associated with significant reductions in the Gini coefficient, referencing the fact that the poorest households are more dependent on remittances and have more limited options for other work. Similarly, Zhu and Luo (2010) find remittances are associated with lower inequality levels in the Hubei province of China, in part reflecting patterns of migration, but again the greater dependence of the poorest on remittances. Odozi *et al.* (2010) also find evidence that remittances contribute to reduce inequality in Nigeria. Bang *et al.* (2016), using instrumental variables and a quantile regression approach, find that remittances contribute to reductions in inequality in Kenya. Kóczán and Loyola (2021) use the 1994 Mexican Peso crisis and the 2008 global financial crises as exogenous shocks to household remittance receipts to identify the effect of remittances on inequality. They find that remittances reduce inequality, becoming more pro-poor over time. Remittances also serve an important insurance function, reducing the effect of adverse shocks on the poorest. Though these papers use a range of methodological tools to provide important insights into the causal link between remittances and economic inequality, they are mostly based on cross-sectional data and none of them identify life-cycle inequality dynamics as we do here. Furthermore, many focus on international rather than internal migration.

The issue of a counterfactual—namely the incomes of households with migrants had they not migrated—is also addressed in our article. Although we have no explicit experiment within the data (such as partially randomized migration through lotteries), we construct a sample of households with similar characteristics to high-remittance households but with zero or low levels of remittances. If these 'control' households had similar trends in income inequality to high-remittance households, we would infer that intra-household adjustments of the income stream offset the remittance effect. However, we show that the decline in inequality over the life cycle continues to be significantly greater among households that receive high levels of remittances. In summary, establishing the role of migrants' remittances within an explicit cohort approach to income inequality appears to us to be an innovation in this literature.

3. The data

The Townsend Thai Project started in 1997, when 2,880 rural households in 192 villages across 4 provinces were selected for the baseline survey (Townsend, 2011). In 1998, one-third of the original sample was chosen for resurvey from a restricted sample of villages. Thereafter, sample size fluctuated as additional areas were included and subsequently excluded from the survey and from attrition of the 1998 panel. This article utilizes data from both the 960 households in the 1998 sample (the 'unbalanced panel') and from the 609 households that were interviewed throughout the whole period 1997–2011 inclusive ('the balanced panel'). We examine the data over time and also group the data into head of household date-of-birth cohorts.

Household income is reported as 'net income' which is the difference between the household's gross income and agricultural and business expenses over the last 12 months. We revalue these numbers over time to allow for inflation using Bank of Thailand data. The survey records both 'net income' and the contribution of individual sources. The survey enumerator ensures that the latter add up to the former, providing a basic check on accuracy. Goods that are produced by the household for its own consumption are explicitly

recorded as a part of income, as are gifts received by the household, addressing potentially important sources of underestimation. Where household members are employed in jobs that pay either monthly or daily wages, these wage rates are recorded.[5] The values of the resulting income variable at the 25th, 50th (median), and 75th percentile are approximately 17,500; 33,200; and 59,600 Thai Baht, respectively, at 2011 prices and per adult equivalent.[6]

The consumption variable used in the present analysis is constructed from two distinct parts of the questionnaire: annual consumption items and monthly consumption items. The annual consumption items include spending on household and vehicle repairs, education, clothing, and eating outside the home. Monthly consumption items include various food items (including the consumption of food produced in the home), gasoline, alcohol, and tobacco as well as expenditure on rituals. These two components are annualized, added to one another, adjusted for inflation and then equivalized before the analysis of cross-household inequality measures. The values of the resulting consumption variable at the 25th, 50th, and 75th percentiles are approximately 10,300; 15,900; and 25,200 Thai Baht, respectively (at 2011 prices and per adult equivalent). These consumption measures do not include durable goods such as televisions, motor vehicles, and refrigerators which are instead included in the measure of household assets (this is why the moments of the distribution of income exceed those for the distribution of consumption).

Our primary focus in this article is the evolution of household inequality over time within cohorts (measured by date-of-birth decades). The presence of measurement error could lead to an overestimate of income inequality when the variance of these errors is added to the true variance of underlying household income. Hence, we must assume that the distribution of measurement error is independent of the age of the head of household. However, apart from our own careful checks of individual income data points in the data set, there are reasons for allaying concerns as to measurement error in the income data. First, in the balanced panel, the log of mean household income strongly predicts the log of mean household consumption. Secondly, the trend in income inequality across households over time is also reflected in the trend in consumption inequality. Thirdly, the usual predictors of household income such as the level of education of the head of household, the number of income earners in the household, and the level of agricultural assets, all have significant predictive power.

At the heart of our analysis are the dynamics of household composition and the role of remittances from family members living outside the household's village. The survey collects data on all individuals either who live in the household for at least 6 months out of the year or who are in school and are financially supported by the household. On average each head has less than 1.5 children living in the household at a given time, though the standard

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5 The 1997 data on individual wages appear to be inconsistent with the rest of the panel. In 1997 the data report 100 individuals as earning monthly wages <300 Baht a month, compared with a total of 8 observations in all the remaining 14 years of the panel. This is either an error, or evidence that the 1997 sample is systematically different from other years. For this reason, the 1997 data are dropped from the subsequent analysis that is conducted on individual (as opposed to household) level data.

6 In 2011, a Thai Baht was worth around US$ 0.03. The results we report here are computed using the 'Old OECD Scale' where the first adult receives a weight of 1, further adults a weight of 0.7, and children (aged under 14 years) receive a weight of 0.5.

deviation of this number is high (the range is from none to 10), and not surprisingly, much of this variation is over the life cycle of the head. However, what is interesting about the survey data and relevant for our purpose is the section of the questionnaire dedicated to the offspring of the head of household living outside the village. On average, each household reports 2.4 children living outside the village, with the number ranging from 0 to 13.

