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Climbing the Economic Ladder: Earnings Inequality and Intragenerational Mobility among Thai Formal Workers

Abstract

This paper investigates inequality and intragenerational economic mobility among formal workers in a developing country with large inequality. Understanding economic mobility is important because it shapes our perception of inequality. Despite its significance, evidence on intragenerational mobility, especially that based on administrative data, is relatively limited in developing countries. Using Thailand's tax return data, we study the evolution of earnings inequality, estimate medium-term earnings mobility, and examine the heterogeneity of mobility across age, gender and employment arrangement. Our analysis yields three main findings. First, annual earnings inequality rises during the 2009-2018 period. We find that the inequality is largely permanent, and its increase is primarily driven by top-earnings workers. Second, medium-term mobility tends to be limited at both ends of the earnings distribution, with particularly pronounced persistence observed at the top decile. Our suggestive comparison indicates that Thailand's earnings mobility is among the lowest in the pool of evidence from both developed and developing countries. Third, there is a considerable heterogeneity in mobility regarding employment arrangement. Workers in less-formal jobs have much lower upward mobility than those in more-formal employment. Our findings also indicate significant heterogeneity in mobility with respect to gender and age.

JEL-Codes: D310, D630, H200, J310, J600.

Keywords: intragenerational earnings mobility, inequality.

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1. Introduction

The Covid-19 crisis has brought to light several long-standing social conflicts, including wage disparities. The heightened global concern about inequality is unsurprising given that the pandemic struck at a time of high inequality in many countries. The pandemic impact is also likely to be disproportionately large on low-wage workers, particularly those in less-secure jobs. Of equal importance, however, is the issue of intragenerational earnings mobility.³ Having a sense of mobility is important because it influences how we perceive inequality. Increased intragenerational mobility may help alleviate concerns about high inequality, whereas decreased mobility may exacerbate them.

Despite its significance, evidence on intragenerational income/earnings mobility is relatively limited in developing countries. The majority of research (e.g. Kopzcuk et al., 2010; Carr and Wiemers, 2022) focuses on advanced economies, possibly due to the availability of administrative and register data. Research on intragenerational income mobility in developing countries tend to rely on household survey data which provide good coverage of low- and middle-income groups but may be subject to underrepresentation at the top of the distribution as well as underreporting of income (Yang et al., 2020).

This paper uses a panel of de-identified tax return data for the population of Thai personal income tax filers from 2009 to 2018 to provide a highly granular picture of earnings inequality and intragenerational earnings mobility among formal workers in the developing-country context. We examine the evolution of earnings inequality, estimate medium-term earnings mobility, and examine its heterogeneity across gender, age and

³ Jantti and Jenkins (2015) distinguishes 4 concepts of intergenerational income mobility: positional change, individual income growth, reduction of long-term inequality and income risk. This study focuses on the first concept; that is, the positional movements along the income/earnings distribution.

employment arrangement.

Thailand and the data from its administrative tax returns provides an excellent context for examining inequality and intragenerational mobility among formal workers in developing countries. This choice is justified for at least two key reasons.

First, Thailand has been known for having one of the greatest unequal income distributions in the world. Its income inequality is largest among Southeast Asian countries and ranks in the third quartile globally (Yang et al., 2020). This enables us to investigate economic mobility in the context of wide income disparities.

Second, while Thailand, like other developing countries, has a sizable informal economy, it also has a strong network of withholding taxes on labor earnings for formal workers. Thai employers are generally required to withhold income tax from employee wages as well as freelancer compensation. This allows us to obtain a comprehensive picture of earnings inequality and mobility for formal workers. Tax returns data is also typically more reliable than survey data, which may experience self-reporting issues and is likely to miss individuals with high income (Ravallion, 2022).

Our findings indicate the rising annual inequality over the 2009-2018 period. The inequality is mostly due to the multi-year component, and its increase is largely driven by the highest-earnings groups. As in most other countries, Thailand exhibits limited medium-term mobility at both ends of the earnings distribution. Individuals in the top decile demonstrate particularly strong earnings persistence. Although evidence from different countries is not completely comparable, we try to improve comparability by reproducing our mobility results using comparable measurement. While only indicative, we find that Thailand has one of the lowest levels of earnings mobility in the pool of evidence from both developed and developing countries. This is true for overall persistence, upward mobility and top 1% persistence.

We also document a significant heterogeneity in earnings mobility. Women have significantly lower upward mobility than men. Young workers have relatively high mobility, which declines sharply with age. Finally, there is a clear pattern of worker division based on employment arrangement. Workers with more-formal jobs have significantly larger upward mobility than those with less-formal jobs.

Our findings complement the literature on intragenerational income/earnings mobility in the following ways. First, we use the population of tax return data to investigate the positional movement of earnings in the Asian developing-country context. This enables us to examine movement in a wide range of granularities, including those at the very top of the distribution. Like previous significant works in this area, our study is descriptive in nature and does not identify the causal mechanisms determining economic mobility. Our findings on intragenerational earnings mobility and its heterogeneity, on the other hand, can aid research into such mechanisms.

Second, our comparison provides policymakers with a basic understanding of where international evidence on economic mobility stands relative to that of a developing country with large and persistent inequality.

Third, our heterogeneity analysis adds to the body of research on trends in occupational mobility (e.g. Jarvis and Song, 2017; Kye et al., 2022). Our findings stress the importance of not treating all formal workers uniformly. We show that, in the developing-countries context, economic mobility can vary significantly between workers with different levels of job formality. Upward mobility is especially lower for workers who are in less-formal jobs, i.e., those with fewer benefits and likely less job security.

The remainder of this paper is organized as follows. The following section discusses related studies. Section 3 describes data and methodology. Section 4 illustrates

empirical findings. Section 5 discusses the limitations of tax return data, while Section 6 concludes the study.

2. Related studies

Our paper speaks to two strands of the existing literature. The first strand is the literature on intragenerational earnings/income mobility, which has largely concentrated on advanced economies. Kopczuk et al. (2010) makes a seminal contribution by using Social security administrative data to show that long-term earnings mobility increased alongside annual inequality in the US between 1950 and 1980. Carr and Wiemers (2022) demonstrate that long-term earnings mobility in the United States has decreased from 1980 to 2011, reversing an earlier trend. Acs and Zimmerman (2008), Auten and Gee (2009), Auten et al. (2013) and Splinter (2021) investigate income mobility for the US as well. Examples of other studies for developed countries include Saez and Veall (2005) for Canada, Jenderny (2016) for Germany, Oh and Choi (2018) for South Korea, Aghion et al. (2019) for France, Burdin (2020) for Uruguay, and Jansson (2021) for Sweden.

The empirical evidence on earnings mobility in the developing-country context is much more limited. For example, Zeng and Zhu (2022) uses the China Household Finance Survey to focus on top earnings. It finds that earnings mobility above the 90th percentile exhibits the inverted U-shape over 2011-2017. Other examples include Khor and Pencavel (2006) for China, Martinez et al. (2014) for the Philippines, and Nguyen and Nguyen (2020) for Vietnam.

The second strand is the literature on inequality in Thailand. Studies based on household surveys have illustrated a decline in Thailand's income inequality over the past decades (see, for example, Kilenthong, 2016; Poggi et al., 2016; Wasi et al., 2019; Lekfuangfu et al., 2020). Other examples of studies on Thailand's income distribution include Jenmana (2018), Vanitcharearnthum (2019) and Muthitacharoen and

Phongpaichit (2020). We complement these studies by using the population of tax returns data to provide a granular analysis of earnings inequality for formal workers. We demonstrate rising earnings inequality among formal workers, identify the extent to which it is permanent, and document the increasing concentration at the very top of the earnings distribution.

3. Data and methodology

This section describes our dataset construction and methods for measuring inequality and mobility. We use a panel of de-identified tax return data for the population of Thai individual income tax filers from 2009-2018. Tax return data includes taxable income, tax deductions, and basic demographic information such as age and household size.

In Thailand, filing a tax return is generally mandatory for everyone who earns above the minimum threshold.⁴ Tax filers makes up 29% of Thailand's labor force in 2018. We delve into greater detail regarding the proportion of the labor force encapsulated in each of our inequality/mobility analyses in Section 5.

Our focus is on inequality and mobility of earnings, which is defined as the sum of all wages and labor compensation. Following Kopczuk et al. (2010) and Carr and Wiemers (2022), we reduce the impact of workers with low labor-force participation by focusing on those with annual earnings at least one-fourth of the full-year minimum wage in 2018 (indexed to inflation). To concentrate on those whose primary source of income is earnings, we include only workers with earnings at least 50% of their gross income in

⁴ The minimum tax-filing threshold during the period of study is 60,000 baht per year or 120,000 baht per year if having only wage income. These are about USD 1,700 and 3,400, respectively (based on the exchange rate in October 2022). In 2018, these are roughly 25% and 50% of GDP per capita, respectively. It should be noted that even if one's earnings is below the filing threshold, filing a tax return may be advantageous because it allows one to recover withheld taxes.

each year.⁵ We concentrate on pre-tax earnings which is the standard focus of inequality and mobility studies. To take into account inflation, we adjust earnings to the 2018 level.

Workers have the option of filing their tax returns individually or jointly with their spouse. During our study period, approximately 80% of tax filers chose to file their returns individually. Furthermore, only 5% of those who filed joint tax returns reported earnings from their spouses. This suggests that the earnings reported on tax returns are primarily those of individuals. Consequently, we use the terms worker and tax filer interchangeably to refer to a tax-filing unit in this study. In our baseline analysis, we do not adjust for differences in family size because it is more transparent. However, we provide robustness tests where earnings are adjusted for family size by dividing it with the square root of the reported number of family members. This follows the practice used in previous studies that typically based are on US tax returns such as Auten and Gee (2009) and Congressional Budget Office (2021).

For our inequality analysis, we restrict our data to individuals aged 25-60 in order to focus on the working-age population. The sample for the annual inequality analysis consists of 45.2 million observations (Table 1). The average real earnings is 473,037 baht.

⁵ Gross income can be divided into three main types: earnings, capital income and business income.

Table 1: Data description

Panel A: Summary statistics for real earnings					
	N	Mean	Median	SD	
Annual inequality (all years)	45,254,000	473,037	330,060	625,029	
2009	3,652,690	407,697	292,636	610,270	
2010	3,794,245	415,312	297,075	1,948,916	
2011	3,950,583	425,964	301,522	672,265	
2012	3,628,861	442,554	306,708	744,451	
2013	4,406,702	464,261	322,932	2,534,813	
2014	4,576,722	480,906	327,507	969,216	
2015	4,829,717	499,603	340,805	757,070	
2016	5,168,715	503,778	352,598	742,777	
2017	5,297,458	520,044	363,943	772,947	
2018	5,948,307	510,145	357,060	2,277,786	
Annual vs. 5-year inequality (all years)	33,985,872	511,374	363,353	1,457,316	
Baseline med-term mobility (all years)	5,768,854	490,509	353,422	607,897	
Panel B: Breakdown in the heterogeneity analysis for the medium-term mobility section					
Gender	% in 2009	Job formality	% in 2009	Age	% in 2009
Female	52.9%	High	38.2%	25-30	25.3%
Male	47.2%	Low	37.9%	31-35	21.8%
				36-40	19.6%
				41-45	17.3%
				46-50	16.0%

Notes: This table describes basic summary statistics of the datasets used in our analyses. Earnings are in 2018 baht. The annual inequality analysis uses the sample of eligible tax filers aged 25-60 from 2009-2018. For the comparison between annual and 5-year inequality, we include only eligible tax filers aged 25-60 who consistently appear in the sample over a contiguous 5-year period ($t-2$, $t-1$, t , $t+1$ and $t+2$). The medium-term mobility analysis uses the sample of eligible tax filers aged 25-50 appear in the dataset in both 2009 and 2018.

