Intergenerational Mobility in Hong Kong, 1976-2016

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Abstract

Using a large census dataset spanning 40 years, this paper presents the first comprehensive study of absolute intergenerational income mobility in Hong Kong, by employing the commonly used "copula and marginals" approximation method. The main findings indicate a significant decrease in absolute income mobility, declining from 82% in the 1976 cohort to 49% in the 2001 cohort. In 1976, Hong Kong's absolute income mobility exceeded that of major higher-income countries, but within 20 years, it converged to the level of the United States. This decline is primarily attributed to decelerating GDP growth rather than increased income inequality. During the same period, increasing relative income mobility further demonstrated that income inequality is not the primary cause of this decline. Our findings remain robust under various alternatives of copula forms. Additionally, we observe that the absolute intergenerational income mobility of immigrants from Mainland China is initially lower than that of natives, but these gaps diminish over time. We argue that the rapid economic growth of China and the expansion of Hong Kong's tertiary education plays a central role in shaping intergenerational income mobility in Hong Kong.

Contents

I Introduction

The aspiration for improved living standards across generations is a common global sentiment. Consequently, the study of intergenerational mobility has been a prominent area of interest for economists and social scientists, who strive to understand the degree of persistence in outcomes between parents and their children.[1] A key distinction in the literature is between absolute and relative mobility: absolute mobility refers to changes in real income across generations, while relative mobility refers to shifts in income ranks. Although relative mobility has been extensively studied, research on absolute mobility has only been expanding in the past decade (see (Jäntti and Jenkins, 2015), 2015 for a recent overview).

The most seminal work in the absolute mobility literature is from Chetty et al. (2017) which documents the fading American dream using the so-called "copula and marginals" approach and pooled cross-sections of income data for sequential US cohorts born 1940 to 1980. Following Chetty et al. (2017), there has been a consistently expanding body of literature on country-specific estimates of absolute income mobility (AIM), primarily in Europe and North America. However, the findings present a somewhat varied picture (see (Chen et al., 2017) for Canada; (Blanden, 2019) for the UK; (Bönke et al., 2024) for Germany; (Kennedy and Siminski, 2022) for Australia; (Liss et al., 2023) for Sweden). Additionally, these country-specific estimates have recently been complemented by cross-country comparative studies (see (Berman, 2022); (Stockhausen, 2021); and (Manduca et al., 2024)). These studies find that overall absolute mobility peaked for individuals born around 1940, with 90% earning more than their parents, but then declined significantly for those born in the 1980s cohorts.

Due to data constraints, research on absolute income mobility outside Europe and North America has been scarce. This paper aims to address this gap by conducting a comprehensive analysis of AIM in one of the most unequal yet understudied cities in the world, Hong Kong.

Hong Kong epitomizes the Laissez-Faire economic development model, often heralded as the "Hong Kong miracle," which was once touted as the optimal path for economic growth in underdeveloped Asian economies. Therefore, Hong Kong provides the best example to study evolutions of social mobility and income inequality with minimal government intervention. Much like the American Dream, Hong Kong was envisioned as a land of opportunity where industrious individuals, equipped with academic excellence and entrepreneurial zeal, could transcend the struggles of their upbringing and secure a brighter future. This vision encapsulated the essence of the Hong Kong dream.[2]

[1] While social scientists, such as sociologists often focus on mobility in occupation, education, or social class, economists emphasize on income mobility both within and across generations, known as intergenerational income mobility (for detailed reviews, see Torche (2015); Cholli and Durlauf (2022).

[2] Hong Kong has been proud of its free-market economy for a long time. It ranked the world's freest economy

However, while the Laissez-Faire economic approach fueled Hong Kong's remarkable economic growth, it also catalyzed the evolution of stark inequalities and complexities in social mobility. The laissez-faire policies, characterized by minimal government intervention in economic affairs, facilitated rapid economic expansion but also created a landscape where wealth and income inequality widened, posing challenges to equitable access to opportunities (Piketty and Yang, 2022). Consequently, while many thrived in Hong Kong's dynamic economic environment, others found themselves increasingly marginalized, highlighting the dual nature not only of Hong Kong itself but also of the Laissez-Faire economic development model. With the persistent rise of income and wealth inequality in Hong Kong over the past few decades, does the once-illustrious Hong Kong dream appear to be fading, mirroring the decline of the American dream (Chetty et al., 2017)?[3] [4]

To answer the above questions, this paper investigates whether Hong Kong is undergoing a declination of absolute income mobility across generations. Moreover, this paper seeks to uncover the factors driving income intergenerational mobility in Hong Kong through the decomposition of absolute mobility and look at the heterogeneity of absolute mobility from 1976 to 2016.

In the earlier research in this field, the approach to characterizing intergenerational mobility is mostly by examining relative mobility, which compares the outcomes of children from low-income families to those from high-income families. The canonical representation of relative mobility is captured by intergenerational income elasticity (IGE, $\frac{\mathbf{d}E[\log Y_i|X_i=x]}{\mathbf{d}\log x}$), which measures the percentage change in children's income concerning their parents (Chetty et al., 2014a; Fan et al., 2021), which can be estimated by the following equation:

$$\log Y_i = \alpha_0 + \alpha_1 \log X_i + \epsilon_i \tag{1}$$

Where Y_i and X_i are the log total income of children and parents respectively. The coefficient α_1 measures the percentage change in children's income with respect to their parents, which represents IGE. Higher α_1 indicates greater intergenerational income persistence and higher inequality/mobility levels across generations.

Another method involves intergenerational rank correlation, which assesses the association between a child's position in the income distribution and the parent's position:

$$rank_{Y_i} = \beta_0 + \beta_1 rank_{X_i} + \epsilon_i \tag{2}$$

for many years until Singapore replaced Hong Kong to become the number one in 2023, according to a report realized by Fraser Institute (Gwartney et al., 2023).

[3]For insights into the impact of inequality on income mobility, refer to the work of DiPrete (2020).

[4]Interestingly, while Hong Kong grapples with these challenges, mainland China has witnessed a notable rise in the Chinese dream over the same period.

Where the rank-rank slope β_1 measures the association between a child's position in the income distribution and the parent's position in the distribution. Based on the rank distribution of parents and children, one can also estimate the intergenerational transition matrix of relative mobility. This matrix offers a detailed portrayal of the percentage of children in quintile i, contingent on their parents' income falling within quintile j. By setting the values to 100, a comprehensive 100×100 rank matrix is obtained, establishing the foundational structure for the copula method introduced later in this study (Chetty et al., 2017).

Recently, more researchers have shifted their focus to absolute income mobility, which examines the outcomes of children from families at a specific income level in absolute terms(Chetty et al., 2014a; Manduca et al., 2024). In contrast to relative mobility, absolute mobility is framed in a more normative context, with increases in absolute mobility aligning with the increase in general welfare according to the pareto principle. Therefore, absolute mobility avoids the secular comparison between individuals since one upward relative mobility always comes at the expense of the downward mobility of another, while everyone can enjoy upward absolute mobility at the same time under ideal circumstances.

Absolute upward mobility can be expressed as the proportion of children earning 100, 120, or 150 percent more than their parents(Fan et al., 2021). However, the direct comparison is limited to panel data, requiring parent-child pairs. Therefore, in this study, we employ the copula method developed by Chetty et al. (2017) to estimate absolute mobility in the absence of historical panel data, using cross-sectional census data in Hong Kong. This innovative method leverages the distribution of parent and child income ranks, providing a robust framework for understanding intergenerational mobility. The robustness of this copula method was further affirmed by Berman (2022) across ten different developed countries.

The renowned Great Gatsby Curve posits that countries with higher inequality tend to exhibit lower earnings mobility across generations. For instance, the United States, characterized by a high GINI Index of approximately 0.4 and a relatively elevated IGE coefficient ranging from 0.33 to 0.35, contrasts with Nordic countries with a GINI Index below 0.3 and an IGE of less than 0.2 (Corak, 2013). Given Hong Kong's pronounced economic inequality, reflected in a GINI Index around 0.5 (World Inequality Database, 2023), it is reasonable to infer that Hong Kong has experienced low intergenerational mobility, potentially declining in recent decades with rising inequality.

This paper is organized as follows. The next section presents a simple introduction to the copula method introduced by Chetty et al. (2017). Section III outlines the data, while Section IV presents the empirical results. Section V concludes and makes a discussion.

II Methodology

II.1 Basic Setting

It's ideal to use the historical panel data to estimate intergenerational mobility. However, such data is rather scarce in many countries or regions including Hong Kong. Fortunately, following Chetty et al. (2017), it is possible to overcome this limitation by employing a copula with the actual joint distribution of parent and child income ranks. This method does not indicate whether a specific child earns more than his or her parents, but it estimates the upward absolute mobility of the whole generation.

A copula is a function used to model the dependence between random variables, where each variable has a uniform marginal distribution on the interval [0, 1], which could be represented by the 100 × 100 transition matrix in our study. The rate of absolute mobility in cohort c, A_c, is conceptually defined as:

$$A_c = \frac{1}{N_c} \sum_i \mathbb{I}\{y_{ic}^k > y_{ic}^p\} \tag{3}$$

Where N_c is the number of children in the cohort c; y_{ic}^k and y_{ic}^p denote the income of child i in birth cohort c and his or her parents, respectively.

Since A_c can't be estimated directly using cross-sectional data, we can decompose the joint distribution of parent and child income into the marginal distributions of parent and child income and the joint distribution of the ranks (copula):

$$A_c = \int \mathbb{1}\{Q_c^k(r^k) \geq Q_c^p(r^p)\} C_c(r^k, r^p) \mathbf{d}r^k \mathbf{d}r^p \tag{4}$$

Where r_{ic}^k and r_{ic}^p denote the percentile rank of child/parent i in the income distribution for children/parents in birth cohort c. And $C_c(r^k, r^p)$(copula) denotes the joint distribution of parent and child ranks for cohort c. $Q_c^k(r)$ and $Q_c^p(r)$ denote the rth quantile of the child and parent income distributions respectively, which summarize the marginal distributions of parent and child incomes.

II.2 Justification for Copula

Based on our empirical data, obtaining the marginal income distribution for both children and parents is straightforward. For copulas, we have to assume copula stability across different cohorts, and the choice of copulas has little to do with the results.

In terms of temporal stability, Chetty et al. (2014b) have shown that the copula (relative mobility) is approximately stable from the 1971 to 1984 birth cohort in the U.S., and can be

applied to 1940-1980 cohorts without too much variation (Chetty et al., 2017). Such stability is further valid by Manduca et al. (2024) who found that the copula constructed based on data from the exact cohort and from all cohorts are almost identical. In conclusion, the marginal income distributions and a single relative mobility measure(copula) are very reliable when estimating absolute mobility in various countries and cohorts.

Moreover, the impact of the copula on results is limited as long as it reflects a reasonable distribution. Absolute intergenerational mobility primarily depends on the income distributions of parents and children, with the copula being relatively inconsequential. Berman (2022) examined 28 copulas from different developed countries and found little variance in absolute mobility results when applied to the U.S. income distribution. Similarly, Manduca et al. (2024) noted that regardless of the copula chosen, absolute mobility results remain quite similar, even with rank-rank slope variations from 0.07 to 0.34 across different countries. Thus, using marginal income distributions and a single copula provides reliable estimates of absolute mobility across various countries, a conclusion supported by the current research's results.

Regarding the choice of copulas, Berman (2022) reveals that the fundamental structures of realistic copulas are similar. Despite differences in relative mobility measures, these measures are almost linearly related across time and countries. Using a single copula provides a good approximation for a wide range of intergenerational copulas. Therefore, given that empirical copulas are limited, reliable synthetic copulas should also be considered. For instance, the Gumbel copula can be represented as:

$$\exp[-((-log(u))^{\theta} + (-log(v))^{\theta})^{\frac{1}{\theta}}] \tag{5}$$

which is a good representation of the true rank correlation. This copula creates a synthetic two-generation rank distribution, matching ranks in the first generation with those in the second generation based on the copula with a rank correlation parameter. Subsequently, ranks can be replaced by cross-sectional incomes in each generation to obtain a joint income distribution. Finally, we use the Gumbel synthetic copulas and the U.S. empirical 100100 percentile cell matrix copula from Chetty et al. (2017), with Gaussian and Clayton copula functions as cross-validation.