Along with characteristics of these children, this section of the survey collects specific information on the amount remitted from these children outside the village to the household of origin. This permits the study of the intergenerational aspect of remittance transfers, without confounding the data with remittances from other sources, such as the spouse of the head of household, or extended family living outside the villages. On average, each household reports one child remitting money from outside the village, with the range of remitters varying from 0 to 12 per household. Whilst children of the heads of household who live outside the village of origin are roughly equally split between males and females, the average woman living outside the village of the head of household is more likely to remit to her parents' household than the average man (55% of women remit in the average year, as opposed to only 48% of men) and typically remit more (c.12k Baht as opposed to c. 9k Baht, respectively, in 2011). These differences are statistically significant. Unfortunately, information is not collected on either the reasons why these children choose to leave the village, or their earnings at their destination, so we cannot separate economic migrants from other migrants whose behaviour may be systematically different, such as those who migrate for marriage.

4. The decline in household inequality

Figure 1 illustrates the evolution of income inequality in the balanced panel of 609 households between 1997 and 2011. Inequality, as measured by the standard deviation
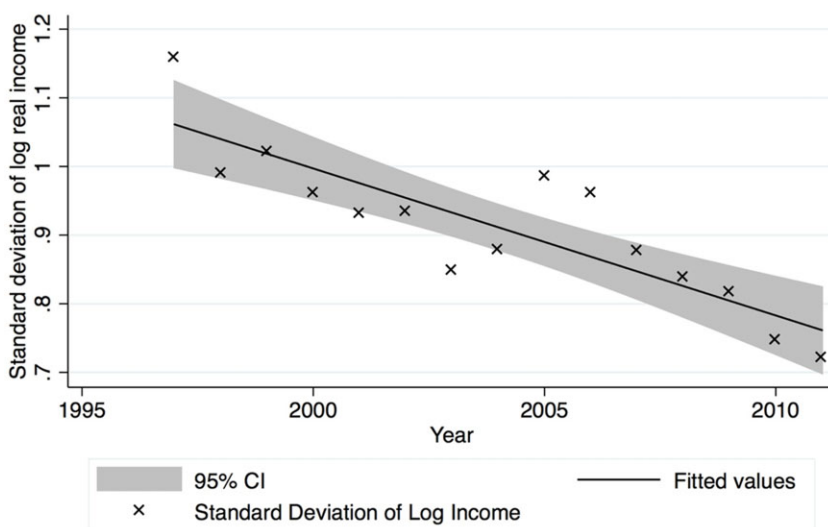

Fig. 1. Income inequality in the balanced panel.

(SD) of the log of real equivalized income, is declining over the 15-year duration of the panel and the 95% confidence interval around the line of best fit shows that the decline is statistically significant. However, this depiction of the data conflates a number of potential factors such as between-cohort effects, within-cohort effects, and common shocks. Each cross-section contains households headed by people who are drawn from different year of birth cohorts, and are at different stages of the life cycle. Given the extensive literature documenting how income inequality varies systematically between cohorts and evolves over the life cycle (such as Hall, 1978; Deaton and Paxson, 1994; Blundell and Preston, 1998; Dickens, 2000 *inter alia*), we now examine the evolution of income inequality within cohorts defined over the dates of birth of the heads of households.

4.1 Household income inequality declines over the life cycle

In this section, we divide the sample into cohorts defined by decade-averages of the year of birth of the head of household. With a view to maintaining cohort–year cell sizes, the illustrative figures are based on the 'unbalanced panel' of the 960 households from the set of 64 villages that were interviewed in all years between 1997 and 2011, but we check that the results are also statistically robust for the 'balanced panel' of 609 households. Given the possibility of differential panel attrition by household type, we formally test whether there are significant differences in variable means between the balanced and unbalanced panels. For the key variables: mean real income per household, mean real expenditure per household, mean age and sex of household head, and household size, we cannot reject the null hypothesis that the means of the balanced and unbalanced panels are equal for all at the 5% level of significance.

Owing to the relatively small number of households in each cross-section, finer definitions of 'cohorts' than decade-averages are not feasible. Table A2 in the Supplementary Appendix describes sample sizes by date of birth and year in the unbalanced panel. As the table illustrates, constructing cohorts in this way yields reasonable cell sizes over the duration of the panel for households headed by cohorts born in the 1930s, 1940s, 1950s, and 1960s.[7]

Figure 2 plots the evolution of income inequality (including receipt of remittances) between households headed by people from each of these four cohorts. The remaining cohorts, which are not well identified for the whole panel, are dropped from the analysis. As before, the standard deviation of the log of real income is used as the measure of inequality (other inequality measures are used in sensitivity testing in the Supplementary Appendix). Figure 2 shows that the decrease in income inequality observed in Fig. 1 is not primarily driven by younger (and potentially less unequal) households replacing older ones as the panel progresses, but is a genuine feature of the life cycle of Thai households. The general trend appears to hold true for every cohort for which we have a reasonable number of observations in each cohort–year cell. The level of income inequality at the beginning of the panel does not appear to vary systematically between cohorts, as it does in other studies (e.g. Blundell *et al.*, 2008), though there does appear to be some heterogeneity in the rate at which inequality is declining: the earliest cohort may be experiencing a faster decline than others.

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7   Hence, the 'age' of a cohort is shorthand for the number of years that have elapsed from the year that is at the centre of the range of birth years that defines that cohort.
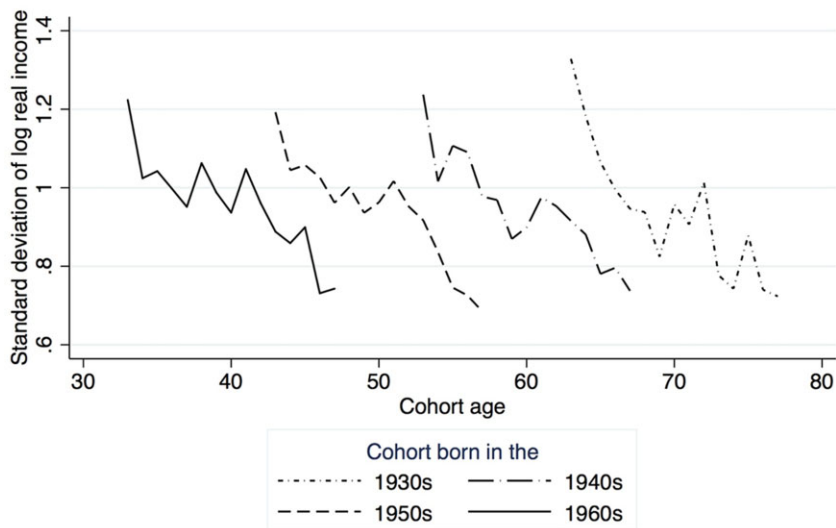
Fig. 2. Household income inequality over the life cycle.