We measure annual inequality using 3 main metrics: Gini coefficients, variance of log earnings and mean log deviation. This allows us to obtain a complete picture of inequality based on measures that place emphasis on different parts of the earnings distribution.

One may divide annual inequality into two components: multi-year inequality, which is a more lasting source of inequality, and variability, which is a more transitory

source. Following Shorrocks (1978), Kopczuk et al. (2010), and Splinter (2021), we define variability as follows:

$$\text{Variability} = \text{Inequality}_{\text{Annual}} - \text{Inequality}_{\text{Multiyear}}, \quad (1)$$

where annual inequality is the average value of the annual inequality measure over the 5-year period and multi-year inequality is the inequality measure based on the 5-year average earnings. In our analysis, we ensure consistency by including only workers who appear in the sample for the entire 5-year period in both the annual and multi-year inequality measures. To elaborate, for a given year t , each worker has to file tax returns and meet our requirements in all five years: $t-2$, $t-1$, t , $t+1$ and $t+2$. Since the sample is the same, the multi-year measure is smaller than the average of the corresponding annual measures over the same time frame (Kopczuk et al., 2010).

Next, we consider medium-term earnings mobility. We investigate the movement across the earnings distribution from 2009 to 2018. We impose age restrictions to 25-50 in 2009 to limit the number of workers who are still in school and those who retire. We include those who filed tax returns and met our requirements in both 2009 and 2018. The attrition is low as detailed in Section 5. There are around 2.8 million filers who are in the sample in both 2009 and 2018 (Table 1).

We employ three approaches: transition matrices, rank-rank regression and upward mobility. In our main analysis, we rank workers relative to the panel population (cohort). That is, the comparison is only to the other workers who are in the sample in both years of interest. This approach is similar to a cohort analysis—allowing us to isolate effects of potential changes in the age structure of the population and effects of new entrants to the labor force.

Transition matrix represents a simple way to illustrate the movement into and out of the income group. Workers are divided into 10 deciles based on their earnings in the

respective year. We focus on the persistence probability, that is, the probability of being in the same earnings decile in both starting and ending years. A larger persistence probability increases lower mobility.

Following Chetty et al. (2014) and Carr and Wiemers (2022), we employ the rank-rank regression methodology specified as

$$r_{i,t+n} = \beta_0 + \beta_1 r_{i,t} + \varepsilon_i, \quad (2)$$

where $r_{i,t}$ denotes percentile rank of worker i in the earning distribution in year t , and ε_i denotes an error term. β_1 represents the degree of relative income mobility. It represents the association between a tax filer's positions in the income distribution in year t and $t+n$. A steeper slope (β_1) implies less mobility. β_0 represents absolute mobility in the ranks. Its higher value indicates a greater absolute increase in ranks for those with extremely low earnings.

It should be noted that the rank-rank regression requires the assumption that the association between the beginning and ending percentiles is constant across the distribution of earnings. Figure A1 in the appendix depicts average ending rank in 2018 by starting rank in 2009 and demonstrates that the correlation is nearly linear across the entire distribution.

Our third approach considers the extent to which one can make a significant upward movement in the earnings distribution. It is important to distinguish this from broad mobility, which includes any movement regardless of direction. We compute the probability of moving up at least two deciles across the entire earnings distribution based on the starting decile. This provides a comprehensive picture of economic progress across the distribution. Note that, throughout our study, to effectively illustrate the statistical significance when comparing measures, we employ a bootstrap method to calculate the confidence intervals for the corresponding statistic.

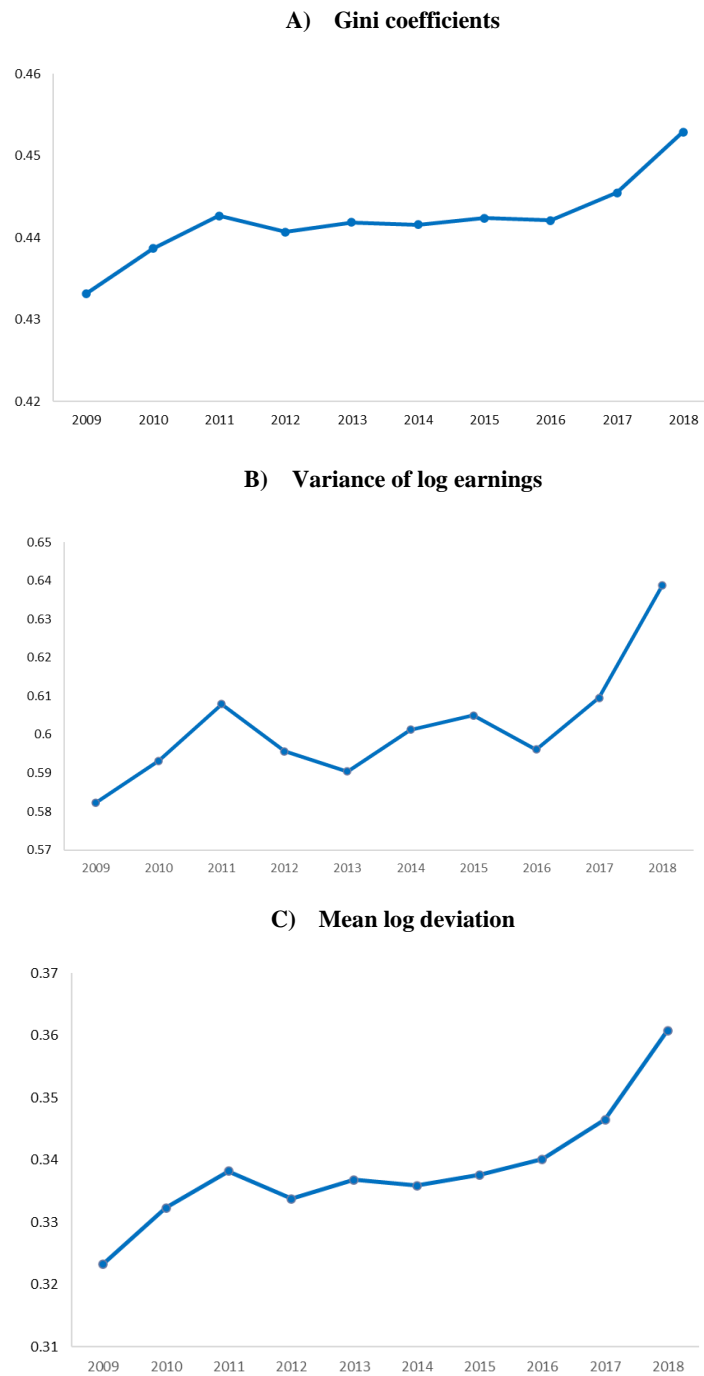
4. Empirical findings

This section begins with the evolution of annual earnings inequality. We then examine how much annual inequality can be attributed to multi-year inequality. Finally, we present our findings on medium-term mobility, including how it compares internationally and its heterogeneity.

4.1 Annual earnings inequality

Figure 1 illustrates annual earnings inequality from 2009 to 2018 using 3 measures: Gini coefficients, variance of log earnings and mean log deviation. All three measures consistently indicate an increase in the earnings inequality over the period. The Gini coefficients rise from 0.43 in 2009 to 0.45 in 2018 (Panel A of Figure 1). While the Gini coefficient emphasizes the middle of the distribution, using measures that are more sensitive to the bottom of the distribution yields consistent results. The variance of log earnings rises from 0.58 to 0.64 over the period (Panel B of Figure 1), whereas the mean log deviation rises from 0.32 to 0.36 (Panel C of Figure 1).

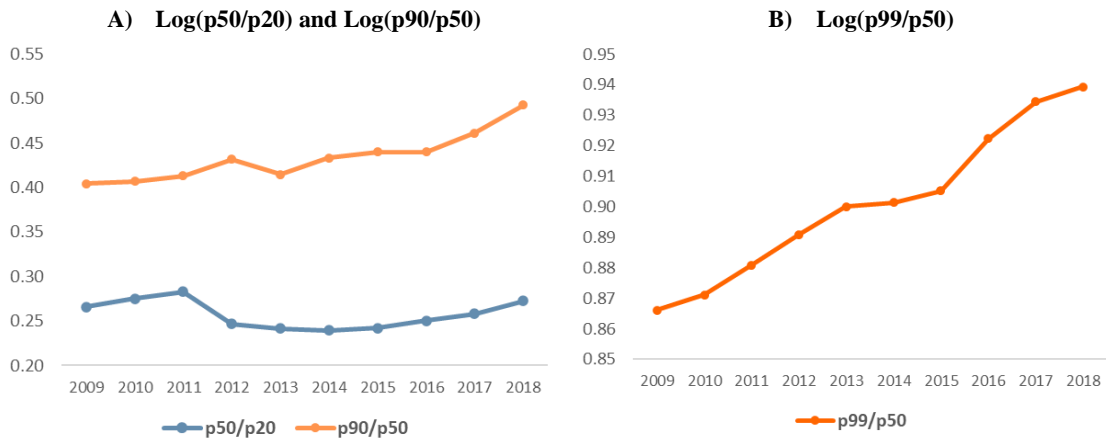
Figure 1: Annual earnings inequality measures, 2009-2018



Notes: This figure shows annual earnings inequality measures (Gini coefficients, variance of log earnings and mean log deviation) over the 2009-2018 period.

An important question is where the increase in inequality is occurring in the earnings distribution. To answer that question, we construct two percentile ratios in Panel A of Figure 2. The (log) percentile annual earnings p50/p20 ratios illustrate inequality in the lower half, while the p90/p50 ratios measure inequality in the upper half.

Figure 2: Annual percentile ratios, 2009-2018

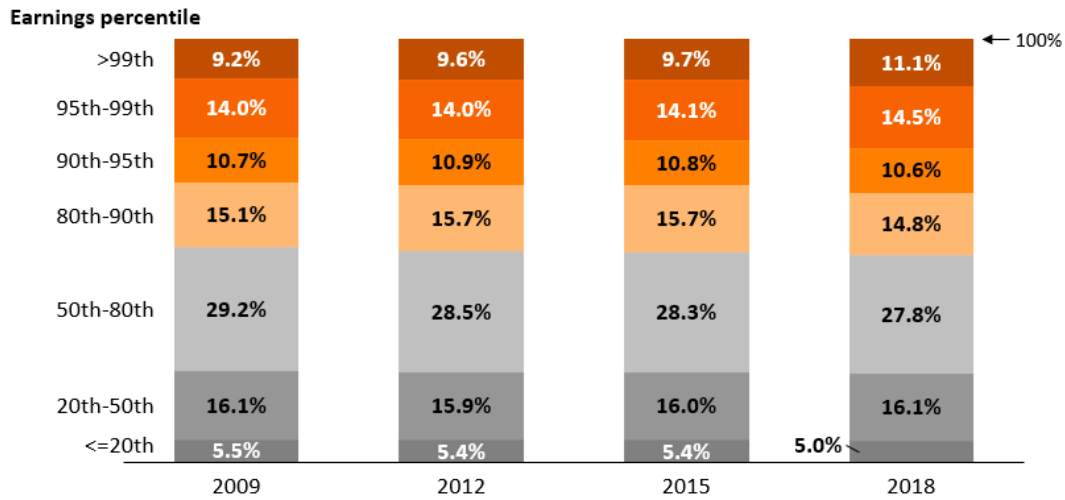


Notes: This figure shows ratios of annual percentiles over the 2009-2018 period. Panel A displays $\log(p50/p20)$ and $\log(p90/p50)$ while Panel B shows $\log(p99/p50)$.