II.3 Practical Methodology

In most literature, the absolute mobility rate is calculated by comparing whether children earn more than their parents in each real or synthetic child-parent pair cell, in which the pair assigned to each cell is attributed to the probability of copula. However, Manduca et al. (2024) utilizes panel data to obtain both children's income in their 30s and parents' income when the

parents are in their 30s. On the other hand, the method proposed by Berman (2022) does not require such a paired match to generate the result, making it more applicable to cross-sectional data.

The choice between these two methods does not significantly affect the results. The difference observed between the two empirical papers is primarily attributed to the use of non-empirical data in Berman (2022). He employs the method of generalized Pareto curve interpolation to derive marginal income distributions based on the World Inequality Database (WID), which is not micro-level data, unlike the survey data focusing on specific cohorts of interest in Manduca et al. (2024). When Manduca et al. (2024) applies both methods to their micro-level survey data in the UK, the results are very similar. Therefore, since our paper utilizes micro-level large-scale survey data rather than synthetic data, using the method proposed by Berman (2022) should yield a very reliable result.

Another issue is the representativeness error when the entire population represents a specific cohort of children and parents. Berman (2022) utilizes the entire population to reflect a person's income, potentially introducing life-cycle bias that could make the result downward bias. Although Manduca et al. (2024) shows that the choice of population age does not significantly alter the result as long as micro-survey data is used, they still restrict the age used to measure a person's income to the 30s for both parents and children to mitigate life-cycle bias. Therefore, our research measures income both at the entire population level and in people's specific age from 30 to 55.

III Data

III.1 Sample

The data source comes from the 1976-2016 Hong Kong Population By-census 1%/ 5% Sample Dataset, in which the censuses are conducted every five years. For the 1981 and 1986 data, only 1% population is covered, while for the 1991, 1996, 2001, 2006, 2011, and 2016 data covers 5% of the total population, and 10% is covered in 1976.

To ensure a representative sample, individuals with ages below 25 or above 60 have been excluded from the analysis. This decision is motivated by the fact that a significant proportion of the youth population in Hong Kong is engaged in university studies during their early twenties, while individuals tend to retire around the age of 60. No additional restrictions are implemented on population selection.

III.2 Variable Definitions

The primary focus of our analysis is the total income of each individual. In the census, there are three sources of income: (1) Monthly income from main employment: For employers or self-employed persons, this is the amount earned excluding expenses incurred in running their main business. For employees, this is the total amount earned from their main employment including salary or wage, bonus, commission, overtime, housing allowance, tips, and other cash allowances; (2) Monthly income from other employment: the amount he/she earned from all secondary employment; (3) Other cash income: the total recurrent cash income received by a person which is not remuneration for work, including e.g. rent income, interest, dividend, education grants (excluding loan), regular/ monthly pensions, social security payment, old age allowance/old age living allowance, disability allowance, comprehensive social security assistance, scholarships, the regular contribution from persons outside the household. These three sources are aggregated as the variable "total income". Additionally, the total income for each year is adjusted by dividing it by the Consumer Price Index (2010 = 100) obtained from the World Bank database (World Bank Database, 2023).

Within the census data, approximately 10%-25% of individuals report zero income in different census years. Considering this proportion is too large and is not very likely to reflect the real unemployment situation, these zero-income data points were removed. Despite this adjustment, a significant portion of the population remains below the poverty line (18.7%), preserving a high level of representativeness for individuals in the lower-income bracket, and very close to the actual poverty ratio of 19.9%.

For top-income individuals, the census code 99998 for all population whose income is higher than 99998 in 1981, 1986, and 1991, and this number increases to 150000 in the following years. However, due to challenges associated with the top code data, including the inability to adjust for the Consumer Price Index, a static threshold in a dynamically growing economy, and a substantial percentage of individuals falling into this category in 2016 (around 1%), it's unreasonable to keep the original top income data. Instead, we assume the top of the wage distribution follows a Pareto distribution and employ the top-code technical from Piketty and Yang (2022) and correct the observations with top-coded income (see Appendix).

III.3 Data Processing

This section details the data process of baseline results and other extension estimations closely mirror it.

To facilitate the matching of parent-child pairs with the copula, we restricted the sample to the census with the least cases, which is the 1981 census. Using 1981 as the baseline, we

randomly drew an equal number of cases from other censuses. This yielded a 15,392 9 matrix, with the columns representing the years from 1976 to 2016, and with 15,392 cases in each statistical year.

We used copulas on two specific columns to calculate an absolute mobility data point. Assuming parents were 20 to 40 years old when children were born, we had marginal income distributions for ages 20, 25, 30, 35, and 40 due to the census being conducted every five years. For example, to estimate absolute mobility for the 1976 cohort, we generated the marginal children's income distribution for 1996, 2001, 2006, 2011, and 2016, assuming parents were between 20 and 40 years old. Using a 30-year gap, we paired columns 1976 and 2006, representing parent and child generations, respectively. With a 100100 copula matrix showing parents' and children's ranks, we matched income pairs between 1976 and 2006 based on the copula's density, creating quasi-parent-child pairs. By determining how many children earned more than their parents, we obtained the absolute mobility data point. This process was repeated using 1981 and 2011 data for the second point, and 1986 and 2016 data for the third point. Connecting these points revealed a trend for absolute mobility, and combining trends at different year gaps produced the final map of the evolution of absolute intergenerational mobility shown in the next section.

IV Results

IV.1 Absolute Mobility: Baseline Result

Firstly, we used the Gumbel synthetic copula to estimate the absolute mobility. Following a wide range of rank correlation results from developed countries (Chetty et al., 2014a; Jantti et al., 2006; Ueda, 2009), the rank correlation is set as 0.3 as a benchmark. These rank correlations are obtained from the estimation of relative intergenerational mobility, so combining the mathematical copula and the empirical rank correlations generates similar effectiveness of empirical copula. The result is presented in Figure 1, with five lines in different colors representing the estimation of absolute mobility for a specific cohort with different years gap of parents. According to Berman (2022), the gap is 30 years, which is also the benchmark in our research. However, when we combine different years' gap trends together, the graph indicates nearly perfect overlaps when estimating a particular child cohort with different years of gap. For example, for the 1981 income cohort, using the 20 to 35 years gap results in the mobility level from 79 to 82, which is very close to each other. Consequently, using the 20-year-old gap curve serves as a suitable representation for all gap years from 20 to 40. To obtain a longer period trend, the subsequent analysis will utilize the 20-year gap trend. Noting that this year's gap only represents our assumption of a generational age gap rather than the real year's gap of

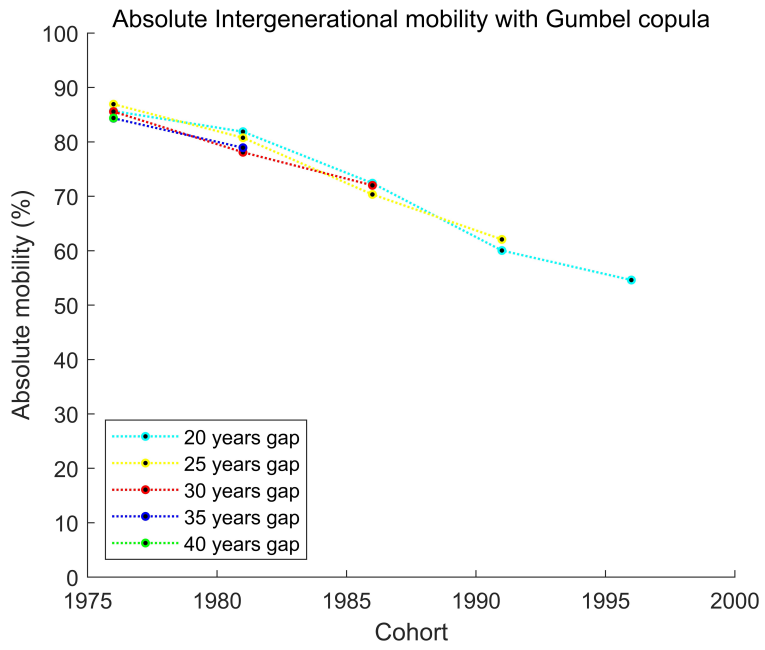


Figure 1: The evolution of absolute intergenerational mobility in Hong Kong using Gumbel copula with rank correlation 0.3

a specific family.

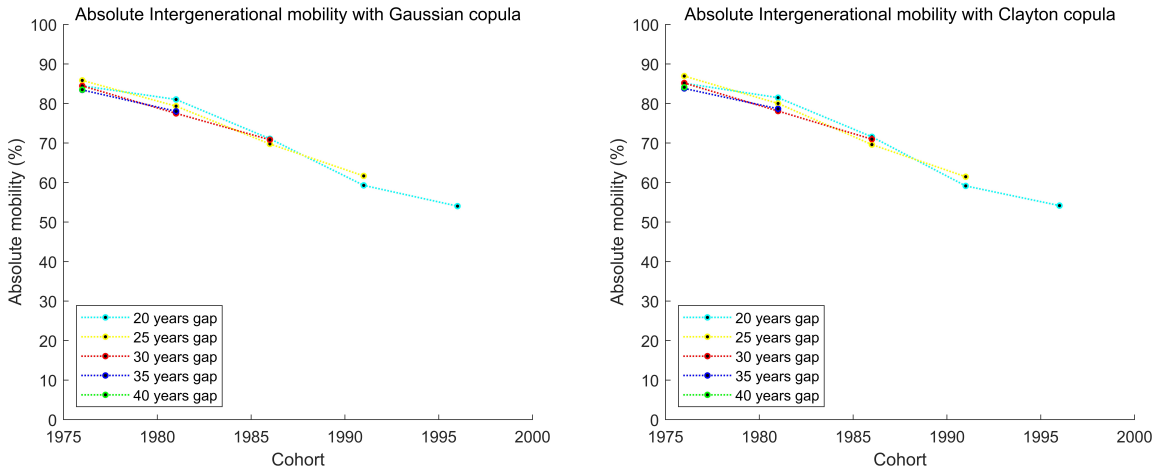
Table 1: Absolute Mobility from 1976 to 2016 - Gumbel copula

Year(income cohort)	1976	1981	1986	1991	1996
Percentage(20 years gap)	85.58	81.70	72.43	59.74	54.86
Percentage(25 years gap)	86.76	80.45	70.00	62.18	
Percentage(30 years gap)	85.41	77.90	72.09		
Percentage(35 years gap)	84.28	79.11			
Percentage(40 years gap)	84.50				

Figure 1 and Table 1 illustrate a notable decline in absolute intergenerational mobility, dropping from 85.34% for the 1976 cohort to 54.81% for the 1996 cohort. That is to say, when measuring the income for the entire working-age population, the 1976 generation had approximately an 85% probability of earning more than their parents, while the 1996 generation saw this probability diminish to only half.

IV.2 Robustness Check: Choice of Copulas

To assess the impact of different copulas on the estimation of intergenerational mobility, we also employed the Gaussian copula and Clayton copula, aligning with the approach outlined



(a) Gaussian copula (b) Clayton copula

Figure 2: The evolution of absolute intergenerational mobility in Hong Kong using other synthetic copulas

by Berman (2022), utilizing a rank correlation of 0.3. As depicted in Figure 2, the overall trend maintains a consistent shape.

Except for the synthetic copulas, we also took advantage of the empirical copula from the United States Chetty et al. (2017). Extensive evidence supports the efficacy of this copula, demonstrating its robust fit across cohorts from various periods, yielding results comparable to those obtained from other synthetic copulas. From Figure 3 and Table 2 we know the empirical copula has no discernible difference in estimating absolute mobility compared to the synthetic ones.