To pin down whether or not this observed decline in inequality is statistically significant, we model the evolution of income inequality as a set of cohort fixed effects and cohort-specific time trends:

$$\sigma_{ct} = \alpha + \beta_c \cdot + \gamma_c \cdot t + u_{ct} \tag{1}$$

where σ_{ct} is the standard deviation of household income in cohort c in year t. β_c is a set of cohort fixed effects. The omitted category is the cohort born in the 1930s. The next term, $\gamma_c \cdot t$, is a cohort-specific time trend. The vector of coefficients on this interaction, γ, is a key variable of interest: if inequality within a cohort is declining over time, then γ will be negative and significantly different from zero. The error term u_{ct} is assumed to have mean zero, and α is a constant. The full set of time trends is identified in this instance by assuming that they are linear and by omitting an overall time effect. The results for the full sample are presented in the first column of Table 1.

The estimated intercept terms for each cohort are statistically indistinguishable from one another.[8] In the case of the estimated cohort-specific time trends, for every cohort the hypothesis is rejected that $\gamma = 0$ in favour of the alternative that $\gamma < 0$. Hence, income inequality is declining over time within each group of households categorized by the cohort of birth of the head of household.

Figure 2 was suggestive of possible heterogeneity in the rate at which income inequality was declining within cohorts. Table 1, on the other hand, indicates no statistically

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8 We have also modelled household inequality as a set of cohort-specific initial conditions and cohort time trends. We find statistical evidence that inequality at the beginning of the panel is highest in the earliest cohort, but that the three later cohorts are statistically indistinguishable from one another. We continue to find strong evidence of declining inequality within cohorts in that specification.

Table 1. Inequality in net income declines within cohorts

Regressors	SD of log real income	
	Unbalanced panel	Balanced panel
Cohort born in 1940s	−0.037	−0.018
	(0.071)	(0.088)
Cohort born in 1950s	−0.031	−0.008
	(0.064)	(0.077)
Cohort born in 1960s	−0.046	−0.096
	(0.071)	(0.084)
Time × born in the 1930s	−0.033***	−0.031***
	(0.006)	(0.007)
Time × born in the 1940s	−0.026***	−0.023***
	(0.004)	(0.005)
Time × born in the 1950s	−0.028***	−0.025***
	(0.003)	(0.003)
Time × born in the 1960s	−0.024***	−0.016***
	(0.004)	(0.004)
Constant	1.195***	1.133***
	(0.057)	(0.074)

Robust standard errors are in parentheses. The omitted category is the cohort born in the 1930s. Identification of the four within-cohort time trends is achieved by the omission of an overall time trend.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.
Source: Authors' calculations.

robust evidence of such heterogeneity. All estimated coefficients are within two robustly calculated standard errors of one another. To test these hypotheses formally, *F*-tests of pairwise comparisons between all estimated cohort-specific time trends were constructed. The results are presented in Table 2 and in every case fail to reject the null hypothesis that each pair of trends is the same, against the alternative. Thus income inequality is declining significantly within cohorts, but the extent of the decline is not statistically different between cohorts. These findings are statistically robust when we re-estimate the model on the balanced panel of households, presented in the second column of Table 1. Income inequality is again declining over time within each decade of birth cohort.

The empirical literature from developed countries has shown that trends in income inequality are often transmitted to consumption inequality as predicted by permanent income theory (see, e.g., Blundell *et al.*, 2008). To test if this is the case in the Thai data, Table 3 re-estimates Equation (1) on the standard deviation of the log of various measures of household consumption (as opposed to household income in Table 1). The first two columns present the results for household consumption (including both the items reported on a monthly and annual basis) for the unbalanced and balanced panels. Columns 3 and 4 focus on non-durable consumption, that is, the variables measured on a monthly basis listed above. Across these models we find a consistent pattern of declining inequality in consumption within cohorts, over time.

Table 2. *F*-tests for differences between cohorts of time trends in the evolution of household income inequality

Cohort born in the	1930s	1940s	1950s
1940s	0.81 (0.374)	–	–
1950s	0.42 (0.519)	0.15 (0.703)	–
1960s	1.44 (0.235)	0.17 (0.683)	0.64 (0.427)

F-statistics distributed with $(1, 51)$ degrees of freedom; *p*-values in parentheses.
Source: Authors' calculations.

Table 3. Inequality in consumption declines within cohorts

Regressors	SD of aggregate consumption		SD of log of food, tobacco, alcohol, and fuel consumption	
	Unbalanced panel	Balanced panel	Unbalanced panel	Balanced panel
Cohort born in 1940s	−0.003	0.002	−0.037	−0.025
	(0.032)	(0.053)	(0.052)	(0.062)
Cohort born in 1950s	0.010	0.059	−0.021	0.026
	(0.037)	(0.054)	(0.059)	(0.069)
Cohort born in 1960s	−0.030	−0.013	−0.043	−0.045
	(0.054)	(0.057)	(0.057)	(0.061)
Time × born in the 1930s	−0.011***	−0.006*	−0.015***	−0.013***
	(0.002)	(0.003)	(0.004)	(0.005)
Time × born in the 1940s	−0.013***	−0.010**	−0.015***	−0.014***
	(0.003)	(0.004)	(0.004)	(0.004)
Time × born in the 1950s	−0.011***	−0.013***	−0.016***	−0.017***
	(0.003)	(0.004)	(0.004)	(0.005)
Time × born in the 1960s	−0.011**	−0.008*	−0.014***	−0.011**
	(0.005)	(0.004)	(0.004)	(0.004)
Constant	0.765***	0.712***	0.698***	0.661***
	(0.018)	(0.034)	(0.034)	(0.043)

Robust standard errors are in parentheses. The omitted category is the cohort born in the 1930s. Identification of the four within-cohort time trends is achieved by the omission of an overall time trend.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Source: Authors' calculations.