Throughout the period, the p50/p20 series are nearly constant. This contrasts with the p90/p50 series which steadily increases. This suggests that the rise in inequality has been primarily driven by changes in the top half of the distribution. Panel B of Figure 2 plots the (log) percentile annual earnings p99/p50 to further investigate the change in inequality at the very top. Remarkably, the p99/p50 series accelerates over time. This implies that a sizable portion of the gains at the top occurred above the 90th percentile.

An examination of annual earnings shares displays a consistent picture of the inequality change during the period. Figure 3 depicts the share of total earnings allocated to various earnings groups, with a particular emphasis on the top quintile. In 2009, the bottom 50% accounted for 21.6% of total earnings, and its share has steadily declined to 21.1% in 2018. On the contrary, the top 1%’s share increases from 9.2% in 2009 to 11.1% in 2018. This strongly suggests that the top of the distribution has been primarily responsible for the change in inequality over the period.

Figure 3: Annual earnings shares, 2009-2018



Notes: This figure shows annual earnings shares by earnings percentile groups over the 2009-2018 period.

Table 2 illustrates a sensitivity exercise where we compute annual earnings inequality using earnings with adjustment for family size. All three inequality measures exhibit an increasing trend from 2009 to 2018 and are in line with our baseline estimation.

Table 2: Annual earnings inequality based on earnings with adjustment for family size 2009-2018

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Gini	0.42	0.43	0.43	0.43	0.44	0.44	0.44	0.44	0.44	0.45
Variance of log earnings	0.53	0.54	0.56	0.56	0.56	0.56	0.57	0.56	0.57	0.59
Mean log deviation	0.30	0.31	0.32	0.32	0.32	0.32	0.33	0.33	0.33	0.34

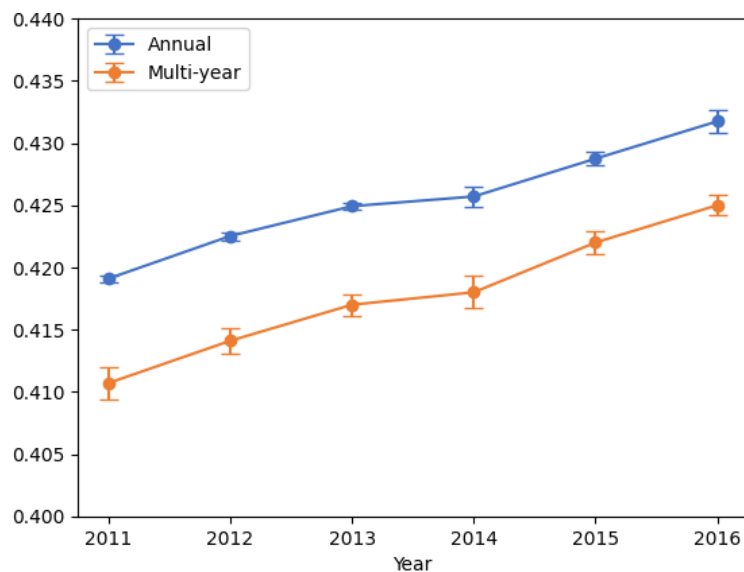
Notes: This table shows a robustness test where annual inequality measures are computed using earnings with family-size adjustment.

4.2 Annual vs. 5-year inequality

To what extent is annual inequality due to multi-year inequality, which is a relatively permanent source of inequality? Furthermore, how much of the increase in annual inequality discussed above can be attributed to multi-year inequality? To answer these questions, we compute the Gini coefficients using the average earnings over a 5-

year period and compare it to the average value of the annual Gini coefficients over the same 5-year period. For each year t , we calculate the measure that is centered on that year ($t-2, t-1, t, t+1$ and $t+2$). For example, the average annual Gini in 2011 is the average value of annual Gini over 2009-2013 while the multi-year Gini in 2011 is the Gini associated with the average income during 2009-2013. To ensure consistency, we utilize the same sample in the calculation of both annual and multi-year series. Figure 4 depicts this comparison over the 2011-2016 period. The annual Gini follows the same trend as that shown in Figure 1. It rises from 0.42 in 2011 to 0.43 in 2016. Interestingly, the 5-year Gini runs nearly parallel to the annual Gini during the period. The difference between the two series is statistically significant across all years.

Figure 4: Annual vs. 5-year Gini coefficients with 95% confidence interval, 2011-2016



Notes: This figure compares Multi-year Gini (Gini coefficients based on average earnings over a 5-year period) and Annual Gini (average value of the annual Gini coefficients over the same 5-year period). Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

Panel A of Table 3 shows annual inequality, 5-year inequality and variability in 2011 and 2016 for Gini, variance of log earnings and mean log deviation.⁶ For Gini

⁶ Bootstrapped confidence intervals are provided in Table A1 in the appendix.

coefficients, multi-year inequality accounts for 98.0% of annual inequality in 2011, which has risen slightly to 98.4% in 2016. Our findings, therefore, imply that the annual earnings inequality is primarily permanent, and this has changed very little between 2011 and 2016. A similar pattern emerges for variance of log earnings and mean log deviation. We find consistent results when using earnings with family-size adjustment (Panel B of Table 3).

Table 3: Annual vs. 5-year earnings inequality, 2011 and 2016

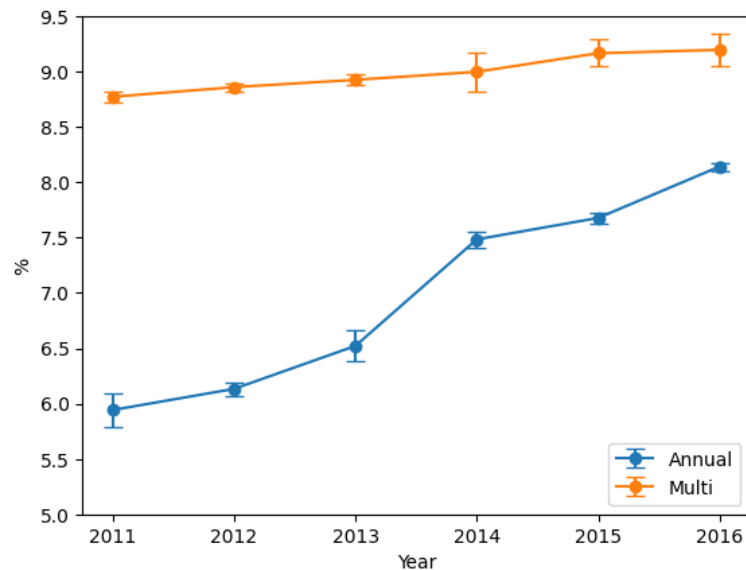
	Earnings inequality					
	2011			2016		
	Annual	5-year	Variability	Annual	5-year	Variability
Panel A: Baseline						
Gini	0.419	0.411	0.008	0.432	0.425	0.007
		(98.0%)	(2.0%)		(98.4%)	(1.6%)
Variance of log earnings	0.526	0.492	0.034	0.537	0.504	0.033
		(93.5%)	(6.5%)		(93.8%)	(6.2%)
Mean log deviation	0.298	0.283	0.015	0.304	0.290	0.014
		(95.0%)	(5.0%)		(95.4%)	(4.6%)
Panel B: Sensitivity test (based on earnings with adjustment for family size)						
Gini	0.418	0.408	0.010	0.437	0.428	0.009
		(97.5%)	(2.5%)		(97.9%)	(2.1%)
Variance of log earnings	0.508	0.467	0.040	0.521	0.483	0.039
		(92.0%)	(8.0%)		(92.6%)	(7.4%)
Mean log deviation	0.293	0.275	0.018	0.302	0.285	0.017
		(93.8%)	(6.2%)		(94.3%)	(5.7%)

Notes: This table shows annual inequality, 5-year inequality and variability in 2011 and 2016 for Gini, variance of log earnings and mean log deviation. Panel A shows our baseline estimate, while Panel B shows a robustness test using earnings with family-size adjustment. Numbers in parentheses indicate % of annual inequality.

It may be interesting to investigate the protracted nature of the increase in the earnings share of the top 1% during the period. Figure 5 depicts a comparison of the average annual earnings share over a 5-year period and the earnings share of the 5-year

average earnings. We find that the 5-year measure rises at a much faster pace than the annual measure. The difference between the two series is again significant across all years. This suggests that the concentration of earnings at the very top is becoming more permanent.

Figure 5: Top 1% earnings share—Annual vs. 5-year with 95% confidence interval, 2011-2016



Notes: This figure focuses on top 1% earnings share and shows average annual earnings share over a 5-year period (denoted Annual) and the earnings share of the 5-year average earnings (denoted 5-year). Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

4.3 Medium-term mobility

Baseline mobility findings

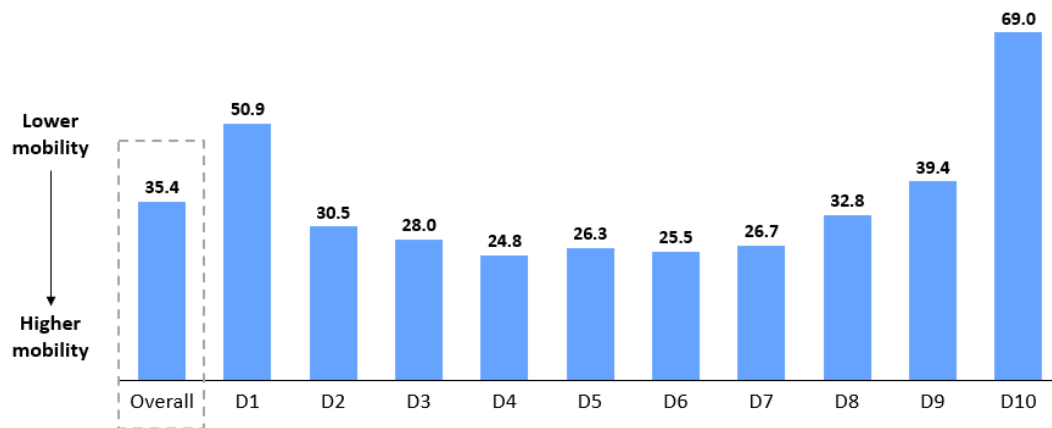
Figure 6 depicts the probability of remaining in the same earnings decile in 2009 and 2018 based on the transition matrix.⁷ Overall, about 35.4% of workers remained in the same earnings decile between 2009 and 2018. Earnings persistence across the distribution in Thailand demonstrates a pattern similar to other countries, with it being

⁷ All transition matrices in this section are available upon request.

particularly pronounced at both the lower and upper ends of the earnings distribution (e.g. Jansson, 2021; Carr and Wiemers, 2022).