Table 2: Absolute mobility from 1976 to 2016 - US copula

Year(birth cohort)	1976	1981	1986	1991	1996
Percentage(20 years gap)	85.99	82.04	71.76	58.78	53.59
Percentage(25 years gap)	87.28	80.70	69.80	61.44	
Percentage(30 years gap)	86.03	78.47	71.42		
Percentage(35 years gap)	84.74	79.40			
Percentage(40 years gap)	84.71				

Given that our estimated relative mobility rates drop from around 0.2 to about 0.1, we also select rank correlations 0.2 and 0.1 instead of 0.3 to see whether there's variation in the result. As shown in 4, the results are similar to the result when we choose rank correlation 0.3. The choice of rank correlation parameter is insignificant for the result.

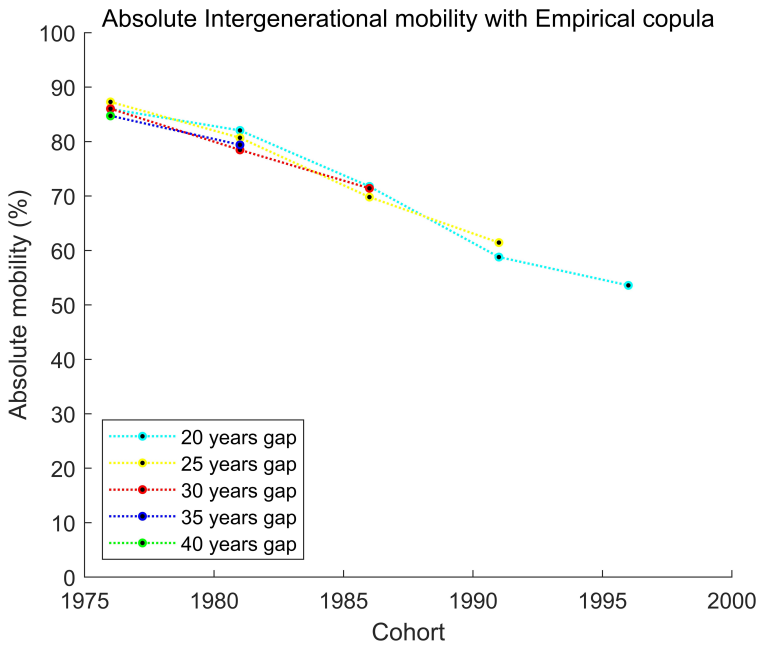
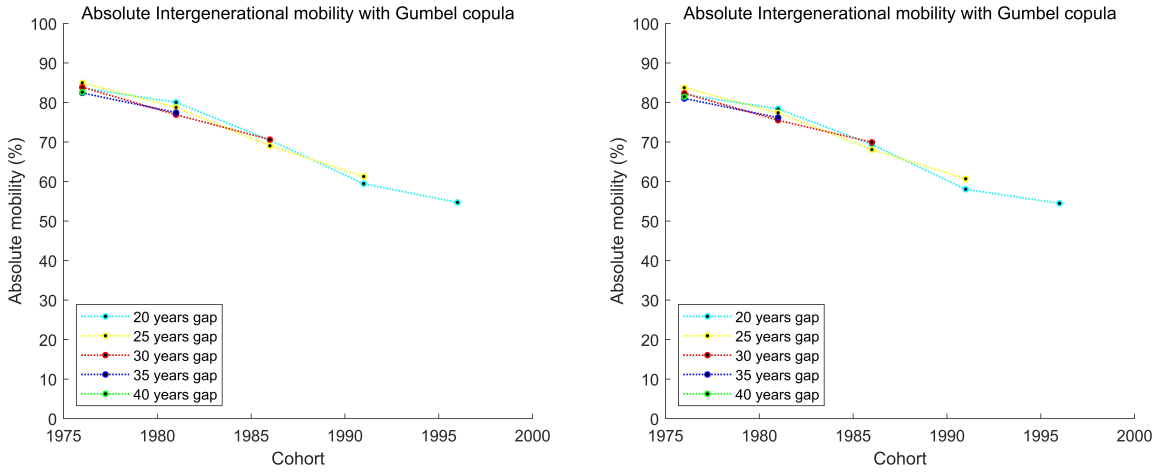


Figure 3: The evolution of absolute intergenerational mobility in Hong Kong using empirical copula



(a) Rank Correlation 0.2 (b) Rank Correlation 0.1

Figure 4: The evolution of absolute intergenerational mobility in Hong Kong using Gumbel copulas with different rank correlation

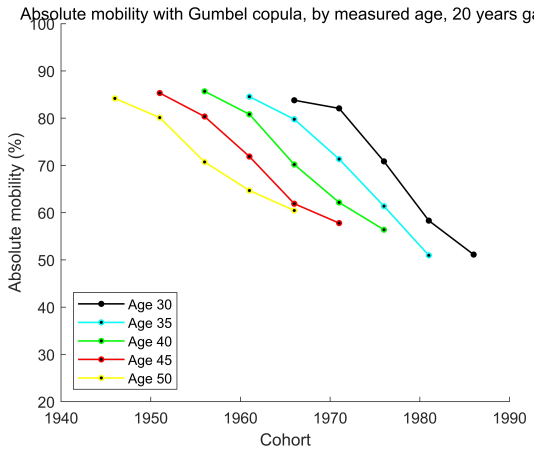
IV.3 Robustness Check: Sensitivity to Age of Income Measurement

As noted earlier, using the entire population may not accurately represent a specific cohort, and no single age may perfectly reflect one's lifetime income. However, if there is stability in the mobility rate after a certain age, or if income at an earlier age can reasonably estimate later income, then using income at a certain age for both children and parents could provide a meaningful estimate of absolute mobility. Therefore, we calculate absolute upward mobility using income measured at ages 30, 35, 40, 45, 50, and 55. Since the data is specific to certain ages, we average the income over 5 years, including two years before and after, to represent each age. For example, the 28-32 age group is selected to represent 30-year-olds. Given the rapid expansion of education in Hong Kong, many individuals may still be pursuing higher education, such as a master's degree, when they are 23-27 years old. Therefore, we do not include the age of 25 when measuring income. If a child's income at age 30 is measured in 1996, then the corresponding birth cohort is 1966.

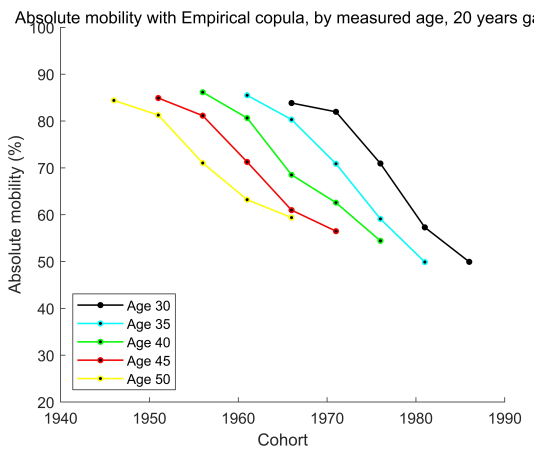
From Figure 5 and Table 3, we observe that when the age gap is 20 years, the mobility rates at which ages are measured are very similar to each other. This finding suggests that the choice of age at which income is measured does not significantly impact the result as long as the age falls within the 30-50 range. Upward mobility rates measured at ages 30-50 are generally consistent with results from the entire population. This aligns with the findings of Manduca et al. (2024), who suggested that 35 years old and above is suitable for obtaining results. The similarity in mobility rates across different measured ages, ranging from around 85% to 50%, indicates that the birth cohort does not play a significant role, while the year in which income is measured is the primary determinant. This suggests that the mobility rate is largely influenced by natural changes over the years rather than increases in an individual's lifetime income. Given the smooth downward mobility trend, we do not specifically consider the business cycle or macroeconomic shocks.

This pattern resembles trends observed in countries like Norway and Canada (Manduca et al., 2024), where the trajectory of different age groups shows a similar, overall downward trend. In these economies, the year of measurement is more critical than the age group in determining the trend. This makes sense, as decreasing income growth rates largely explain the decline in absolute mobility in these economies (Berman, 2022). In other words, the overall growth of the national economy significantly impacts mobility more than individual efforts and job promotions.

Figures 6 and 4 depict upward mobility when income is measured at different ages, using a 30-year gap as the baseline. Consistent patterns are observed across all age groups, indicating a higher mobility rate in specific years compared to previous results. This further underscores that the choice of age at which income is measured is not crucial for the mobility rate; rather,



(a) Gumbel copula



(b) Empirical copula

Figure 5: The evolution of absolute mobility by age at which income is measured, 20 years gap

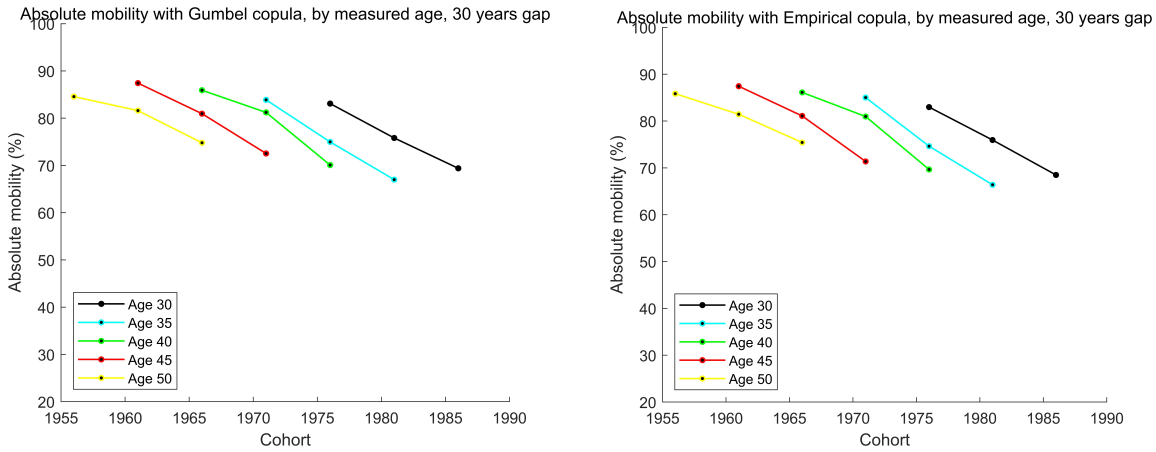
Table 3: Absolute Mobility from 1976 to 2016 with Gumbel copula - income measured at different age, 20 years gap

Year(birth cohort)	1946	1951	1956	1961	1966	1971	1976	1981	1986
Age 30					83.00	82.14	71.44	58.69	49.91
Age 35				85.87	79.96	71.49	60.21	51.89	
Age 40			85.52	79.81	69.12	63.52	55.83		
Age 45		84.03	81.81	71.07	62.98	58.34			
Age 50	84.73	81.49	71.77	64.47	59.86				

the specific year of income measurement is the determining factor. This aligns with Manduca et al. (2024) findings, suggesting that the choice of age for measuring income is not the primary reason for the differences with Berman (2022) results; instead, it is mostly attributed to the use of survey data. In conclusion, utilizing the entire population from a specific year is quite robust, even if it may seem unrepresentative at first glance.