5. The impact on household inequality of remittances from children living outside the household

The measure of 'household income' used so far in the analysis includes the amount remitted to the household by children of the head of household living outside the village. This section examines the nature of these remittances further. It demonstrates that they have increased over time during the period 1997–2011; that they increase with age of the head of household within cohorts; that they disproportionately accrue to poorer households; and that they differ by the sex of the child. Having described these characteristics, we then deduct

receipt of remittances from the incomes of the household to examine what the pattern of income inequality would have been over time and within cohorts had these remittances not been received. We reiterate the *caveat* that this is not a true counterfactual in the sense of defining what household incomes would have been in the absence of remittances. We discuss this issue further in Section 5.6.

5.1 Remittances over time and age of head of household are both increasing

We noted that the average real value of remittances received by households in the panel from children living outside the family increased substantially between 1997 and 2011 (see Table A1 in the Supplementary Appendix). This may reflect a variety of factors: for example, as non-agricultural work becomes increasingly available, it may be later cohorts of households that benefit from the new opportunities. Some of the increase will also be due to households ageing as the panel progresses and the consequent increase in the number of adult children who are potential remitters. As before, then, we decompose remittance receipts so that we can measure how the real value of remittances changes as each cohort ages.

Figure 3 plots the proportion of household income that is accounted for by remittances from children, by cohort, as the heads of household age. The figure illustrates that remittances from children start to gain importance as household heads enter their early 40s, and the share of remittances in household income continues to increase until the heads of household reach their late 50s or early 60s where they peak at, on average, approximately 30% of household income. We see a dip in the proportion of household income derived from children's remittances in the last 4 years of the panel: this seems to have been driven by rapid growth in rural incomes outpacing remittances from children over those years, although there is no substantial decline in the level of remittances from children over these years, as shown in Supplementary Appendix Table A1. For the two earliest cohorts, household
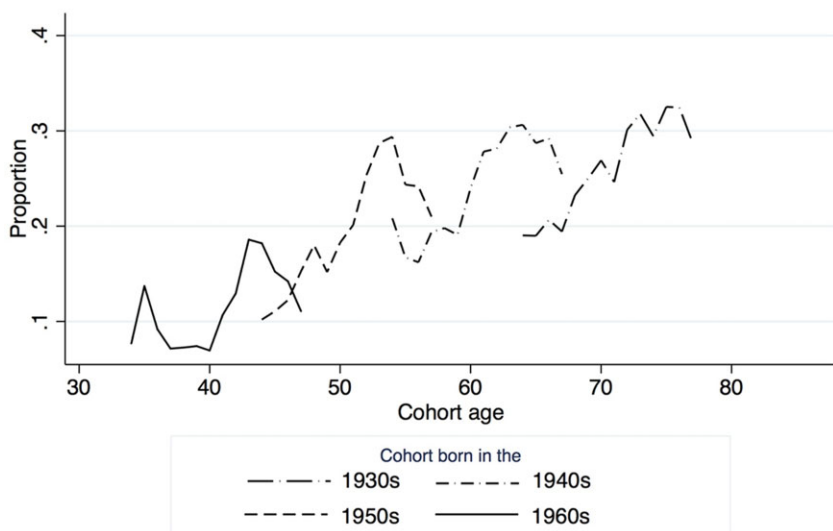

Fig. 3. Remittances from children as a proportion of household income.

Table 4. Remittance shares and number of children by decile of permanent income

Decile of permanent income	Proportion of remittances in household income	Number of remitting children	Number of female children living outside the village
1	0.369	3.663	2.043
2	0.345	3.448	1.849
3	0.253	3.323	1.709
4	0.322	3.646	2.011
5	0.266	2.879	1.577
6	0.285	3.011	1.586
7	0.193	2.833	1.589
8	0.231	2.860	1.727
9	0.168	2.306	1.194
10	0.090	1.994	0.937
T-statistic	−6.15[***]	−6.78[***]	−4.41[***]

The results in the last row are based on univariate regressions of the decile of permanent income on the reported values for (i) the share of remittances in household income, (ii) the number of remitting children, or (iii) the number of female children living outside the household. In each case, we test the null hypothesis that the variable of interest is independent of the decile of permanent income against the alternative that it is not. ***$p < 0.01$.
Source: Authors' calculations.

income will also be supplemented by the introduction of a flat pension in 2009. In general, however, the results confirm the findings of Lo (1987) (cited in Deaton, 1989) that in East Asian households the elderly receive a great deal of financial support from their children, even though the number of adults living together in East Asian households has been declining.

5.2 Remittances constitute a larger share of income of poorer households

We next calculate remittance receipts from the children of the head of household as a fraction of net household income, at each decile of household permanent income. We define permanent income as the average over time of the log of household consumption, in the spirit of Friedman (1957). The first column of Table 4 lists these proportions. From the lowest income decile, in which remittances account for over 35% of household income, the share declines to less than 10% in the highest decile. The final row reports the results of a *t*-test of the null hypothesis that the share of remittances in household income is independent of the decile of permanent income from which the household is drawn. The null is clearly rejected. Thus, although children from richer households tend to remit more money,[9] the *share* of household income which arises from remittances from children living outside the village is statistically significantly higher among poorer households.

In doing this calculation, we of course conflate cohort and age effects. It is therefore interesting to combine the data in Fig. 3 (cohort age effects) with the first column of

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9   A graph to show this is available on request. The result is illustrated most concisely by a linear regression of the household's percentile in the income distribution on the mean amount remitted by each child. On average, a 1 percentage point improvement in a household's percentile in the income distribution is associated with an increase in the amount of money remitted by each child annually of 148.4 Thai Baht, at 2011 prices (*t*-stat=12.17).