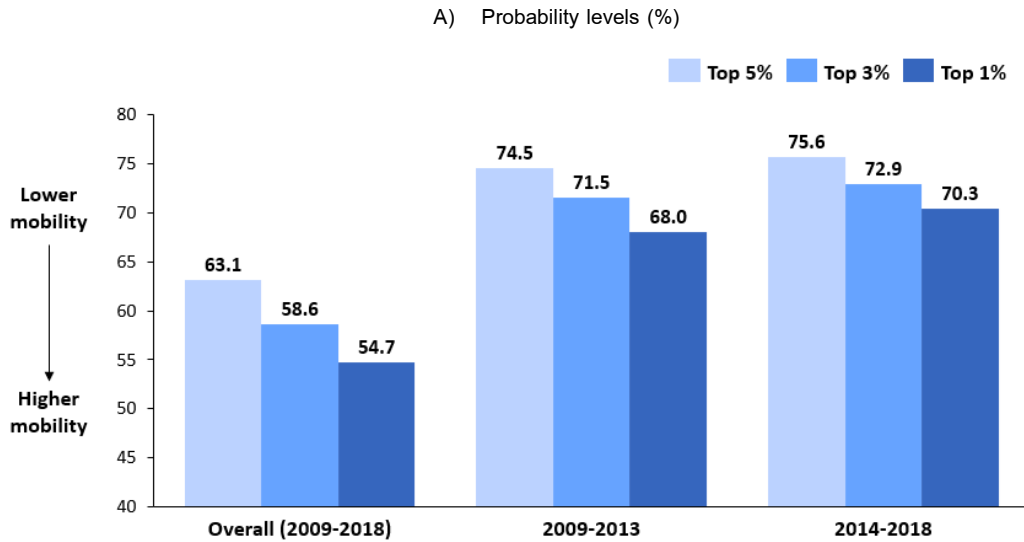
The persistence is particularly large at the top of the earnings distribution. For workers in the starting bottom decile, 50.9% of them remain there in 2018. On the other hand, 69.0% of workers in the top decile in 2009 remain in the same group nearly a decade later. Furthermore, as shown in Figure 7, the persistence probability during the same time period for top 5%, top 3% and top 1% workers are 63.1%, 58.6% and 54.7%, respectively.

Figure 6: Probability of remaining in the same decile by starting decile (2009-2018)

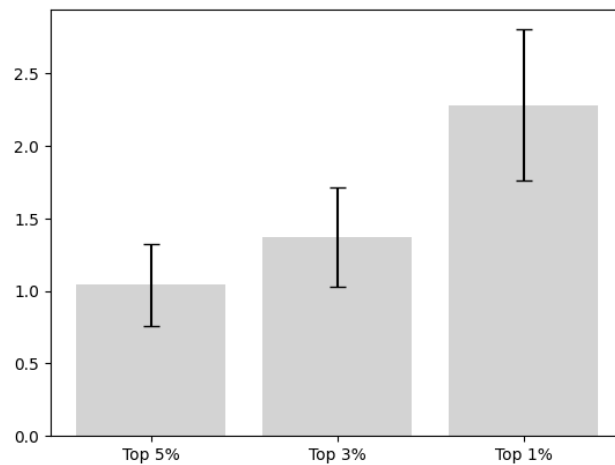


Notes: This figure shows the probability of remaining in the same earnings decile in 2009 and 2018. Higher persistence probability indicates lower mobility.

Figure 7: Probability of remaining in the top 5%, top 3% and top 1%



B) Differences between 2009-2013 and 2014-2018 with 95% confidence interval (percentage point)



Notes: This figure shows the probability of remaining in top 5%, top 3% and top 1% over three time periods (2009-2018, 2009-2013 and 2014-2018). Higher persistence probability indicates lower mobility. The upper panel (A) shows the probability levels, while the lower panel (B) shows the difference between 2009-2013 and 2014-2018 periods with 95% confidence interval. In Panel B, difference = (2014-2018) – (2009-2013). Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

Next, we present the rank-rank regression result (Table 4). The slope coefficient, representing the average correlation between an individual's rank in 2009 and their corresponding rank in 2018, is estimated at 0.79.

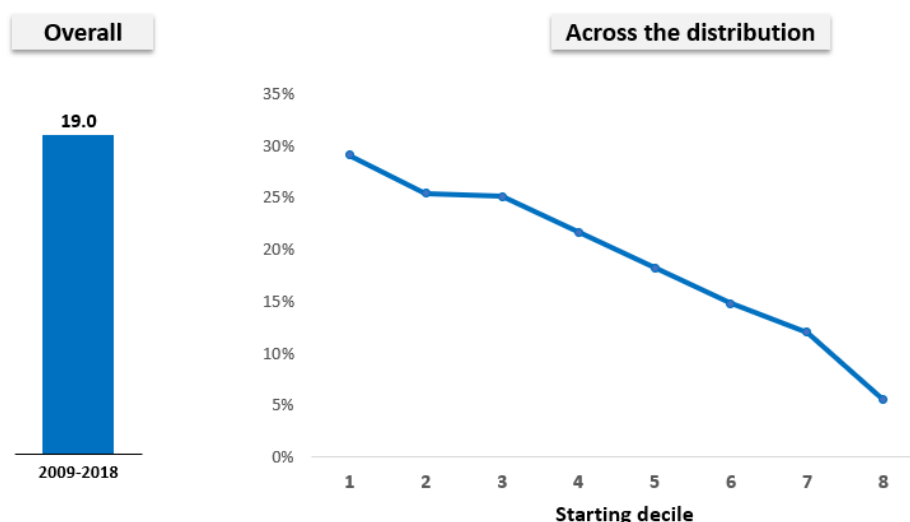
Table 4: Rank-rank regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Overall 2009-18	Robustness: with family-size adjustment	Period 1: 2009-13	Period 2: 2014-18	Female	Male	High job formality	Low job formality	Age 25-30	Age 31-35	Age 36-40	Age 41-45	Age 46-50
Rank	0.792*** (0.000)	0.745*** (0.000)	0.870*** (0.000)	0.871*** (0.000)	0.775*** (0.001)	0.795*** (0.001)	0.793*** (0.001)	0.736*** (0.001)	0.750*** (0.001)	0.780*** (0.001)	0.850*** (0.001)	0.893*** (0.001)	0.925*** (0.001)
Intercept	10.526*** (0.021)	12.899*** (0.022)	6.560*** (0.018)	6.538*** (0.016)	11.475*** (0.030)	11.344*** (0.037)	15.145*** (0.041)	7.433*** (0.026)	16.681*** (0.039)	11.860*** (0.042)	5.876*** (0.045)	1.902*** (0.047)	-1.693*** (0.055)
Observations	2,884,427	2,884,427	2,954,951	3,511,022	1,493,006	1,331,865	1,103,057	1,094,190	730,232	629,055	565,057	497,792	462,291
R-squared	0.627	0.554	0.757	0.758	0.605	0.617	0.681	0.575	0.496	0.599	0.691	0.729	0.701
Difference in the Rank coefficients				Period 2- Period 1		Male- Female		Low-High formality		(31-35)- (25-30)	(36-40)- (31-45)	(41-45)- (36-40)	(46-50)- (41-45)
				0.000 (0.000)		0.020*** (0.001)		-0.056*** (0.001)		0.031*** (0.000)	0.070*** (0.001)	0.043*** (0.001)	0.032*** (0.001)

Notes: This table presents the rank-rank regression results. Standard errors are heteroscedasticity-robust and clustered at individual level. The bottom panel show differences in the rank coefficients between the two dimensions in the heterogeneity analyses. Numbers in parentheses indicate standard error. ***, **, * denotes significance at the 1%, 5%, and 10% levels, respectively.

So far, we consider only the likelihood of persisting in one's current earnings decile. Another important indicator of mobility is the degree to which one can make a large movement up the earnings ladder. Figure 8 depicts the probability of moving up at least two deciles in 2018, based on their 2009 decile. Overall, the probability of such upward movement is 19.0%. For those in the first decile in 2009, the probability of moving up to at least the third decile in 2018 is 29.1%. As expected, the potential for upward mobility decreases for those starting from higher deciles. For instance, individuals in the 8th decile in 2009 have a mere 5.5% chance of reaching the top decile in 2018.

Figure 8: Probability of moving up at least two deciles conditional on starting decile (2009-2018)

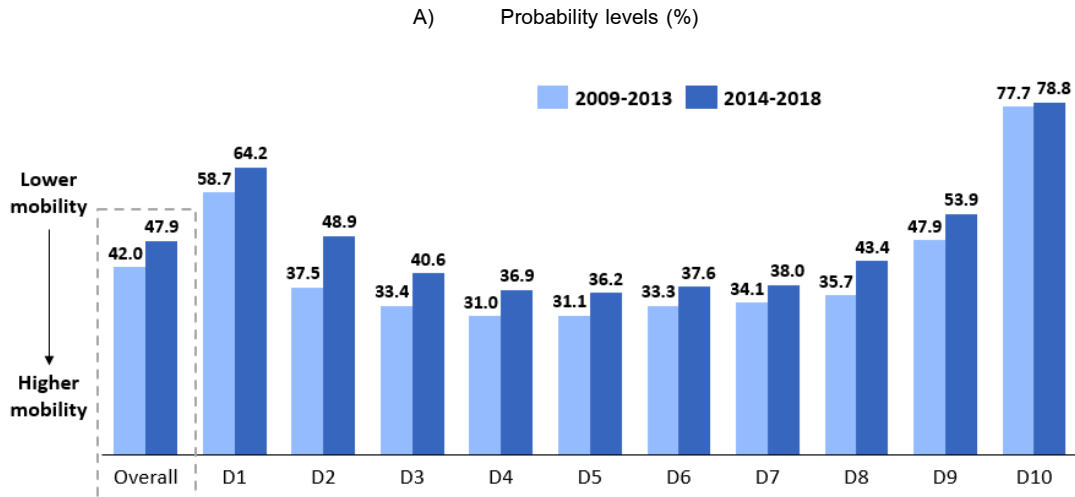


Notes: This figure shows the probability of moving up at least two deciles in 2018, based on their 2009 decile. The left panel shows the overall probability, while the right panel shows the probability across the starting earnings decile.

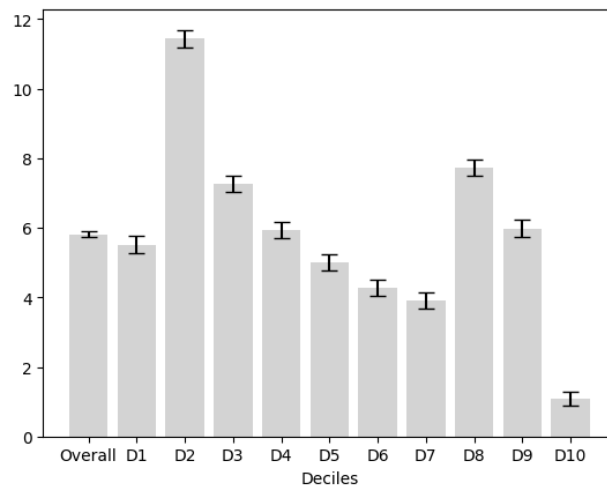
Next, we divide our study period into two subperiods: 2009-2013 and 2014-2018. Our findings based on the transition matrix indicate that overall persistence is larger in the 2014-2018 period. The likelihood of remaining in the same decile rises from 42.0% in the first subperiod to 47.9% in the second (Panel A of Figure 9). This increase in persistence is also seen across the earnings distribution. The differences in the persistence

are statistically significant across all deciles (Panel B of Figure 9). Nevertheless, it should be noted that the slopes derived from the rank-rank regression results indicate that the persistence levels for both time periods are not significantly different from zero (Columns 3-4 of Table 4).