IV.4 Fraction of Children Earning More than Parents

In addition to displaying the fraction of children's generation earning more than their parents by 100%, we also show percentages of 120% and 150%, reflecting the rapid economic growth in Hong Kong during the late 20th century Chetty et al. (2017); Fan et al. (2021). Figure 7 demonstrates similar trends whether using 120% or 150%, both showing a decrease in overall mobility. The trend for the 120% fraction is consistently 5% lower than the baseline, while for the 150% fraction, it is 15% lower. There is no significant difference in pattern between the baseline and other trends, suggesting that the decline in absolute mobility is evenly distributed



(a) Gumbel copula (b) Empirical copula

Figure 6: The evolution of absolute intergenerational mobility by age at which income is measured, 30 years gap

Table 4: Absolute Mobility from 1976 to 2016 with Gumbel copula - income measured at different age, 30 years gap

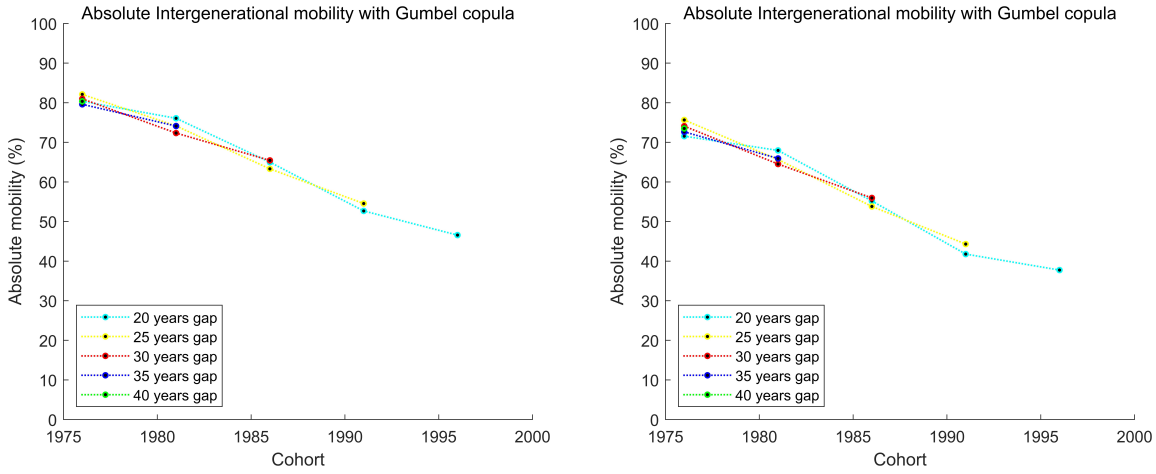
Year(birth cohort)	1956	1961	1966	1971	1976	1981	1986
Age 30					82.97	75.66	69.27
Age 35				84.27	75.99	66.41	
Age 40			81.58	81.00	70.87		
Age 45		87.05	81.38	71.99			
Age 50	85.17	80.83	74.35				

across all income levels above parents'.

Table 5: Absolute Mobility with fractions 100 percent, 120 percent, 150 percent

Year(income cohort)	1976	1981	1986	1991	1996
100 percent	85.58	81.70	72.43	59.74	54.86
120 percent	79.98	76.21	64.75	52.68	46.73
150 percent	71.95	67.61	55.33	42.47	38.16

In order to verify that the fraction of children who earn more than their parents is evenly distributed, we also plot the absolute mobility against the choice of fraction from 100% to 300% in 1% intervals. From Figure 8 we can see that children who earn the fraction more their parents are evenly distributed across 100% to 300% without any significant variation. That is to say, absolute mobility in Hong Kong does not concentrate on a certain level, instead, the chance of earning much more than parents is quite open to the next generation.



(a) Children Earn 120 Percent More (b) Children Earn 150 Percent More

Figure 7: The evolution of absolute intergenerational mobility with fractions 120 percent and 150 percent

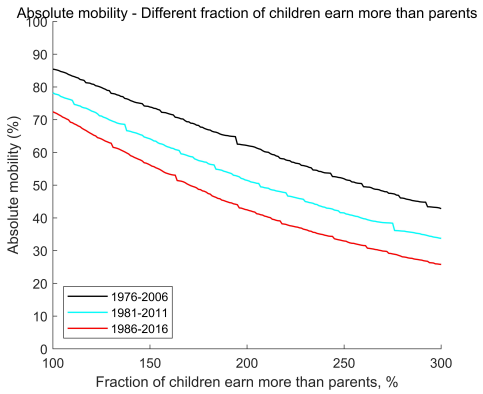


Figure 8: The absolute intergenerational mobility by different fractions of children earn more than parents

IV.5 Country Comparison

To investigate mobility patterns across different market economies with diverse institutional settings and economic structures, we compare our results with those of other developed economies Berman (2022). In Figure 9, the blue line represents a 30-year gap benchmark trend, similar to other economies, while the black line shows a longer trend with a 20-year gap. The trend of absolute mobility closely resembles that of other developed economies such as the United States, Japan, and France (Berman, 2022; Chetty et al., 2017). However, the disparity lies in the timing of the trend, with Hong Kong exhibiting a 15 to 20-year lag behind Japan and France and a 25 to 30-year lag behind the United States. The results are compelling and intuitive. As one of the "Four Asian Tigers," Hong Kong's economic development lagged behind Japan by approximately 20 years and even further behind the United States for 30 years or more.

The dramatic speed of declination in absolute mobility, from 85% to 50% within 15 years in Hong Kong, also coincides perfectly with Japan's trend from 1965 to 1980. Another notable feature is that East Asian economies all experience a sharp drop in absolute mobility, while Western European countries like France and the US undergo a moderate drop. The absolute mobility of the US has stabilized around 55%, which might be the lower limit of developed economies which we do not fully know yet. Sweden has the least drop over decades, experiencing more than 65% absolute mobility in 1980. The Nordic countries (especially Sweden, Denmark, and Norway) are one of the few developed economies where absolute mobility didn't decline to around 50%, indicating that these countries enjoyed equal distribution and high economic growth in the 1970s and 1980s. It is worth noting that countries in similar regions (Western Europe, Nordic countries) yield similar patterns, which are not fully shown here for clarity.

IV.6 Decomposition of Absolute Mobility

An inherent query arises concerning the factors contributing to the observed decline. One potential determinant is the diminished GDP growth rate in Hong Kong during the latter years. During the 1976-2021 period, the average real growth rate from 1976 to 1996 is 4.61%, in contrast, the average real growth rate from 1996 to 2016 is 0.67%. Another factor in this decline is the more unequal income distribution. Hong Kong's GINI Index has surged from 0.53 (1981) to 0.59 (2016), as reported by the World Inequality Database (2023). Consequently, we conducted a decomposition of absolute mobility trends to discern the respective contributions of these factors. In investigating the first factor, we hold the income growth constant, maintaining each year's income growth rate at the 1976-2016 average. The second factor involves fixing the income distribution, using the 1976 distribution as a baseline, and applying it to subsequent years.

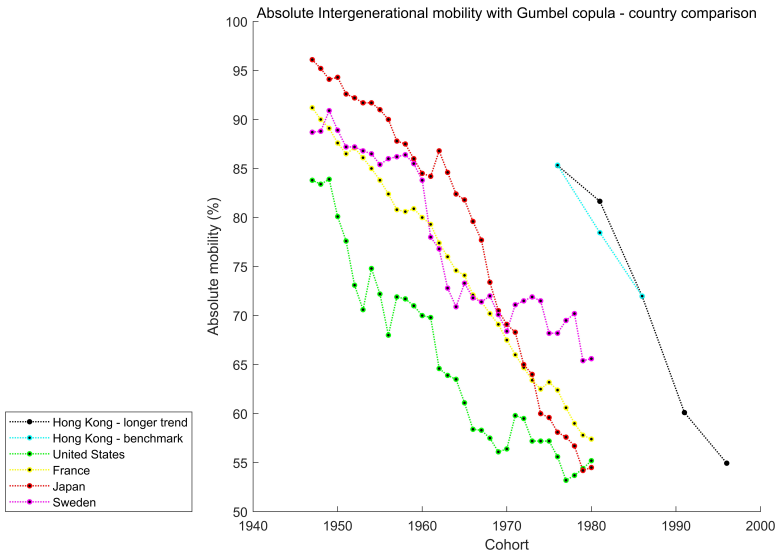


Figure 9: The evolution of absolute intergenerational mobility in four developed economies

Berman (2022) finds that the decline in absolute mobility in Australia, the United Kingdom, and the United States is primarily attributed to unequal income distribution. Conversely, in Japan, France, Canada, and Nordic countries, the deceleration of income or GDP growth assumes a more pivotal role. Since Hong Kong's slowing growth of GDP seems a more disturbing issue compared to the moderate rise of the GINI Index, it's natural to assume the underperformance of GDP is a predominant factor contributing to its diminished absolute mobility.

Table 6: Absolute Mobility from 1976 to 2016 - US copula

Year(income cohort)	1976	1981	1986	1991	1996
Percentage(Baseline)	82.01	79.31	73.79	60.78	52.68
Percentage(Fixed inequality)	82.48	82.21	78.16	63.95	57.41
Percentage(Fixed growth)	67.53	67.31	65.14	65.65	62.77

From Figure 10 and Table 6, we can see that the trends in the fixed inequality counterfactual scenario almost coincide with the baseline estimation. Fixing inequality(distribution) does not influence too much about the decline of absolute mobility. That is to say, if the income is distributed more equally as in 1976, the absolute mobility won't significantly increase. Conversely, when we held the income growth rate constant at the average of 1976 to 2016 based on our data, the absolute intergenerational mobility in Hong Kong remained nearly constant at around 67%.

Hong Kong's situation resembles that of Canada, France, Japan, and the Nordic countries, particularly Denmark and France, where the decrease in absolute mobility is primarily due to

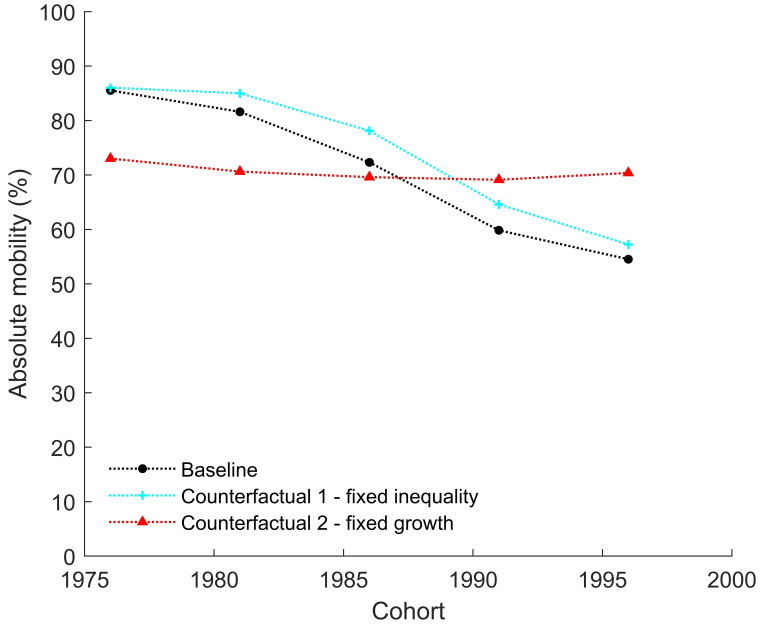


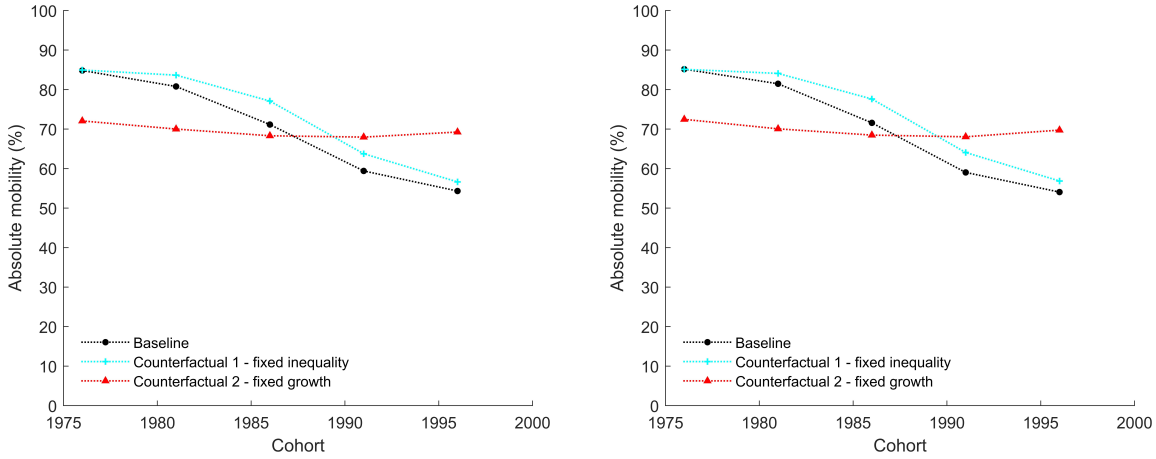
Figure 10: The decomposition of absolute intergenerational mobility in Hong Kong using Gumbel copula

slower income growth rates rather than changes in income inequality. This is surprising given Hong Kong's economic liberalization policies are similar to those of the United States. However, unlike the U.S., U.K., and Australia, where rising income inequality has played a significant role in reducing mobility, Hong Kong's high level of social inequality has remained relatively unchanged. In contrast, inequality in France and Denmark has stayed low in recent decades, so growing inequality has had little impact on mobility there(Berman, 2022). Meanwhile, the U.S. and U.K. experienced sharp increases in inequality, especially after the economic policies of the 1980s, which contributed to their declines in mobility.