Table 4 (effects by level of income). To demonstrate this, we decompose the cohorts into those households within each cohort which are above and below the sample median permanent income, with permanent income defined as before. Figure 4(a) and (b) illustrates how the proportion of household income that is accounted for by remittances from children evolves over the life cycle for these relatively rich and relatively poor families, respectively. On average, the proportion of household income accounted for by remittances is not just higher for poorer households but grows more rapidly with age of head of household than among richer families. Among the richer households, remittances as a share of household income never exceed 30%, whereas among poorer households, remittances exceed 30% of household income for much of the later part of the panel for all cohort heads of households.

5.3 More children of poor families live outside the village and remit a greater share of household income

One impact of children on the income distribution of their parents' households may arise because poorer households have a larger number of children to support them later in the life cycle. To examine this, we again aggregate across all cohorts and examine the numbers of children living both within the family and outside the village, across the distribution of permanent income, as defined above. Figure 5 demonstrates that lower income households have, on average, the same number of children resident in the household when the head of household is aged in the mid-30s. The number in poorer households in fact rises slightly (reflecting continued births) but then falls more or less monotonically so that, when the head of household is aged in their 50s, the number of children living in the household is significantly smaller among households in the lowest quartile of income relative to the highest. The reason is, of course, that children from poorer households are less likely to be living in the household and more likely to be living outside the village.

Not only is this the case, but children of households living outside the village are disproportionately more likely to remit money to poorer households. This is demonstrated in the second column of Table 4. On average, households in the poorest decile receive remittances from over three-and-a-half children, whereas those in the richest decile do so from fewer than two children. Again, a *t*-test reported in the final column confirms that these differences are statistically significant. Hence, children from poorer families are more likely to leave the village and to remit money to the original household.

5.4 More female children from poorer households leave the village

Section 3 noted that female adult children of the heads of these Thai households on average are both more likely to remit, and to remit more, than their male children do. We now briefly demonstrate that this female propensity to remit disproportionately benefits poorer families. This is not because female children of poorer families are more likely to remit than those from richer families—in fact there is no significant difference in the probability of remitting among females from poor and rich families—but simply because there are more female children of poorer families that live outside the village. This is shown in the final column of Table 4. It would be interesting to know more about the reasons why daughters left the village—whether for work opportunities or for the marriage market, for example—and how these probabilities differed across income levels. Unfortunately, the information
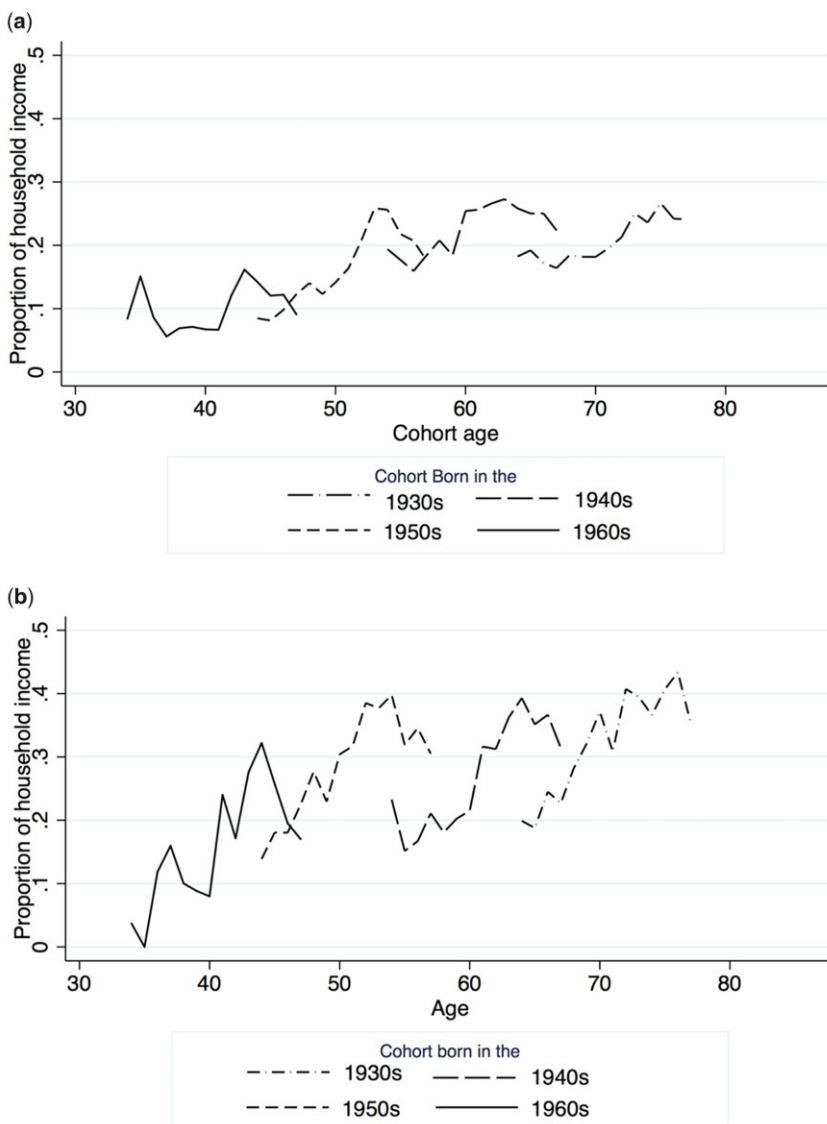
Fig. 4. (a) Proportion of rich household income remitted by children. (b) Proportion of poor household income remitted by children.

collected in the Townsend Thai Project does not catalogue the stated reason for leaving the village.