Figure 9: Probability of remaining in the same decile by starting decile (2009-2013 and 2014-2018)



B) Differences between the time periods with 95% confidence interval (percentage point)



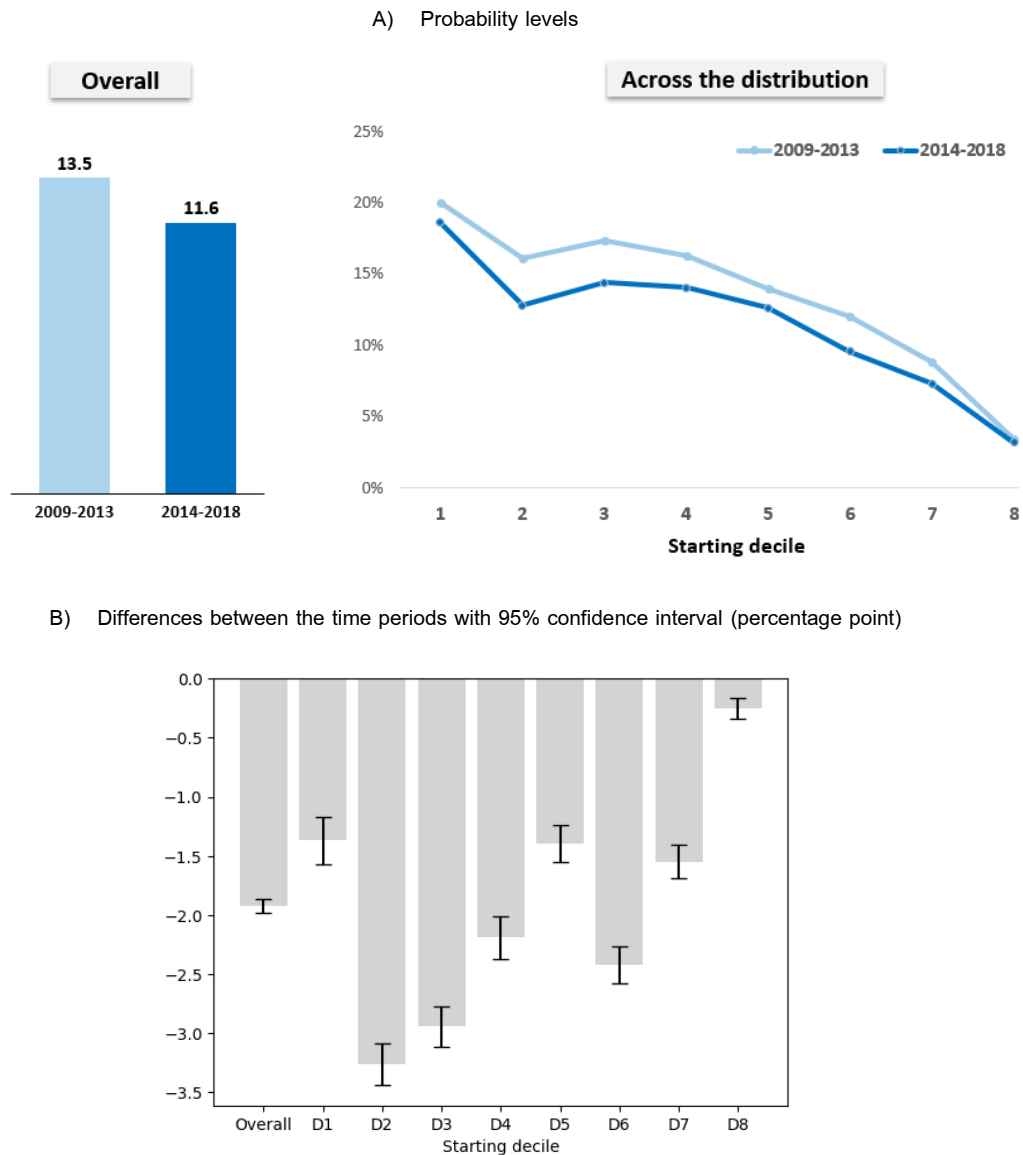
Notes: This figure shows the probability of remaining in the same earnings decile in two time periods (2009-2013 and 2014-2018). Higher persistence probability indicates lower mobility. The upper panel (A) shows the probability levels, while the lower panel (B) shows the difference between the time periods with 95% confidence interval. In Panel B, difference = (2014-2018) – (2009-2013). Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

The probability of upward mobility also experiences a decline over the 10-year period.

Overall, the likelihood of upward movement is 13.5% from 2014 to 2018, compared to

11.6% during the 2009-2013 period (Figure 10). This reduction in upward mobility is consistent across the entire earnings distribution. The differences in upward mobility between these two periods are statistically significant, both in an overall context and across all deciles.

Figure 10: Probability of moving up at least two deciles conditional on starting decile (2009-2013 vs. 2014-2018)



Notes: This figure shows the probability of moving up at least two deciles in the ending year, based on their decile in the starting year. It focuses on two time periods (2009-2013 and 2014-2018). The upper panel (A) shows the probability levels, while the lower panel (B) shows the difference between the time periods with 95% confidence interval. In Panel A, the left graph shows the overall probability, while the right graph shows the probability across the starting earnings decile. In Panel B, difference = (2014-2018) – (2009-2013). Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

We also investigate how sensitive our baseline findings are to our chosen approach. We show the mobility results based on earnings that is adjusted for differences in family size. Our findings show that the mobility is generally consistent with our main findings (Table 5 and Column 2 of Table 4).

Table 5: Medium-term earnings mobility under alternative assumption

	Overall	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Overall mobility (Probability of remaining in the same decile conditional on starting decile)											
Baseline	35.4%	50.9%	30.5%	28.0%	24.8%	26.3%	25.5%	26.7%	32.8%	39.4%	69.0%
Adjustment for family size	29.3%	44.3%	26.4%	21.4%	19.7%	18.4%	18.2%	20.6%	26.2%	33.0%	65.1%
Upward mobility (Probability of moving up at least two deciles conditional on starting decile)											
Baseline	19.0%	29.1%	25.4%	25.1%	21.6%	18.2%	14.8%	12.0%	5.5%		
Adjustment for family size	24.0%	35.0%	32.0%	29.7%	27.3%	24.4%	21.1%	15.9%	7.1%		

Notes: This table shows a supplemental mobility analysis that uses earnings with adjustment for differences in family size.

International comparison

To put our estimates into context, we compare them to studies from other countries. Table 6 shows comparison of intragenerational earnings/income mobility findings across both developed and developing countries. Although the findings are not fully comparable across studies due to data and methodology, we attempt to increase comparability by reproducing our mobility results using comparable time horizon and measurement. We focus on three indicators: overall persistence (probability of changing earnings/income decile), upward mobility (probability of moving upward at least 2 earnings/income deciles) and top 1% persistence (probability of remaining in top 1%).

Our findings indicate that Thailand has one of the lowest levels of earnings mobility in the pool of collected evidence. While it is roughly comparable to France's from 2001 to 2015 (Aghion et al. 2019), its overall persistence was consistently greater than the rest of the evidence. Thailand's upward mobility is greater than that of China in the early 1990s (Khor and Pencavel 2006) and comparable to that of Vietnam from 2004 to 2014. (Nguyen and Nguyen 2020). It is, however, lower than all of the other evidence. Finally, Thailand's top 1% persistence is highest across the board.

It is essential to note that the international comparison here is primarily suggestive. Despite our efforts to enhance comparability, certain factors could still complicate comparisons, including differences in the unit of observations, income types and sample scope. In particular, earnings distributions are typically more equally distributed than income distributions. This suggests that focusing solely on earnings inequality might not fully capture the actual scale of economic inequality when compared to income.

Heterogeneity of earnings mobility

The remainder of the discussion focuses on mobility heterogeneity over gender, job formality and age. All ranks in the subgroup analyses are based on positions in the overall sample. It is crucial to note that our results should not be interpreted as suggesting that certain characteristics, such as job formality, gender, or age, automatically ensure greater or lesser upward mobility. These individual characteristics may be interconnected and likely intersect with a wide array of other contributing factors.

Table 6: Comparison of intragenerational earnings/income mobility findings across countries

Study	Country	Mobility Period	Global evidence				Comparison using Thailand's evidence			
			Mobility measurement	Overall persistence	Upward mobility	Top 1% persistence	Overall persistence	Upward mobility	Top 1% persistence	Mobility period
Developed countries										
Aghion et al. (2019)	France	4 years (2001-2015)	Income	46.6%	17.2%	-	44.5%	12.6%	69.2%	Average 4-year periods during 2009-2018
Auten and Gee (2009)	US	9 years (1996-2005)	Income	33.4% (Quintile-based)	33.7% (Quintile-based)	38.5%	55.1% (Quintile-based)	28.7% (Quintile-based)	54.7%	9 years (2009-2018)
Auten et al. (2013)	US	5 years (2005-2010)	Income			27%	39.1%	15.0%	66.6%	5 years (2009-2014)
Burdin (2020)	Uruguay	7 years (2009-2016)	Income	32.5%	20.4%	52.2%	37.9%	16.4%	60.0%	7 years (2009-2016)
Fairfield and De Luis (2015)	Chile	4 years (2005-2009)	Income	-	-	64.4%	44.5%	12.6%	69.2%	Average 4-year periods during 2009-2018
Jenderny (2016)	Germany	Average 3-year periods during 2001-2006	Income	-	-	65%	51.7%	10.0%	74.7%	Average 3-year periods during 2009-2018
Kopczuk et al. (2010)	US	Average 5-years periods during 1978-1999	Earnings	-	-	60%-65%	39.1%	15.0%	66.6%	5 years (2009-2014)
Hérault et al. (2021)	Australia	Average 5-years periods	Income	-	-	29%-38%	39.1%	15.0%	66.6%	5 years (2009-2014)