Figures 11 and 12 show the decomposition of absolute mobility using other synthetic copulas and empirical copulas. No significant difference is found in the figures. The only disparity is that using the empirical copula generates marginally lower absolute mobility in the fixed growth scenario.

IV.7 Heterogeneity of Absolute Mobility

Our analysis of decomposition results reveals that the decline in intergenerational mobility cannot be solely attributed to the unequal income distribution. This finding may appear counterintuitive, particularly in light of the widely held belief in increased inequality in Hong Kong. However, it is plausible that although income distribution has remained relatively stable



(a) Gaussian copula (b) Clayton copula

Figure 11: The decomposition of absolute intergenerational mobility in Hong Kong using other copulas

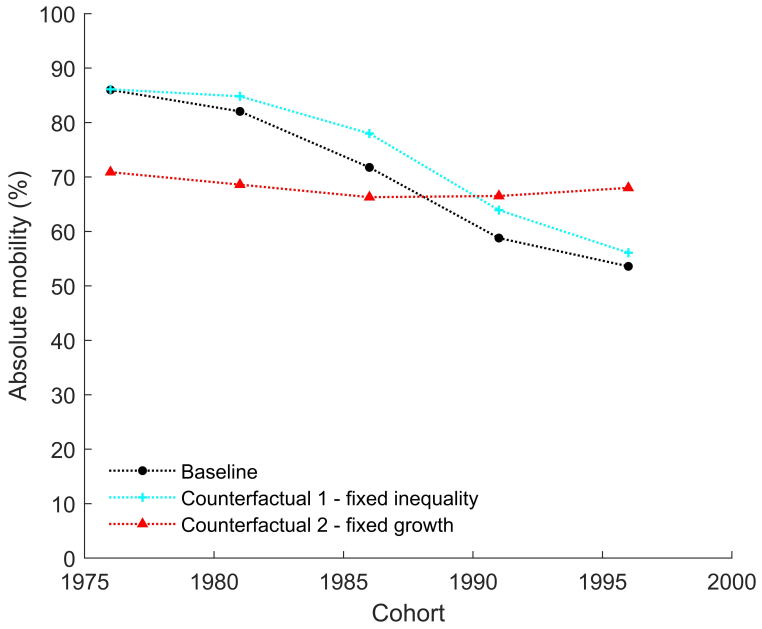


Figure 12: The decomposition of absolute intergenerational mobility in Hong Kong using empirical copula

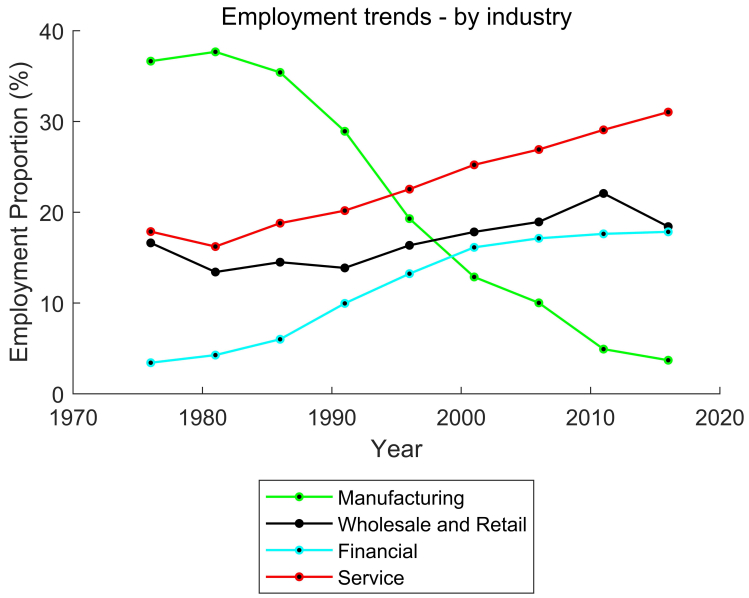


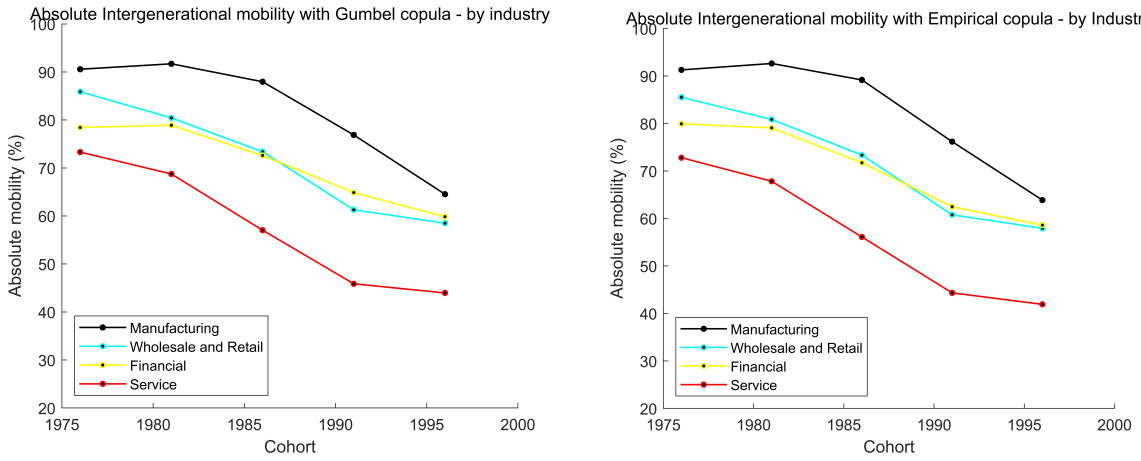
Figure 13: The evolution of each industry sector's share in Hong Kong

in recent decades, substantial changes have occurred in wealth accumulation.

One possible scenario is that affluent individuals have shifted manufacturing activities to mainland China, generating profits there and subsequently reinvesting these funds into real estate or other related industries in Hong Kong. Consequently, even with minimal changes in income distribution, there is a significant increase in cross-generational inequality due to uneven wealth distribution. In response to this observation, our focus shifts to estimating absolute mobility across various industrial sectors in Hong Kong.

Examining the employment share trends in each sector, Figure 13 illustrates a substantial decline in manufacturing employment share from approximately 40% to less than 5%, particularly from 1986 to 2011. In contrast, the service and financial sectors experienced a notable increase in employment from 1981 to 2016, with a slight upward trend in the Wholesale and Retail sectors. The proportions of other sectors remained relatively stable and are all less than 10% across 40 years. Therefore, our subsequent analysis only includes the four sectors mentioned above.

Examining Figure 14, we observe a substantial decline in absolute mobility across all sectors from 1976 to 2001, each experiencing varying degrees of reduction. Notably, the service sector demonstrates the most significant drop, from 75.6% in 1976 to 39.3% in 2001. This suggests a sluggish increase in income within the service sector compared to other sectors, and even possibly indicates a slight decrease in income given that the absolute mobility falls below 50% in 2001 cohorts. Manufacturing also exhibited substantial declines in mobility and remained



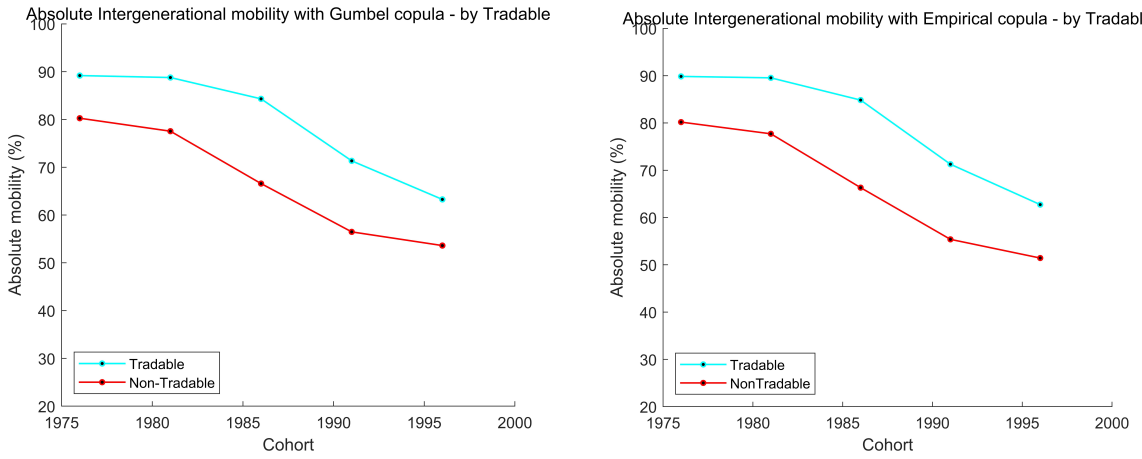
(a) Gumbel copula (b) Empirical copula

Figure 14: The evolution of absolute intergenerational mobility in Hong Kong by industries

relatively stable from the 1976 cohort to the 1986 cohort, but it sharply declined from 86.7% in 1986 to 50.4% in 2001, pointing to income stagnation in the early years of the 21st century. In the Wholesale and Retail sector, absolute mobility decreased from 84.7% in 1976 to 51.7% in 2001. In contrast, the financial sector witnessed a relatively moderate decline, from 77.2% in 1976 to 54.3% in 2001. A common trend among these sectors is that mobility for the 1976 to 1986 cohorts remained relatively stable. However, there was a sharp decline from the 1986 to the 1991 cohorts, followed by stability again from the 1991 to the 2001 cohorts. The result holds for both synthetic copula and US empirical copula, again confirming that the choice of copulas is insignificant for the results.

An alternative approach to understanding the divergent industry patterns is by categorizing sectors into tradable and non-tradable goods, offering insights into the impact of China's shock on intergenerational mobility. Here, Agriculture, Mining, Manufacturing, Electricity & Gas & Water, Wholesale & Retail, and Restaurant & Hotel sectors are classified as the "Tradable Sector," while Construction, Transportation, Storage, Postal, and Courier Services, Service, and Financial sectors are designated as the "Non-Tradable Sector." Figure 15 illustrates that trends in both sectors are quite similar, with the tradable sector consistently exhibiting higher mobility than the non-tradable sector, indicating that income growth in the tradable sector surpasses that of non-tradable sectors.