5.5 Modelling the distribution of household income without remittances

We now examine the evolution of inequality of household incomes over the life cycle in the absence of remittances. Simply subtracting the remittance contributions of children from household income clearly does not provide any information on the counterfactual where the children of heads of household did not migrate. The objective of the exercise in this
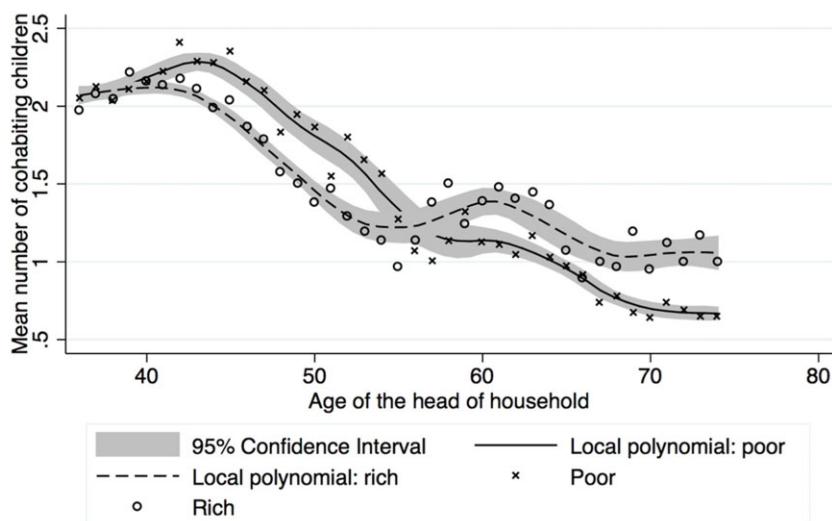
Fig. 5. Cohabiting children in top and bottom income quartiles.

section is not to compare observed income inequality with any counterfactual, but rather to ask whether or not this particular transfer to the household explains the convergence in the distribution of household incomes documented in Section 4. In particular, it is interesting to see if household incomes in the absence of remittances would exhibit the pattern of increasing inequality with age that is common to most other studies of the evolution of income inequality with age.

Figure 6 illustrates the inequality in household incomes by cohort and age of head of household, once remittances from children have been deducted. This should be contrasted with Fig. 2. It is clear that, in the absence of remittances, households do not exhibit decreasing inequality with age. Following the methodology utilized in Equation (1), we test both the contention that inequality is increasing within cohorts over time and the magnitude (if any) of cohort intercept and slope effects on these data with remittances removed. As before, we do this for both the balanced and unbalanced panels. Table 5 gives the results. The key finding from this table in the context of the current analysis is that the estimated coefficients on the cohort–time interaction terms are statistically indistinguishable from zero at the 5% level of significance.[10] Thus, once the remittance contributions of children are subtracted from household income, we arrive at the standard result that within-cohort inequality is nondecreasing over time. A comparison of the first and second columns of Table 5 illustrates that these results hold in both the full sample and the balanced panel.

As before, we test for differences between cohorts in the rate of change of income inequality over time. These results for the full sample are presented in Table 6.[11] Unsurprisingly, there is no evidence of heterogeneity: the rate of change in inequality over time is statistically indistinguishable from one cohort to another.

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10   One of the eight time trends in Table 5 is negative and significant at the 10% level.

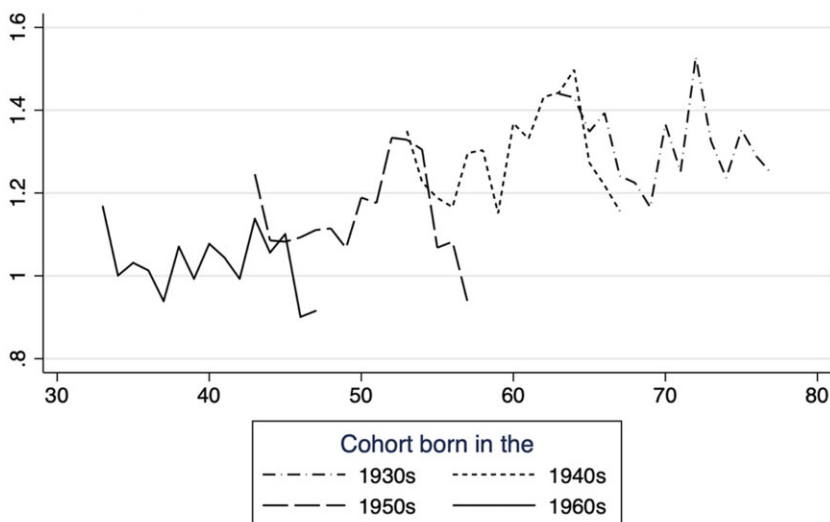11   The corresponding results for the balanced panel are almost identical.

Fig. 6. Inequality over the life cycle of income not remitted.

Table 5. Inequality in income *not* remitted by children

Regressors	SD of log real income	
	Unbalanced panel	Balanced panel
Cohort born in 1940s	−0.117*	−0.145*
	(0.065)	(0.080)
Cohort born in 1950s	−0.222***	−0.227***
	(0.065)	(0.063)
Cohort born in 1960s	−0.308***	−0.393***
	(0.059)	(0.063)
Time × born in the 1930s	−0.007*	−0.002
	(0.004)	(0.004)
Time × born in the 1940s	0.004	0.010
	(0.007)	(0.010)
Time × born in the 1950s	−0.001	0.003
	(0.008)	(0.008)
Time × born in the 1960s	−0.005	0.004
	(0.005)	(0.005)
Constant	1.376***	1.343***
	(0.040)	(0.0373)

Robust standard errors are in parentheses. The omitted category is the cohort born in the 1930s. Identification of the four within-cohort time trends is achieved by the omission of an overall time trend.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.
Source: Authors' calculations.

Table 6. *F*-tests for differences between cohorts of time trends in the evolution of inequality in income that is not remitted by children

Cohort born in the	Unbalanced panel		
	1930s	1940s	1950s
1940s	1.88 (0.177)	–	–
1950s	0.47 (0.495)	0.24 (0.625)	–
1960s	0.08 (0.777)	1.09 (0.301)	0.19 (0.664)

F-statistics distributed with (1, 51) degrees of freedom; *p*-values in parentheses.
Source: Authors' calculations.

5.6 Matching households

In this sub-section, we explore the counterfactual. Adams (1989) noted that if household members had not migrated and remitted, they would presumably have been in some other form of employment, potentially contributing to the income of the household of origin. We use standard matching techniques to find similar households which are less reliant on remittances to those which are reliant in order to examine the evolution of inequality with cohorts over time. There are two possible outcomes from this exercise. One is that those households not in receipt of remittances do not offset the absence of remittances and hence exhibit a pattern of inequality over time that mirrors the results in Table 5. The alternative extreme is that these households, through added worker effects and other mechanisms, have supplemented family income over time such that inequality exhibits the same trend as Table 1.