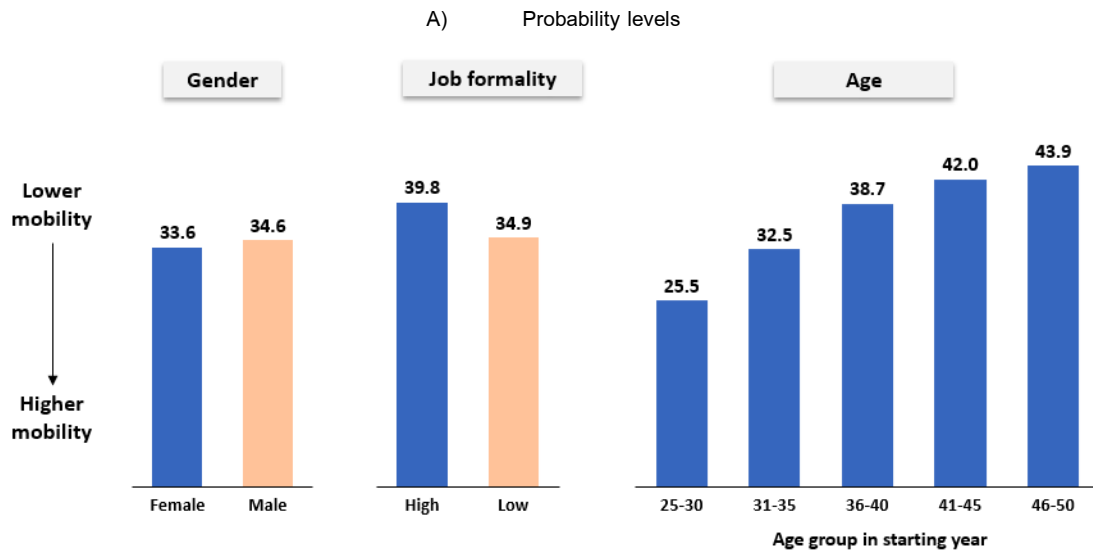
Oh and Choi (2018)	S. Korea	during 1991-2017 7 years (1998-2005)	Earnings	36.4% (Quintile-based)	37.6% (Quintile-based)	-	58.09% (Quintile-based)	26.7% (Quintile-based)	60.0%	7 years (2009-2016)
Oh and Choi (2018)	S. Korea	5 years (2005-2010)	Earnings	36.4% (Quintile-based)	37.6% (Quintile-based)	-	60.6% (Quintile-based)	25.4% (Quintile-based)	66.6%	5 years (2009-2014)
Developing countries										
Khor and Pencavel (2006)	China	5 years (1990-1995)	Income	33.4% (Quintile-based)	17.2% (Quintile-based)	-	60.6% (Quintile-based)	25.4% (Quintile-based)	66.6%	5 years (2009-2014)
Martinez et al. (2014)	Philippines	6 years (2003-2009)	Income	28%	27%	-	39.1%	15.4%	63.0%	6 years (2009-2015)
Nguyen and Nguyen (2020)	Vietnam	Average 4-year periods during 2004-2014	Income	-	12.6% (From bottom 40% to a higher quintile)	-	44.5%	10.1% (From bottom 40% to a higher quintile)	69.2%	Average 4-year periods during 2009-2018
Zeng and Zhu (2022)	China	Average 2-year periods during 2010-2016	Earnings	-	-	40.1%	57.3%	7.6%	78.7%	Average 2-year periods during 2009-2017

Notes: This table compares intragenerational earnings/income mobility findings across countries. Overall persistence is based on decile movement unless indicated otherwise. Mobility evidence for Thailand is based on earnings.

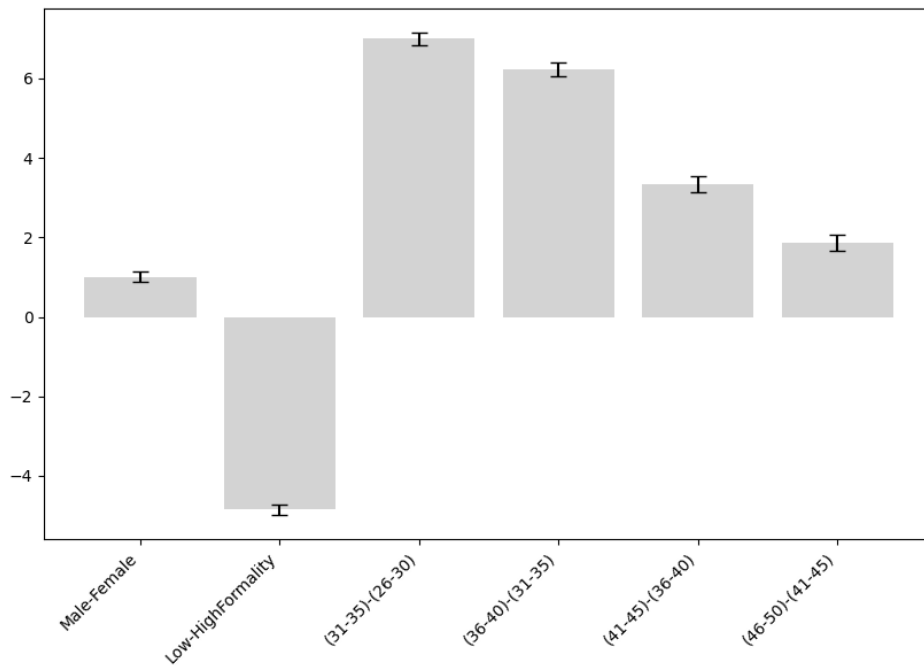
We begin with the heterogeneity with respect to gender. Overall, both the transition matrix and the rank-rank regression indicate that female workers exhibit slightly lower persistence than their male counterparts (Figure 11 and Columns 5-6 of Table 4). Although this difference is statistically significant, its magnitude—roughly 1 percentage point—is economically small. This is generally consistent with the rank-rank regression result (Columns 5-6 of Table 4).

Our findings further indicate that female workers have relatively lower upward mobility. Male workers have an 22.3% chance of moving up at least two deciles, while female workers have a 20.6% chance (Figure 12). Upward mobility is roughly similar between the two genders up to the 5th decile. Above the 6th decile, however, male workers have consistently larger upward mobility. These differences are statistically significant except at the middle of the distribution (Deciles 4-5). This finding is consistent with Jansson (2021) and Carr and Wiemers (2022), both of which show that upward mobility is lower for women in the US and Sweden respectively.

Figure 11: Probability of remaining in the same decile by starting decile: gender job formality and age (2009-2018)

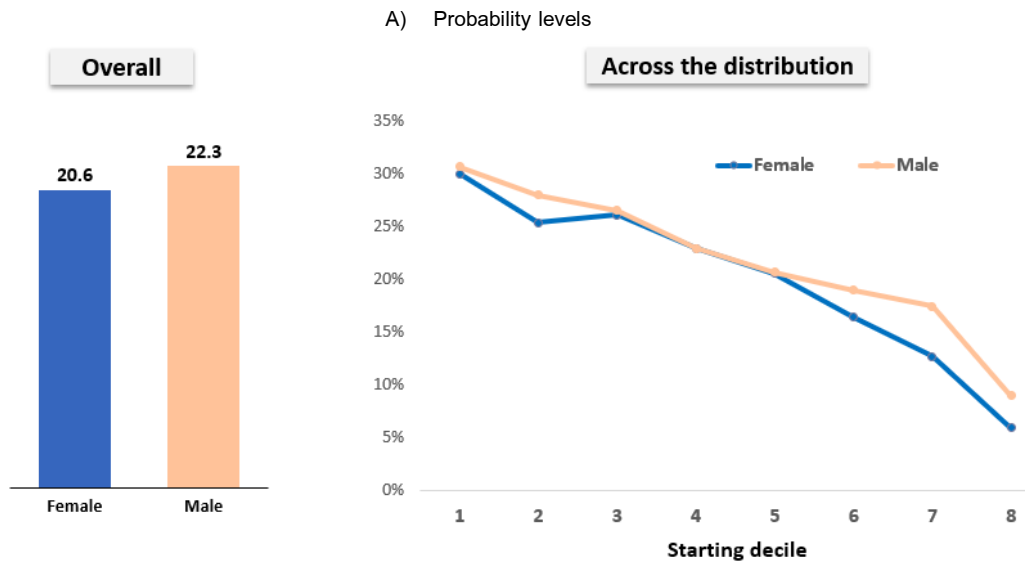


B) Differences in each dimension with 95% confidence interval (percentage point)

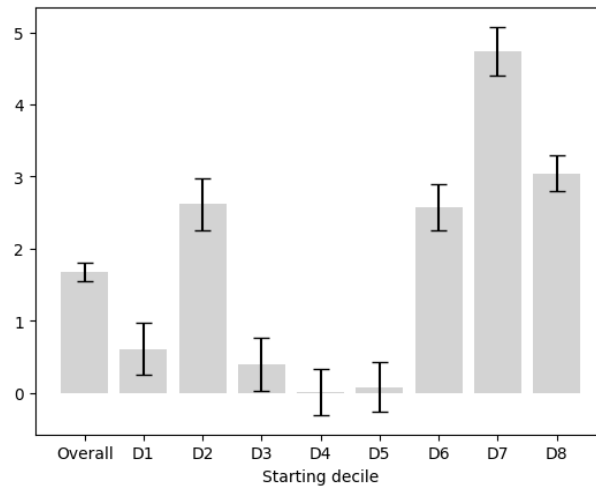


Notes: This figure shows the heterogeneity in the probability of remaining in the same earnings decile in 2009 and 2018 with respect to gender, age and job formality. Higher persistence probability indicates lower mobility. The upper panel (A) shows the probability levels, while the lower panel (B) shows the difference in each dimension with 95% confidence interval. Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

Figure 12: Probability of moving up at least two deciles conditional on starting decile by gender (2009-2018)



B) Differences between the genders with 95% confidence interval (percentage point)



Notes: This figure shows the probability of moving up at least two deciles in 2018, based on their decile in 2009. It focuses on female and male workers. The upper panel (A) shows the probability levels, while the lower panel (B) shows the difference between the genders with 95% confidence interval. In Panel A, the left graph shows the overall probability, while the right graph shows the probability across the starting earnings decile. In Panel B, difference = male - female. Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

Next, we consider the heterogeneity with respect to workers' employment arrangement. Although all workers in our study are formal workers, there is a degree of formality associated with their jobs. At one extreme of the spectrum are jobs that have long-term contracts and come with full benefits like pension and paid time off. On the

other end of the spectrum are those with minimal benefits and no job security. It might be useful to understand how workers' mobility varies depending on how formal their jobs are, as opposed to treating all formal workers uniformly.

We proxy for job formality using information on a worker's provident fund contributions. A provident fund is a type of pension fund that is voluntarily established by employers and requires contributions from both employers and employees. A worker's provident fund contribution therefore indicates that a worker has a job with an employer who offers pension benefits. This could imply a higher level of job security than job without such benefit.⁸

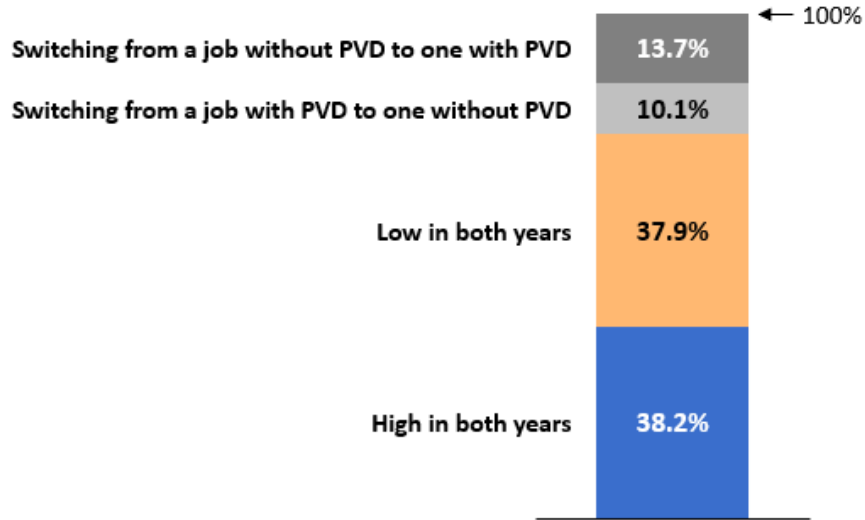
In line with this, we classify workers who make provident fund contributions in both starting and ending years as belonging to the high job formality group.⁹ The low job formality group, on the other hand, consists of those who do not report any provident fund contribution in both years. In our panel, 38.2% (37.9%) of all workers are in the high (low) job formality group (Figure 13). We do not focus on workers who switch between jobs with and without provident fund contribution, which is relatively uncommon (roughly 24% of all workers).