We further classify sectors that lie between tradable and non-tradable regimes, such as Agriculture, Mining, Electricity, Gas, and Water, and Restaurant and Hotel sectors, into a new category: the partially tradable sector. Additionally, we isolate the Service sector from the non-tradable sector due to its extensive and challenging-to-classify nature. Consequently, Figure 16



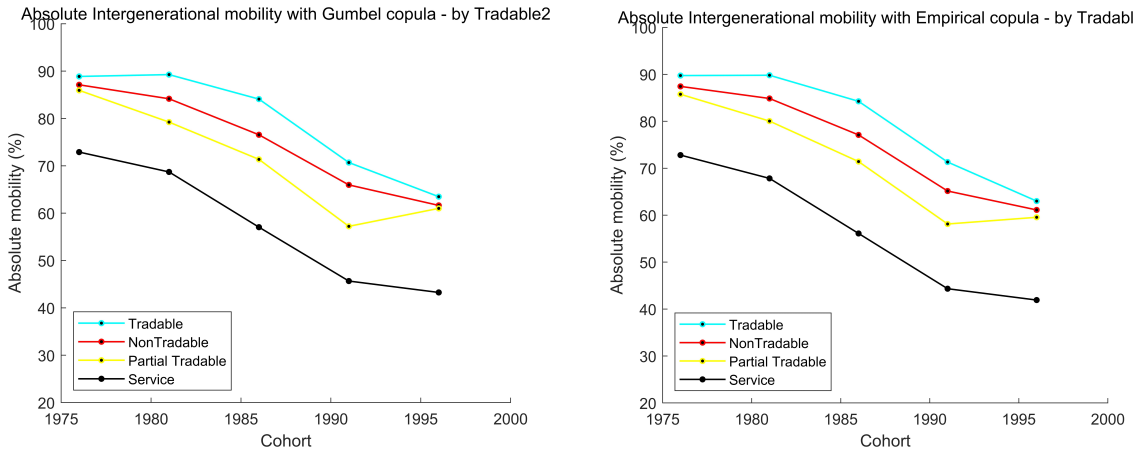
(a) Gumbel copula (b) US copula

Figure 15: The evolution of absolute intergenerational mobility in Hong Kong by tradable industries

reveals that, except for the Service Sector, which consistently exhibits the lowest mobility, other sectors demonstrate similar patterns of declining absolute mobility. The primary distinction lies in the tradable sector's mobility, which remained relatively stable before the 1986 income cohort but steadily decreased afterward. In contrast, the non-tradable and partially tradable sectors experience a comparatively lower decline after the 1991 income cohort.

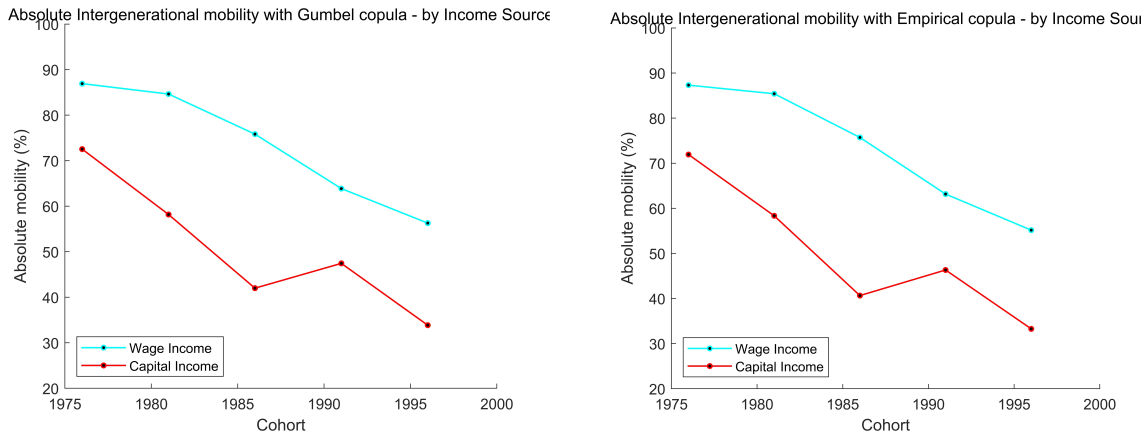
Examining mobility decomposition results, the uneven distribution of wages has a minimal impact on the decline in absolute mobility. However, wealth distribution may be more uneven due to rapid real estate growth and factory relocations. To explore this further, we separate capital and wage income to observe if absolute mobility exhibits similar patterns for both income types.

Figure 17 illustrates that wage income consistently exhibits higher absolute mobility than capital income. This is intuitive since properties and capital like house or dividends are mostly acquired through inheritance, therefore the chance for those whose parents do not have capital income is less likely to have capital income, especially at an early age. Notably, there is a significant decline in capital income mobility observed from the 1981 to 1986 income cohorts, while since 1986, capital income mobility has remained relatively stable at less than 50%. This might be because most capital is held in the elder generation and is more concentrated while young cohorts have fewer chances to have capital in absolute terms (less than 50%). It is important to acknowledge that survey data typically may not precisely capture residents' capital income and could involve substantial deviations. Therefore, the current findings regarding capital income should be regarded as indicative rather than definitive.



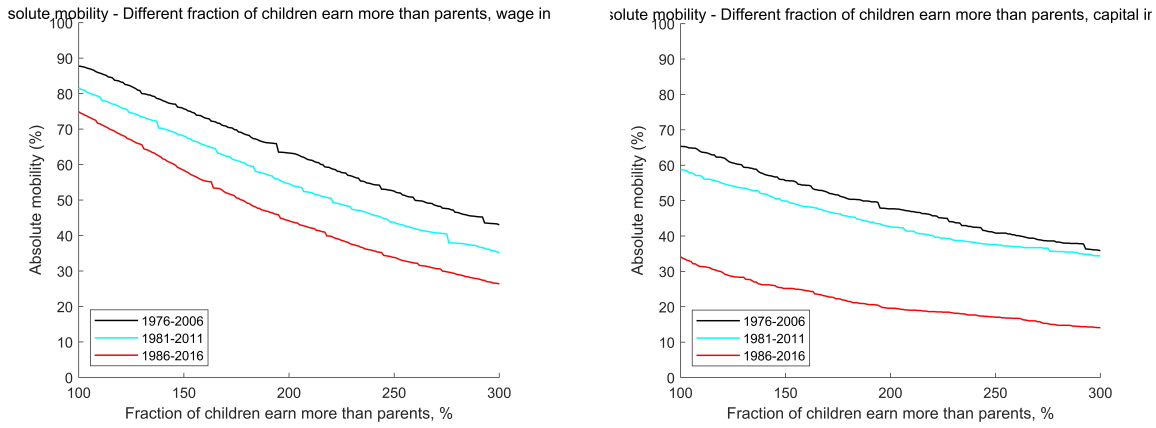
(a) Gumbel copula (b) US copula

Figure 16: The evolution of absolute intergenerational mobility in Hong Kong by tradable industries - second classification criterion



(a) Gumbel copula (b) US copula

Figure 17: The evolution of absolute intergenerational mobility in Hong Kong by income type



(a) Wage (b) Capital

Figure 18: The absolute intergenerational mobility by different fractions of children earn more than parents, by income type

From Figure 18 we can further observe that children who earn a fraction more than their parents are evenly distributed across 100% to 300% for both capital income and wage income. The smooth curve of capital income indicates that when children have capital, they tend to have much more than their parent's generation since the gap between earning 100% and earning 300% more than their parents is 20% or less. In other words, the wealth concentration is severe since greater wealth is concentrated in a few fraction of people. Furthermore, the drop in absolute capital income mobility from the 1981 cohort to the 1986 cohort is even more salient, which might indicate an even sharper increase in wealth concentration during these years.

Moreover, Hong Kong has one of the highest proportions of public housing in the world, which might significantly influences mobility patterns. As shown in Figure 19, the proportion of citizens living in public housing has increased over the years and remains high at around 45%. Therefore, we analyzed absolute mobility separately by housing type to determine if different trends exist for those receiving housing subsidies (relatively poor) compared to those who do not.

As Figure 20 shows, absolute mobility for people living in private housing steadily declined from 80% to 55%. In contrast, citizens in public housing experienced higher absolute mobility at 85% in 1981, as children from poorer families had a greater chance of surpassing their parents' income. However, this mobility declined faster and converged with that of private housing citizens at 60% by 1991. Since then, the absolute mobility for public housing residents has remained stable at 60%, surpassing that of private housing residents again in 1996. The rapid decline from the 1981 to 1991 cohorts may be attributed to the privatization of the housing market following the implementation of the "Sun Jiu Zhao" policy in 2002, which significantly

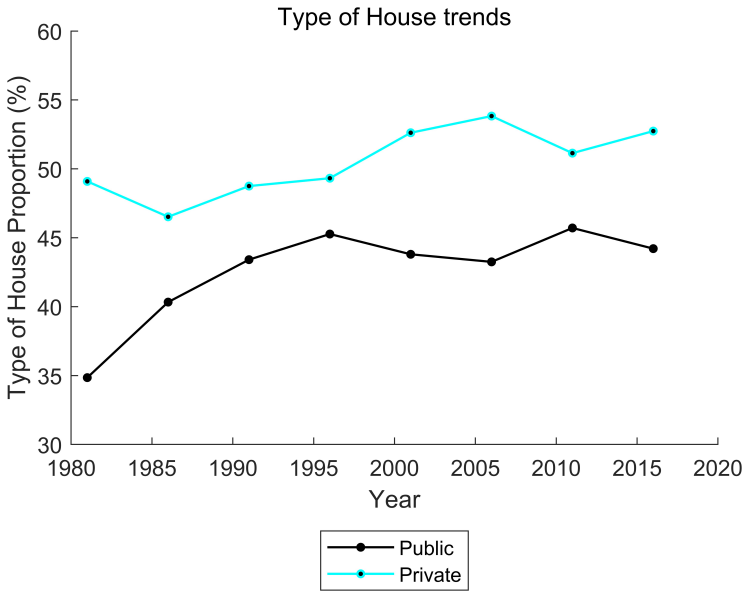


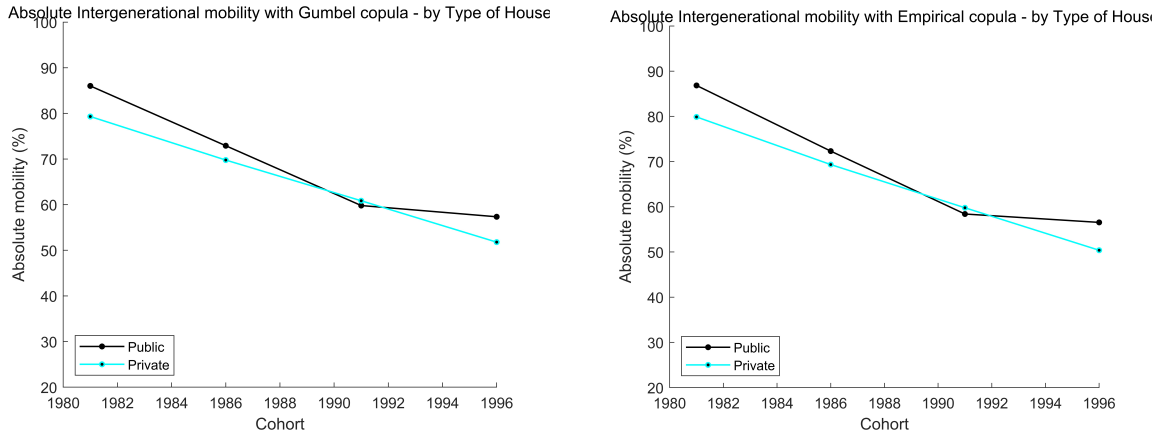
Figure 19: The evolution of each type of house's share in Hong Kong

reduced subsidies for those needing public housing. However, the government's relaunch of the Home Ownership Scheme in 2012 halted the downward trend in absolute mobility. This suggests that public housing policies have a significant impact on the absolute income mobility of public housing residents, while they do not affect those living in private housing.

Moreover, as the proportion of Hong Kong origins and Mainland China origins switch from 1976 to 2016(Figure 21), we also compute the absolute income mobility by the birth of place. No significant different patterns are found between these two groups(Figure 22).

Beyond specific industries, we also examined whether high-level workers experience different patterns of absolute mobility compared to low-level workers. We categorized education into two levels: high-level education, including college, polytechnic, university, and post-graduate, and low-level education, including secondary school and lower (including matriculation in 1976).