Matching methods are widely used to identify causal treatment effects in the absence of random assignment by assuming that on average, the effect of the treatment is independent of any characteristic that has not been used in the matching process. Ideally, we would observe a sufficiently large number of households who never produced a remitting migrant over the duration of the panel as to enable us to find a high-quality match for each migrant producing household. In the balanced panel, however, only 76 households (or 12.5%) never received remittances. The only way to increase the number of potential 'control' households is to allow some households who receive remittances but are not overly dependent on them to also serve as controls. The solution we opt for is to aggregate over time the real remittances received by each household and compare this to the aggregate over time of real net household income. We then select a cut-off value for the share of remittances in household income, aggregated in this way. If the share of remittances in household income is below this cut-off, we add a household to our group of potential controls, but if it is above the cut-off we continue to consider the household treated. The median share of remittances in household income is 10.5%. Setting the cut-off of the share of remittances in household income at the median yields 305 'treated' households and 304 'untreated' ones. We check to see if our findings are robust to cut-offs at the 45th and 55th percentiles as well, which respectively correspond to remittance shares of 7.7% and 12.2%.

When splitting the sample in this way, we need to exercise caution with respect to cohort–year cell sizes. Heads born in the 1960s are between 28 and 37 years of age in the first year of the panel and so are very unlikely to have adult children remitting to them. Supplementary Appendix Table A3 shows that for this cohort, the common support is indeed thin in the 'treatment' group. Supplementary Appendix Table A4 exposes an

analogous problem in the 'control' group in the later years of the survey for the cohort born in the 1930s. Thus the matching exercise will only yield reliable estimates for the two middle cohorts, born in the 1940s and 1950s, where the common support assumption holds.

The Propensity Score Matching technique uses a Probit to model the probability of being 'treated'. We use household characteristics in 1997, denoted by $X_{i,1997}$, to predict whether or not remittances will account for more than 10% of total household income over the duration of the panel. The characteristics included in the control vector (t-statistics from balancing tests in parentheses) are the sex (0.00), age (0.61), square of age (0.69), years of education of the head (–0.50), the total number of adult children (0.83), and the average number of years of education of the adult offspring (–1.12) of the head of household. That is, we assume that:

$$d_i^* = X_{i,1997}\beta + \varepsilon_i, \tag{2}$$

where d^* is an unobserved latent variable such that:

$$d_i = \begin{cases} 1 \ if \ d_i^* > 0 \\ 0 \ otherwise \end{cases} \tag{3}$$

The propensity score is computed by predicting the probability of a household receiving remittances, conditional on its observable characteristics in 1997. That is:

$$\widehat{pr} \ (d_i = 1|X_i) = X_i, 1997 \ \widehat{\beta} \tag{4}$$

where $\widehat{\beta}$ is the vector of coefficients estimated using Equation (2) above.

Let I denote the set of all households which receive more than 10% of their household income from remittances, and let J denote the set of households which do not. Then for each $i \in I$, propensity score matching selects the $j \in J$ which minimizes

$$\widehat{||\widehat{pr_i} - \widehat{pr_j}||}$$

where these predicted probabilities are calculated as above. The observed levels of income of these matched households are then interpreted as counterfactual incomes of remittance receiving households, had these households not received remittances. Furthermore, we assume that the incomes of untreated households would have remained unchanged.[12]

The first column of Table 7 reports the result of this exercise in comparable fashion to Tables 1 and 5. The declines in inequality are less than those reported in Table 1 for the two middle cohorts where we expect reliable results, being approximately two-thirds the size of those documented in Table 1. Nonetheless, they continue to be negative and statistically significant, in contrast to those reported in Table 5 where the declines are not statistically distinguishable from zero at the 5% level of significance in any cohort. We also test the null hypothesis that the estimated time trends in the observed data are equal to the estimated time trends in counterfactual incomes against the alternative that the time trends in the observed data are more negative than those in the counterfactual data. The resulting two sample t-statistics for the cohorts born in the 1940s and 1950s are 7.4 and 15.9,

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12 Note that we do not use this method to identify counterfactual *levels* of inequality. Any error in the matching process will add to the cross-sectional dispersion of the counterfactual distribution, thereby inflating measured inequality, while matches to extreme observations are likely to exhibit some degree of mean reversion, thereby deflating measured inequality.

Table 7. Declining inequality in matched low remittance households

Regressors	SD of log income	SD of log income	SD of log income
	Treated households' remittance share greater than median	Treated households' remittance share greater than 45th percentile	Treated households' remittance share greater than 55th percentile
Cohort born in 1940s	–0.090	–0.069	–0.024
	(0.098)	(0.115)	(0.075)
Cohort born in 1950s	–0.086	–0.111	0.046
	(0.084)	(0.085)	(0.033)
Cohort born in 1960s	–0.249**	–0.205**	–0.088
	(0.104)	(0.090)	(0.060)
Time × born in the 1930s	–0.024***	–0.025***	–0.013***
	(0.008)	(0.008)	(0.004)
Time × born in the 1940s	–0.016***	–0.016**	–0.010
	(0.005)	(0.007)	(0.006)
Time × born in the 1950s	–0.016***	–0.018***	–0.017***
	(0.004)	(0.002)	(0.003)
Time × born in the 1960s	–0.009	–0.007**	–0.009*
	(0.007)	(0.003)	(0.005)
Constant	1.196	1.192	1.065
	(0.078)	(0.082)	(0.026)

*Robust standard errors are in parentheses. The omitted category is the cohort born in the 1930s. Identification of the four within-cohort time trends is achieved by the omission of an overall time trend.
*$p < 0.10$, ***$p < 0.10$, $p < 0.05$, ***$p < 0.01$.
Source: Authors' calculations.

respectively. The critical value for the relevant one-tailed *t*-test at the 1% level of significance is 2.32. Thus for the cohorts on the common support, we conclude that inequality is declining significantly faster in observed data than in the counterfactual data. We may therefore draw the causal inference that remittances from members of the family living outside the household have accelerated declining income inequality in these Thai villages.[13]

If anything, the results are stronger when we re-estimate the counterfactual distributions of income to test if they are sensitive to the specific choice of cut-off between the treatment and control groups. The results obtained by imposing a cut-off at the 45th percentile of the share of remittances in household income (7.7%) are presented in the second column of Table 7 while those for the cut-off at the 55th percentile (12.2%) are presented in the third column. In these specifications, the counterfactual declines in inequality continue to be less than those in Table 1 and are statistically indistinguishable from zero at the 1% level for the cohort born in the 1940s.