Our findings indicate that workers in the low job formality group have relatively greater overall mobility. The low-formality group has a 34.9% chance of remaining in the same decile in both years, while the high-formality group has a 39.8% chance (Figure 11). The difference is statistically significant. This statistically significant difference aligns with the findings from the rank-rank regression results (Columns 7-8 of Table 4).

⁸ Employers are less likely to provide benefits to employees whose employment prospects are uncertain (Kalleberg et al. 2000).

⁹ Despite focusing only on the provident fund status in 2009 and 2018, it is important to note the pattern of job formality continuity. We find that 84% of workers in the high formality group maintain employment with a provident fund throughout all their filing years during 2009-2018. For those in the low formality group, this figure is 91%. Nevertheless, it's crucial to bear in mind that the selection into these job-formality groups may not be random and is likely correlated with factors such as education and inherent abilities.

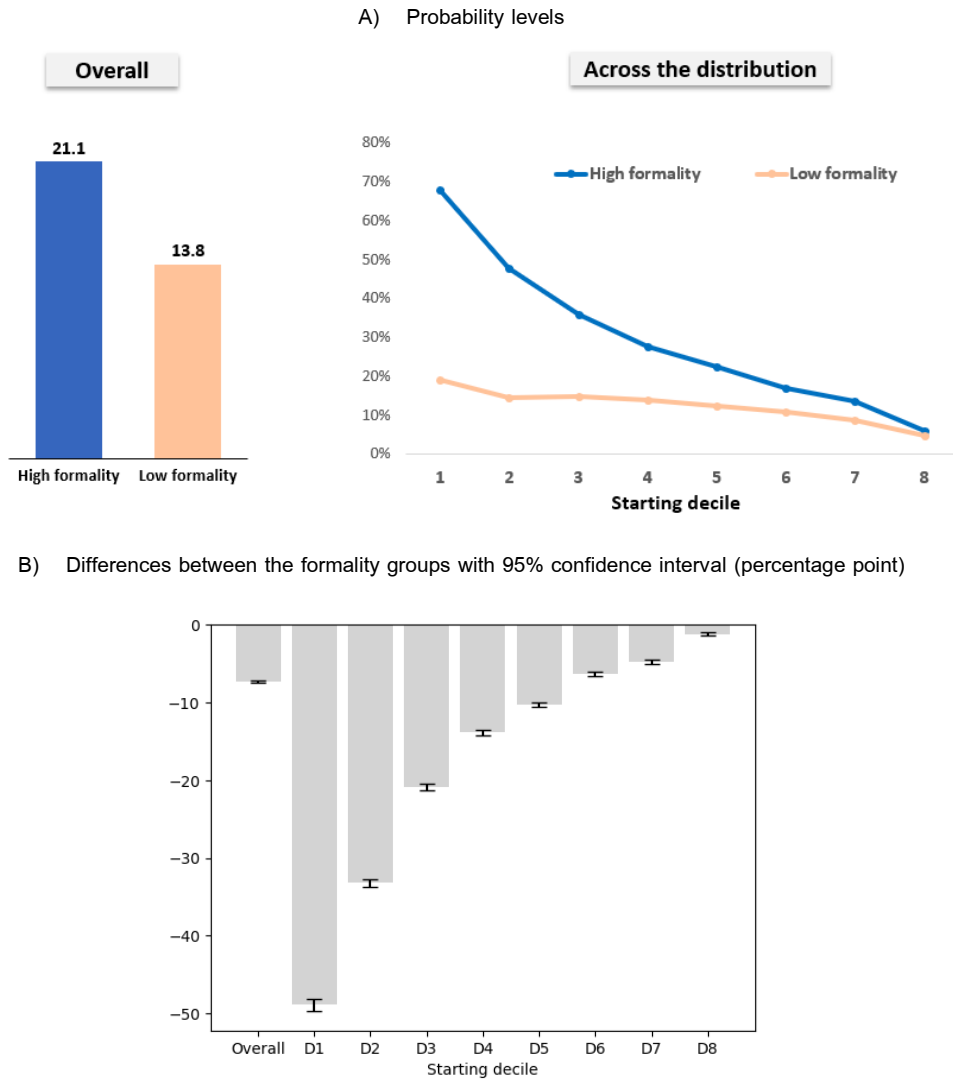
Figure 13: Distribution of workers by job formality groups and movement in 2009 and 2018



Notes: This figure shows the distribution of workers by job formality groups and movement in 2009 and 2018. ‘High in both years’ consists of workers in jobs with a provident fund in both starting and ending years. ‘Low in both years’ consists of workers in jobs without a provident fund in both starting and ending years. The other two groups consist of workers who move between jobs with and without a provident fund. PVD denotes provident fund.

In terms of upward mobility, we find a striking difference between the two groups. The overall upward mobility is 13.8 for those in the low job formality group versus 21.1% for those in the high job formality group (Figure 14). Across the earnings distribution, the low formality group has lower upward mobility than the high formality group, with the difference being greater for those with low earnings. The differences are statistically significant for both overall upward mobility and across all deciles. These findings imply that, while workers in the low job formality group demonstrate less overall persistence, their chances of making substantial upward progress are considerably lower compared to their counterparts in the high job-formality group.

Figure 14: Probability of moving up at least two deciles conditional on starting decile by job formality (2009-2018)



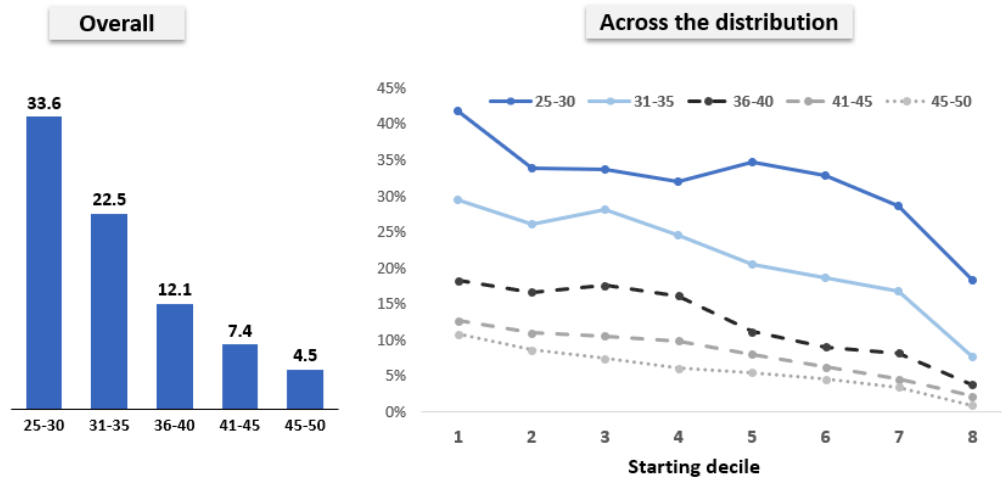
Notes: This figure shows the probability of moving up at least two deciles in 2018, based on their decile in 2009. It focuses on workers in high and low job formality groups. The upper panel (A) shows the probability levels, while the lower panel (B) shows the difference between the formality groups with 95% confidence interval. In Panel A, the left graph shows the overall probability, while the right graph shows the probability across the starting earnings decile. In Panel B, difference = low formality – high formality. Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

Finally, we divide workers into 5 groups based on their age in 2009 (25-30, 31-35, 36-40, 41-45 and 46-50). This allows us to consider how mobility evolves over the life cycle. Note that almost half of workers in the sample are 25-35 in 2009 (Table 1). Both the persistence probability and the rank-rank regression show a decline in mobility with increasing age (Figure 11 and Columns 9-13 of Table 4). A similar pattern is

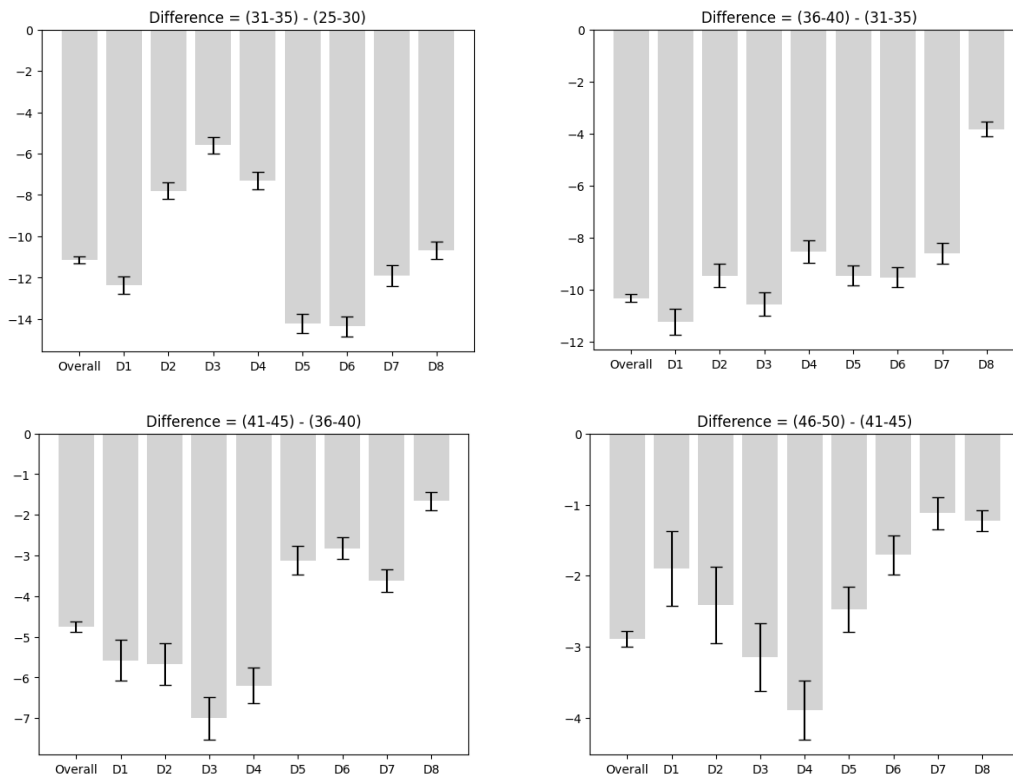
observed in upward mobility (Figure 15). The differences across age groups are also statistically significant for both overall and across all deciles.