Figure 23 shows that the population with high education grew rapidly from 1976 to 2016. Figure 24 reveals that, in earlier years, individuals with high education experienced lower levels of absolute mobility compared to those with low education. This is expected because high-education parents typically earn more, reducing the likelihood that their children will surpass their income. However, the mobility rate for the low-education group declines faster than for the high-education group, converging to the same level for the 1996 income cohort. This convergence may be due to the expansion of higher education, which lowered the income premium for high-education individuals, or the growing income gap between high and low-education groups, making it harder for the low-education group to earn more. The significant increase in absolute



(a) Gumbel copula (b) US copula

Figure 20: The evolution of absolute intergenerational mobility in Hong Kong by type of house

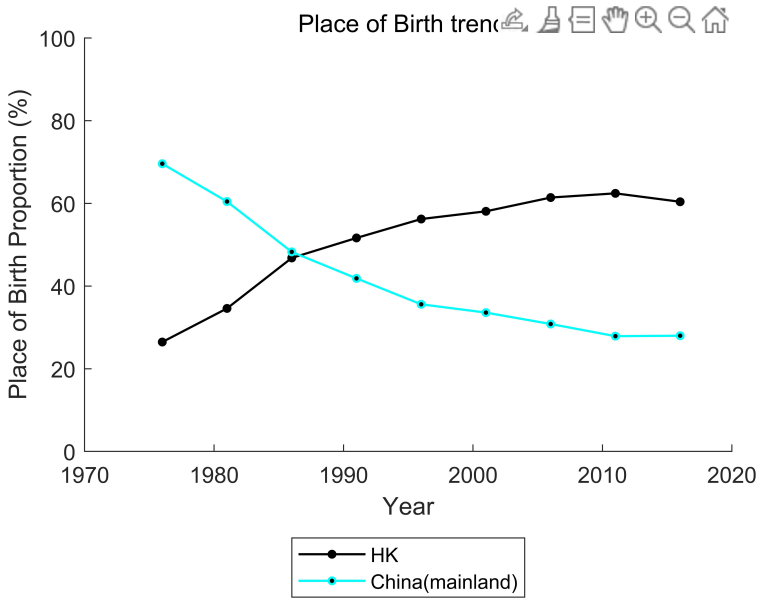
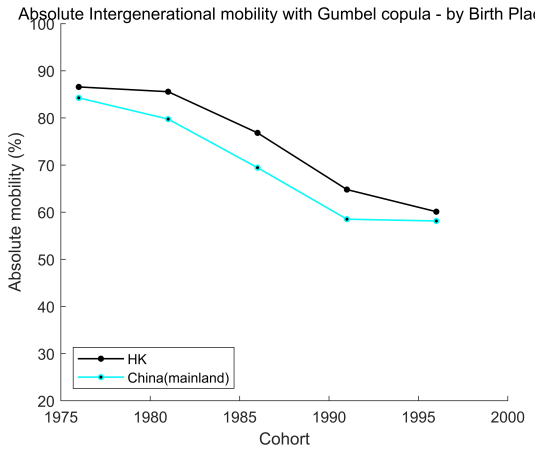
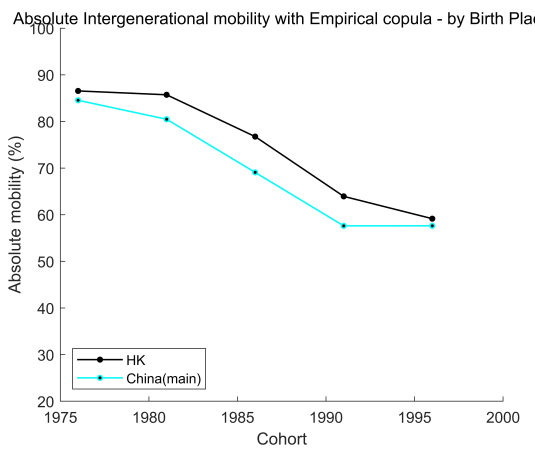


Figure 21: The evolution of each birth of place's share in Hong Kong



(a) Gumbel copula



(b) US copula

Figure 22: The evolution of absolute intergenerational mobility in Hong Kong by place of birth

mobility for the high-education group could be attributed to the initial benefits of educational expansion, which diminish over time as higher education becomes more widespread. Another possibility is the return of education in Hong Kong experienced a significant increase at the beginning of the education expansion, while declined steadily since then.

To address the statement that "Chinese high-end talents dominate Hong Kong's high-end financial and service industries," we examined the interaction between education level and place of birth to determine if there are differences between HK-born and mainland-born high-education populations. As shown in Figure 25, mainland-born individuals with high education exhibit slightly more stable absolute mobility compared to their HK-born counterparts, but the overall trend between the two groups is similar. This stability may be because the education levels of mainland-born immigrants have not been significantly affected by the expansion of Hong Kong's higher education system, thus displaying a slightly different pattern. The observed increase in absolute mobility from the 1991 to 1996 income cohorts could be attributed to the expansion of mainland higher education. If we had a longer data trend, this growth might continue for a few more years.

IV.8 Relative Mobility

Although the calculation of the IGE suffers from potential life-cycle bias without panel data, it's still interesting to obtain relative mobility by leveraging household information to pair the income of fathers and their children in the same year. We focus on individuals aged 25-35 and fathers who are pre-retirement(before 60) to account for potential differences in the reasons for co-residence between younger and older children (co-residence bias). Given that

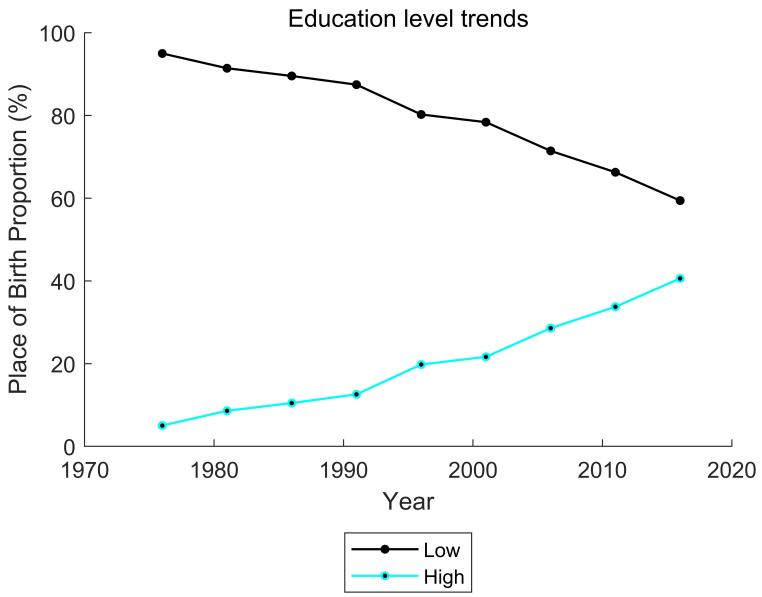
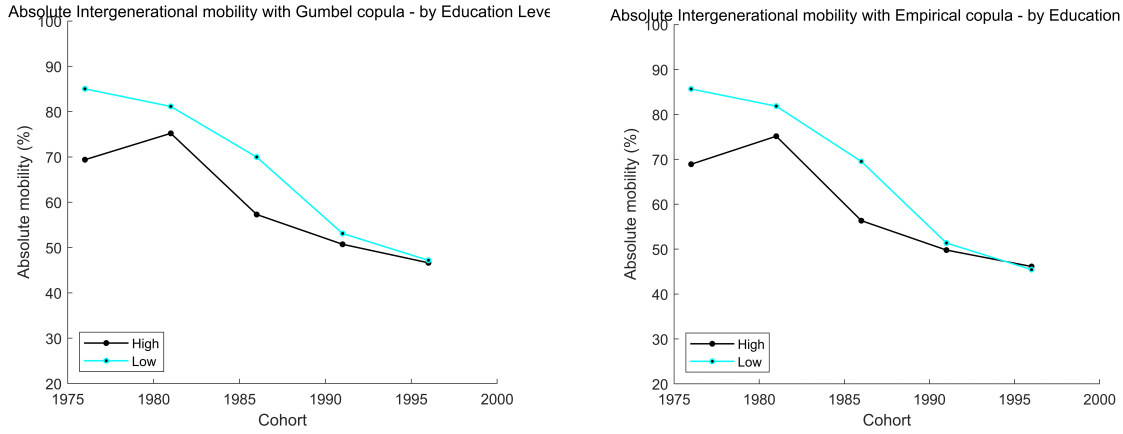


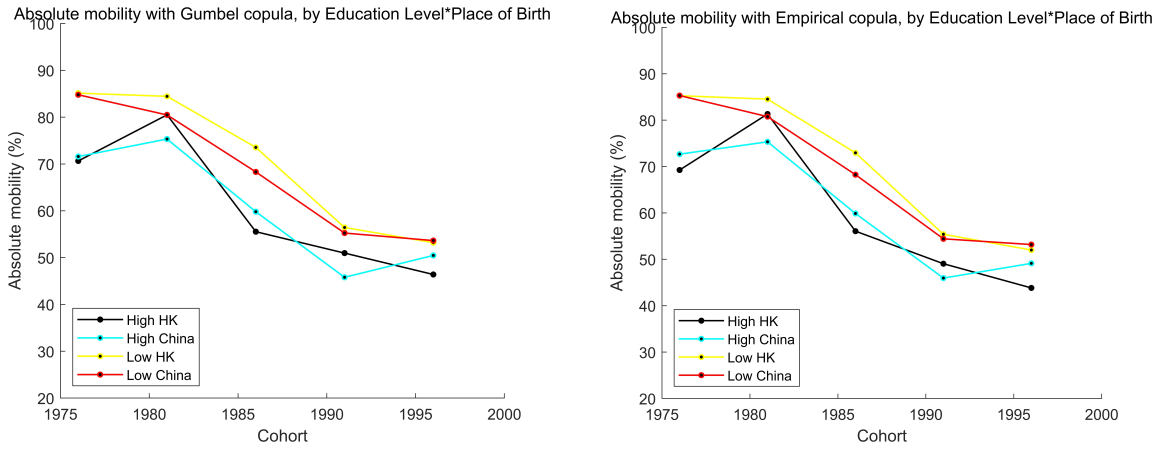
Figure 23: The evolution of each level of education's share in Hong Kong



(a) Gumbel copula

(b) US copula

Figure 24: The evolution of absolute intergenerational mobility in Hong Kong by level of education



(a) Gumbel copula (b) US copula

Figure 25: The evolution of absolute intergenerational mobility in Hong Kong by level of education Place of Birth

more than 70% of young people in Hong Kong co-reside with their parents according to Wu (2023), our sample is highly representative.

The results in Figure 26 display the log-transformed income, normalized by the standard deviation of either father or child income in each respective year. From 1981 to 1996, the intergenerational income elasticity remained relatively stable at approximately 0.19, notably lower compared to other developed economies (Berman, 2022), while similar to western European countries in Manduca et al. (2024). However, this relative mobility increased to a coefficient of 0.11 by 2001 and then remained steady from 2001 to 2016. This finding is surprising as it suggests a high level of intergenerational mobility in Hong Kong, which is only lower than in some Nordic countries(Manduca et al., 2024).

The generally high level of relative mobility found in our analysis, despite some biases, still provides meaningful insights. It indicates that income inequality in Hong Kong has not expanded significantly, which might seem counter-intuitive. It further proves that the sharp decline in absolute mobility is not due to increased inequality but rather to weak economic growth. The high and increasing relative mobility and decreasing absolute mobility level also coincide with Berman (2022); van der Weide et al. (2024)'s finding that the absolute term and the change of relative and absolute mobility are usually the opposite.