13 We do not have a robust explanation as to why there remains a residual decline in inequality in the observed data. One plausible possibility is that the migrant members of poorer households enjoy proportionally better economic opportunities at their migration destinations than in their communities of origin.
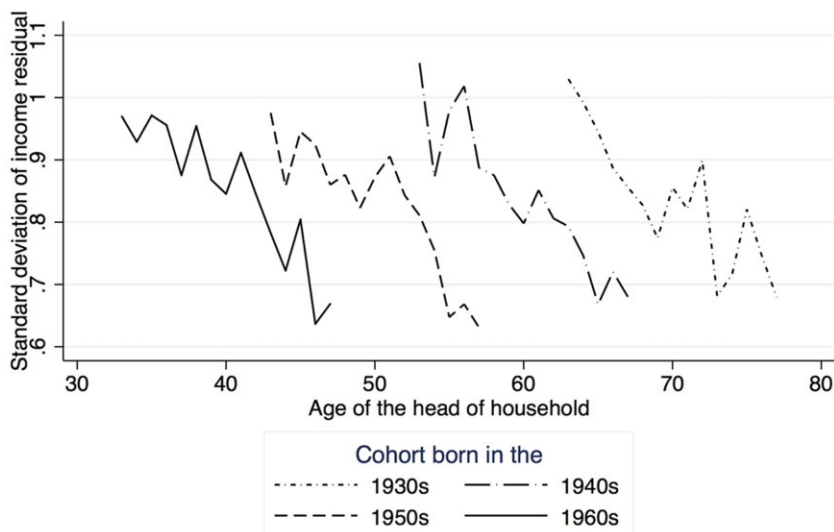
Fig. 7. Inequality in income residuals of fixed effects regression.

5.7 Does variation in migration rates between villages drive the results?

The households in the sample represent 64 different villages over a period of 15 years. Systematic differences between villages, such as the proximity to an urban centre or heterogeneity in the depth of available financial services, could conceivably predispose some villages to receiving a greater share of their income from remittances than others, by giving greater opportunities for migration, and also by inducing other cross-village sources of variation in income inequality. Indeed, Pawasutipaisit and Townsend (2011), and Townsend (2013) show that there are large geographical disparities between these villages, including differences in the levels of remittance receipts. It is therefore possible that the pattern of declining inequality documented above is driven by differences between villages, rather than between households within villages.

To examine this contention, we regress household income on a fully interacted set of village and time fixed effects, and then repeat the descriptive analysis of inequality on the residuals from that regression. That is, we estimate the econometric model:

$$y_{ivt} = \alpha + \vartheta_v \times \tau_t + \varepsilon_{ivt} \tag{5}$$

and use the resulting coefficients to compute the vector of residuals, $\widehat{\varepsilon}_{ivt}$. We then group these residuals into decade of birth cohorts and calculate the standard deviation of this residual within each cohort–year cell. The resulting dynamics of the income residuals are presented in Fig. 7. This illustrates that income inequality within decade of birth cohorts of the heads of household is declining over time, even after the removal of all village-level income dynamics. The results are driven by within-village dynamics rather than between-village differences. To verify that this result is statistically significant, we can test whether the coefficients in Table 1 significantly differ (especially on the time × cohort coefficients) when we include cluster effects. They do not.

6. Conclusion

This article investigated lifetime income inequality among a panel of rural households in Thailand by constructing interval birth-year cohorts. The data show that income inequality between households decreased over time between 1997 and 2011, and also decreased within cohorts constructed from panel data. Although there is some evidence of a fall in underlying inequality between the cohort born in the 1930s and later cohorts, there are significant within-cohort declines in income inequality.

The analysis suggests that a primary cause of this fall in within-cohort inequality is remittances from adult children living outside the household. Five aspects of the distribution of remittances explain why they reduce household income inequality among these Thai households:

1. Remittances constitute a large share of household income: the average of the proportion of net household income that is accounted for by remittances is approximately 25%. Moreover the real value of remittances has increased over time.
2. They increase in importance later on in the life cycle of the heads of household, accounting for 10% of household income, on average, when heads are in their 40s, a figure which rises to approximately 30% by the time heads reach their 50s.
3. They comprise a larger proportion of the incomes of poorer households, accounting for approximately 35% of the income of households in the bottom decile of the income distribution, and less than 10% for those in the highest.
4. The heads of poorer households receive remittances from a significantly larger number of children. Households in the bottom decile of the distribution of permanent income on average receive remittances from 3.5 children, whereas those in the top do so from an average of fewer than 2.5 children.
5. Among the relatively poor, the average amount remitted annually by each child constitutes a greater proportion of household income than it does among the relatively rich.

When outside remittances are deducted from household income, inequality remains roughly constant with age of head of household within cohorts. This finding is compatible with other studies of cohort income dynamics in largely agrarian economies where income shocks are largely transitory. We then employ a standard matching technique to identify the dynamics of income inequality that would have prevailed in the absence of high levels of remittances. This exercise demonstrates that high levels of remittances have accelerated inequality reductions in these communities. We also show that the decline in inequality is not driven by village-level differences in migration and remittances. In the Supplementary Appendix, we conduct further sensitivity tests which show that our findings are not driven by changing composition of income *within* the household, by the evolution of household composition itself or by choice of inequality measure. Hence, our findings are robust to a variety of sensitivity tests.

Supplementary material

Supplementary material is available on the OUP website. These are the replication files and the online appendix. The data used in this article are made available to other researchers by the Townsend Thai Project, accessible from the Harvard Dataverse at the following web address: https://dataverse.harvard.edu/dataverse/rtownsend (last accessed 11 May 2022).

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