Figure 15: Probability of moving up at least two deciles by age groups (2009-2018)

A) Probability levels



B) Differences between the age groups with 95% confidence interval (percentage point)



Notes: This figure shows the probability of moving up at least two deciles in 2018, based on their decile in 2009. It focuses on workers in 5 age groups (25-30, 31-35, 36-40, 41-45 and 46-50 in 2009). The upper panel (A) shows the probability levels, while the lower panel (B) shows the differences between each pair of age groups with 95% confidence interval. In Panel A, the left graph shows the overall probability, while the right graph shows the probability across the starting earnings decile. Bootstrapped 95% confidence intervals are shown as error bars on each estimate.

5. Discussion on tax returns data and study limitations

In this section, we address the potential limitations of our analysis, specifically in the context of understanding Thailand's broader earnings inequality and mobility. Our annual inequality analysis uses the sample of qualified tax filers aged 25-60 during the years 2009-2018, while our medium-term mobility analysis utilizes the sample of qualified tax filers aged 25-50 who appear in the dataset in both 2009 and 2018.

First, it is crucial to recognize the limitations intrinsic to the use of tax return data. While tax return data is generally more reliable than survey data, it does not include informal workers. In a country like Thailand, where the informal economy is sizable, this represents a significant limitation of our study.¹⁰

To provide some context, according to Thailand's Labor Force Survey, there are about 13.2 million workers that met our criteria for the annual inequality analysis in 2009. The tax return data employed for this analysis represents 28% of this total qualified labor force in 2009. In the medium-term mobility analysis, our tax return data accounts for 25% of the total qualified labor force in 2009. This coverage of formal workers roughly aligns with the conventional definitions of formal workers, which usually hinge on enrollment in social security schemes. In 2009, 23% of Thai workers are mandatorily required to register with the official social security system, while 37% of all workers is identified as part of the formal workforce—those receiving some forms of social protection from their employers (National Statistical Office 2014).

During the study period, there is an increasing trend towards formalization. The share of workers required to register with the social security system increases from 23%

¹⁰ Medina and Schneider (2019) estimates Thailand's size of informal economy to range from 49.8% to 41.9% of GDP during the 2009-2017 period. The informal economy is defined in that study as all economic activities hidden from official authorities for institutional, monetary, or regulatory objectives.

in 2009 to 31% in 2018. This trend aligns with the tax return data utilized in our annual inequality analysis—the share of total qualified labor force represented in our tax returns data rises from 28% in 2009 to 41% in 2018.

The second issue concerns potential tax avoidance and evasion, an important concern in many developing countries including Thailand. To minimize its impact on our analysis, we concentrate solely on earnings rather than total income. Tax avoidance opportunities related to earnings are relatively limited, given the robust framework of withholding taxes on formal workers' earnings. As an illustration, Thai employers are generally obligated to withhold income tax from both employee wages and freelance compensation. In 2018, for example, the total earnings reported by all tax filers account for 77% of total employees' compensation in the national Households and Non-Profit Institutions Serving Households (NPISHs) income account. This suggests that, for formal labor earnings, the concern regarding tax avoidance is rather limited.

Third, our mobility analysis focuses on the earning dynamics among formal workers. As explained in the data and methodology section, the comparison in our mobility analysis is relative to the other workers who are in the sample in both years of interest. This methodology, resembling the cohort-analysis approach of seminal studies such as Kopczuk et al. (2010), is purposefully designed to insulate the analysis from factors such as shifting between the formal and informal sectors, changes in the population age structure, and influences of other new labor force entrants.

However, it is critical to acknowledge that the shifts of workers between the formal and informal sectors could potentially influence their earnings. If such transitions are frequent, it might significantly affect our mobility analysis.

Recognizing these caveats, our primary sample for medium-term mobility analysis nonetheless demonstrates a modest degree of attrition. Specifically, we observe

that 90.1% of tax filers from 2009 are still present in the sample in 2018. Further, for those individuals who are in our sample in 2009, the mean number of years in which they continued to file tax returns during the 2009-2018 period is 8.9 years. These persistence rates are also consistent across different gender and age groups, as detailed in the appendix (Table A2). This evidence alleviates concerns related to attrition and frequent movement of workers between formal and informal sectors.

In sum, our results warrant careful interpretation. Although tax return data offer valuable insights, they capture only tax filers—excluding a significant portion of the workforce. The complexities of earnings inequality and mobility, particularly within the context of a substantial informal economy, underscore the need for further research to achieve a more comprehensive understanding.

6. Conclusion

Understanding economic mobility is critical especially in the post-pandemic world where the crisis has left a permanent scar on income distributions in many countries. This article uses a panel of tax returns from Thailand to address a vital question: To what extent, can formal workers in a developing country move up and down the earnings distribution and how does this mobility vary across different worker segments?

We obtain three main findings. First, we document rising annual earnings inequality over the 2009-2018 period and show that the annual inequality is primarily permanent. Our findings indicate that the top of the distribution is primarily responsible for the rise in inequality. The top 1%'s share increases from 9% in 2009 to 11% in 2018, while the bottom half's share falls from 22% in 2009 to 21% in 2018. Further, over 90% of the annual inequality is due to the 5-year inequality, which is a relatively permanent source. We also find that the concentration of earnings at the top has become more permanent over the period.

Second, Thailand's medium-term mobility exhibits a pattern that sees pronounced persistence at both ends of the earnings distribution. Overall, about 35% of workers remained in the same earnings decile over 2009-2018. Persistence is especially high in the top decile, at 69%. Mobility also declines over the course of the study. The persistence probability rises from 42% over 2009-2013 to 48% over 2014-2018. Thailand's earnings mobility is also relatively low when compared to international evidence.

Third, our findings show a significant gender, age, and work arrangement heterogeneity in earnings mobility. Female workers have lower upward mobility than male workers, with the difference being most noticeable at the top of the distribution. Mobility also declines sharply with age. We further document a strong pattern of worker segregation based on their work arrangement. Workers in the low job-formality group have remarkably lower upward mobility than those in the high formality group. This emphasizes the significance of leveling the playing field for vulnerable workers and increasing their access to opportunities.

There are at least three crucial reasons why insights from Thailand's tax return data may carry broader implications and prove beneficial for other countries. First, the Covid-19 crisis emerged during a period of pronounced inequality globally. Our findings highlight the importance of identifying its source and ensuring that the post-pandemic inequality surge does not become permanent. Second, our comparison provides insight into where existing evidence on economic mobility stands in comparison to a developing country with large inequality. Third, and perhaps most significantly, our heterogeneity analysis suggests that workers in certain vulnerable pockets may have significantly lower upward mobility. This underlines the importance of improving access to opportunities for low-income workers, particularly those in less-secure jobs, who are likely to be among those hardest hit by the crisis.

Declaration

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Declarations of interest: None.

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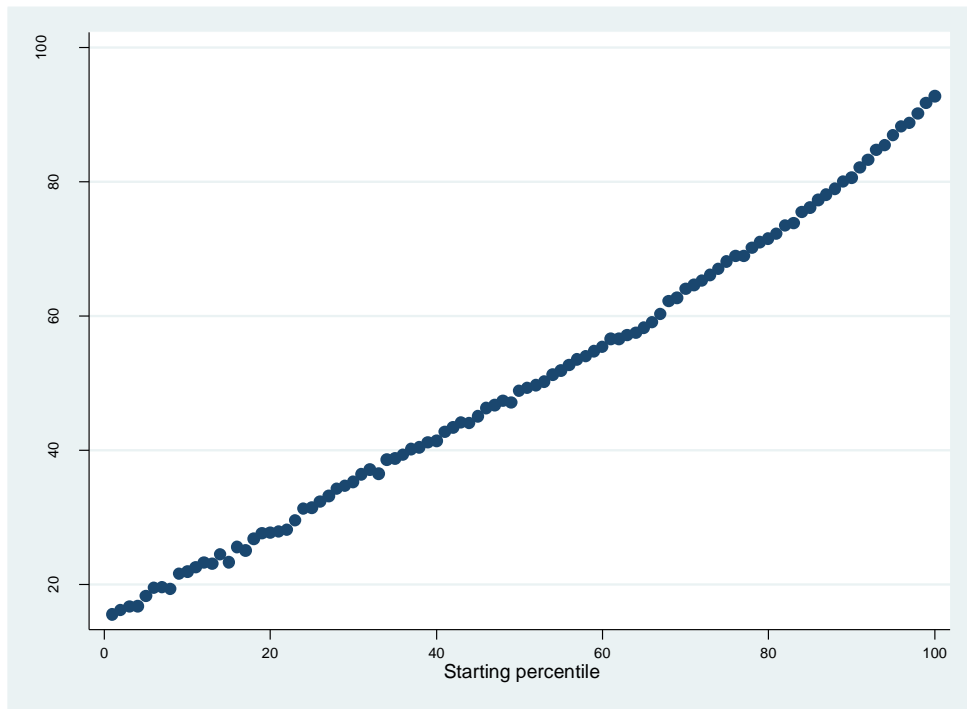
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Appendix

Figure A1: Mean ending rank by starting rank (2009-2018)



Notes: This figure presents nonparametric binned scatter plots of the relationship between earnings percentiles in 2009 (X-axis) and in 2018 (Y-axis).

Table A1: Annual and 5-year earnings inequality with 95% confidence interval, 2011 and 2016

		Earnings inequality					
		2011			2016		
		Estimate	[95% Confidence Interval]		Estimate	[95% Confidence Interval]	
Panel A: Baseline							
Gini							
	Annual	0.4191	0.4188	0.4194	0.4317	0.4309	0.4326
	5-year	0.4107	0.4094	0.4120	0.4250	0.4242	0.4258
Variance of log earnings							
	Annual	0.5262	0.5257	0.5268	0.5370	0.5368	0.5373
	5-year	0.4918	0.4906	0.4930	0.5036	0.5024	0.5048
Mean log deviation							
	Annual	0.2977	0.2971	0.2982	0.3037	0.3021	0.3054
	5-year	0.2828	0.2806	0.2850	0.2896	0.2890	0.2902
Panel B: Sensitivity test (based on earnings with adjustment for family size)							
Gini							
	Annual	0.4184	0.4181	0.4187	0.4365	0.4354	0.4376
	5-year	0.4080	0.4066	0.4094	0.4282	0.4277	0.4287
Variance of log earnings							
	Annual	0.5076	0.5069	0.5082	0.5212	0.5210	0.5215
	5-year	0.4671	0.4656	0.4685	0.4825	0.4812	0.4838
Mean log deviation							
	Annual	0.2928	0.2924	0.2933	0.3021	0.3003	0.3040
	5-year	0.2748	0.2727	0.2769	0.2848	0.2841	0.2854

Notes: This table provides 95% confidence interval for annual inequality and 5-year inequality in 2011 and 2016. Inequality measures are Gini, variance of log earnings and mean log deviation. Panel A shows our baseline estimate, while Panel B shows a robustness test using earnings with family-size adjustment. Bootstrapped 95% confidence intervals are provided.

**Table A2: Share of tax filers from 2009 that are still present in the sample in 2018
by age and gender for the medium-term mobility analysis**

	Percent still present in 2018
Gender	
Female	52.9%
Male	47.2%
Job formality	
High	93.0%
Low	87.7%
Age	
25-30	88.2%
31-35	89.2%
36-40	90.5%
41-45	91.6%
46-50	92.4%

Notes: This table illustrates the attrition rates across age and gender groups in the medium-term mobility analysis. It shows the percentages of tax filers with the corresponding characteristic from 2009 that are still present in the sample in 2018.