V Concluding Discussion

Our census data reveals a clear trend of real wage stagnation in Hong Kong since 2001. The 2006 census data indicates that inflation consistently surpasses or matches wage growth,

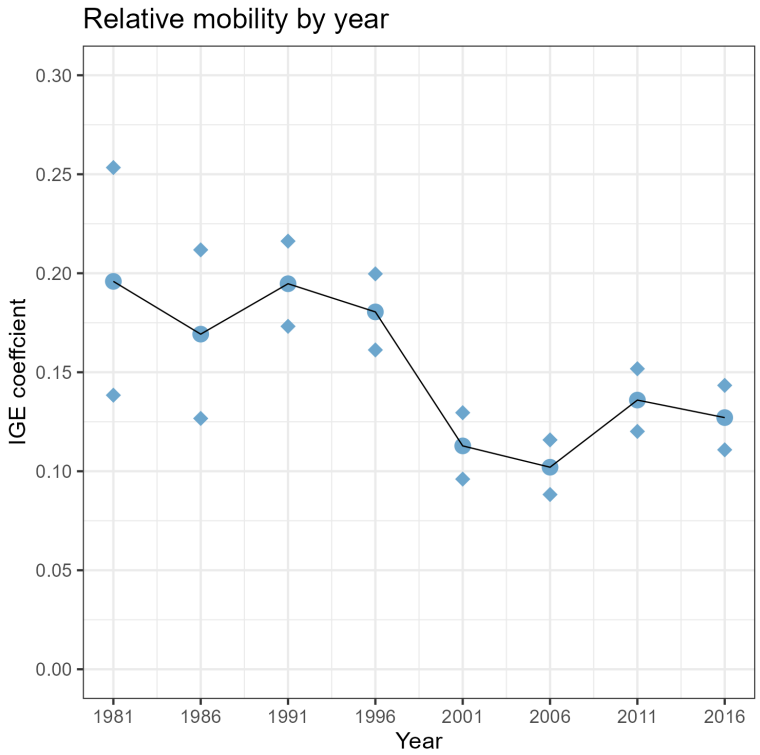


Figure 26: The evolution of relative mobility in Hong Kong

particularly compared to the period before 2001, both in median and average wage terms (Figure 27). Another possible explanation for the decline of absolute income mobility and relevant heterogeneity is the shock from China. Since China's entry into the WTO in 2001, many manufacturing industries have shifted to mainland China, resulting in a decline in jobs and real economic growth in Hong Kong. The city increasingly relies on real estate and finance sectors, which create fewer job opportunities than the manufacturing sector. The influx of highly educated talents from mainland China intensifies competition for jobs, turning the finance-related job market into a zero-sum game. A careful inspection of the relationship between Hong Kong's intergenerational mobility and house price evolution, real estate finance, and return of education is required to better understand the driving force of such declination in future research.

There is a huge literature about the role of China shock in affecting local people's welfare. Nonetheless, few studies are focusing on Hong Kong, presumably because of identification issues within one city on one hand and the data limitation on the other hand. Hsieh and Woo (2005) study how the massive outsourcing from Hong Kong to China starting in the 1980s affects labor markets in Hong Kong using micro-census data from 1971 to 1996. They conclude that the relocation of production from Hong Kong to China in 1980 favored skilled workers and was associated with the rising return to education in Hong Kong. Cheng and Zhang (2018) find that competition from mainland immigrants decreases the earnings of native male workers and the employment ratio of native female workers. The competition from mainland immigrants also may reduce the earnings of female native workers, although the effects are not always statistically significant, which implies the China shock proxied by the flow of immigrants has adverse effects on the local labor markets in Hong Kong. Interestingly, the effects of China shock not only appear in the labor markets but also in the marriage market in Hong Kong. **?** find that cross-border marriages between mainland China and Hong Kong decrease the bargaining power of female natives in Hong Kong and therefore deteriorate the relative position of women in Hong Kong both in the marriage market and within the household. Piketty and Yang (2022) document a rapid rise in income inequality in Hong Kong during the period 1981-2020 and argue that the alliance between the Hong Kong government and business elites, which the Chinese government endorses, is the deep-rooted deterministic factor of Hong Kong's rising inequality. Through the channels above, the China shock will affect intergenerational mobility in Hong Kong ultimately.

Another perspective involves the stagnation of higher-level education in Hong Kong. According to Marginson (2018), East Asian economies, including Hong Kong, witnessed rapid expansion followed by recent stagnation. As wage stagnation set in earlier, many young Hong Kong students discovered their real income lagging behind their similarly educated seniors.

Therefore, a comparison of education mobility with other countries according to van der Weide et al. (2024) is performed to replenish our study of mobility instead of income. This includes both relative mobility and absolute mobility given that the education level in our cross-sectional data does not suffer from life-cycle bias. The absolute educational mobility largely increased from 1981 to 1986 and has stabilized since then, due to the large educational expansion in the 1980s. The level is very similar to other Asian economies which ranks the highest worldwide. While the relative educational mobility increases from 1981 to 1991 it declines to the 1981 level then, while is still one of the highest worldwide. Such a result indicates Hong Kong's educational mobility, either in relative terms or absolute terms, is quite high compared to others. (see Appendix A).

In conclusion, Hong Kong's intergenerational absolute mobility experienced a sharp decline from 1976 to 1996, from around 85% to 55%. Such declines could mostly be attributed to the stagnation of Hong Kong's income growth rather than the uneven income distribution. Such decline is evenly distributed to any fraction of children who earn more than their parents from 100% to 300%. The result is that relative mobility increases through the observation year further indicating that income distribution inequality is not the driving force for Hong Kong's absolute mobility decline.

Firstly, our research is based on the Chetty et al. (2017)'s copula and margins method and Berman (2022)'s empirical method to handle cross-sectional non-retrospective Hong Kong data. Our usage of synthetic and empirical copula yields similar and robust results, further justifying the validity of the copula method. We also solved two potential issues that Berman (2022)'s method suffers. According to Manduca et al. (2024), we first utilized the micro survey data instead of data generated from the WID, which proved to be a more reliable data source. Secondly, besides the entire population, we measure the income of both parents and children in a specific age, from 30 to 50, to ensure our result is more representative of a specific cohort. An interesting result is that the results do not differ much across different birth cohorts as long as the data is chosen from the same year.

Secondly, in an international view, Hong Kong's evolution of income mobility is mostly similar to Japan's among the developed economies. The speed of decline is very sharp in both Japan and Hong Kong while Hong Kong's absolute mobility declined 15 to 20 years later than Japan's. It is even later than the decline of Western Europe and further than the United States, while faster than them.

Thirdly, we explore the heterogeneity of the absolute mobility result. The decline of absolute mobility is sharper in the manufacturing and service sectors, while is more moderate in the financial sector. The speed of decline is similar in the tradable and non-tradable sectors while the mobility rate in the non-tradable sector is always lower, mostly due to the low mobility rate

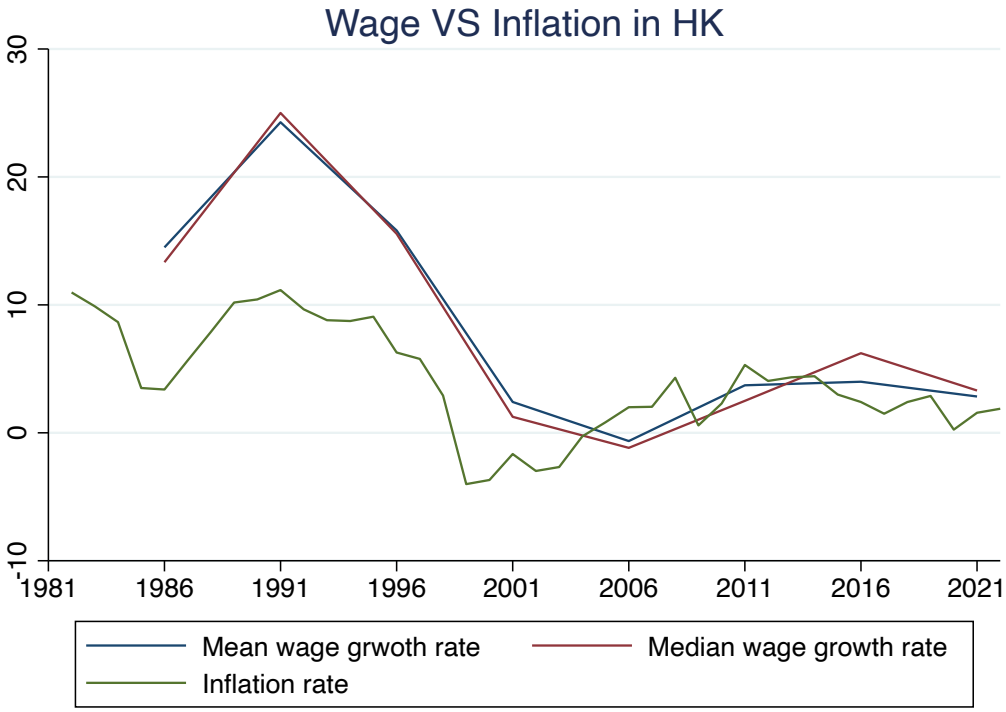


Figure 27: The wage growth rate and inflation growth rate in Hong Kong

of the service sector. The absolute mobility rate is much lower for capital income compared to wage income and has stabilized since 1986 at around 40%. In terms of education and place of birth, we found that the mobility rate of the high-education population was lower than the low-education group in 1976, while it declined more slowly and the two groups converged in 1996. In contrast, Hong Kong-born and mainland-born origins do not influence too much on the result, with mainland-born Chinese having less absolute mobility across years.

Our research pioneer calculates the intergenerational income mobility in Hong Kong under non-panel data. The current unoptimistic absolute mobility situation seems a very critical issue even though the income distribution is not very unequal. We believe that more attention is needed to focus on absolute and relative mobility for Hong Kong's continued prosperity and stability.

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Appendices

A Top-coded Technical

As wage income in the census from 1976 to 2016 is top-coded, it will generate a downward bias at the top of the wage distribution. We then correct the observations with top-coded income, assuming that the top of the wage distribution follows a Pareto distribution.

$$F(x) = 1 - (\frac{c}{x})^{\alpha}, for x > c > 0 \tag{6}$$

A property that characterizes the Pareto distribution is that the average income of individuals above any income threshold, divided by that threshold, is constant and equal to the inverted Pareto coefficient $b = \alpha/(1-\alpha)$. Using the observations near the top-coding threshold, we can estimate the inverted Pareto coefficient $\hat{b}$ (see Blanchet et al. (2018, 2022)). Figure A1 presents the log (wage) and its fitted value in the range between the top 1% and top 0.35% wage earners in 2016. By applying the estimated inverted Pareto coefficient $\hat{b}$ to the threshold, we can estimate the average wage for the observations above the top-coding threshold and assign the average wage to each observation. Finally, we estimate the wage distributional series based on the top-coding-corrected survey.

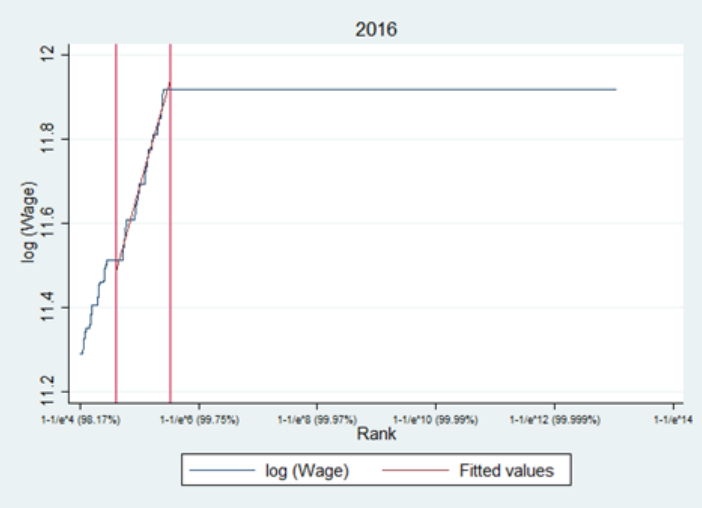

Figure A1: Estimating the Inverted Pareto Coefficient $\hat{b}$

B Educational Mobility

Figure B1 shows absolute educational mobility, calculated as the percentage of individuals attaining a higher educational level than their parents(Max education of parents). Educational levels are defined according to van der Weide et al. (2024) and categorized into five levels based on the International Standard Classification of Education (ISCED): (i) less than primary (ISCED 0), (ii) primary (ISCED 1), (iii) lower secondary (ISCED 2), (iv) upper secondary or postsecondary non-tertiary (ISCED 3–4), and (v) tertiary (ISCED 5–8). Parents with tertiary education are excluded because their children cannot achieve upward mobility beyond this level. Therefore, absolute educational mobility is calculated for children whose parents fall into the lower four education categories. We use co-residence data, selecting children aged 21 to 25 who live with their parents, to minimize co-residence bias, as in van der Weide et al. (2024). The results indicate that absolute educational mobility increased from 0.77 in 1981 to around 0.85 in 1986 and has since stabilized.

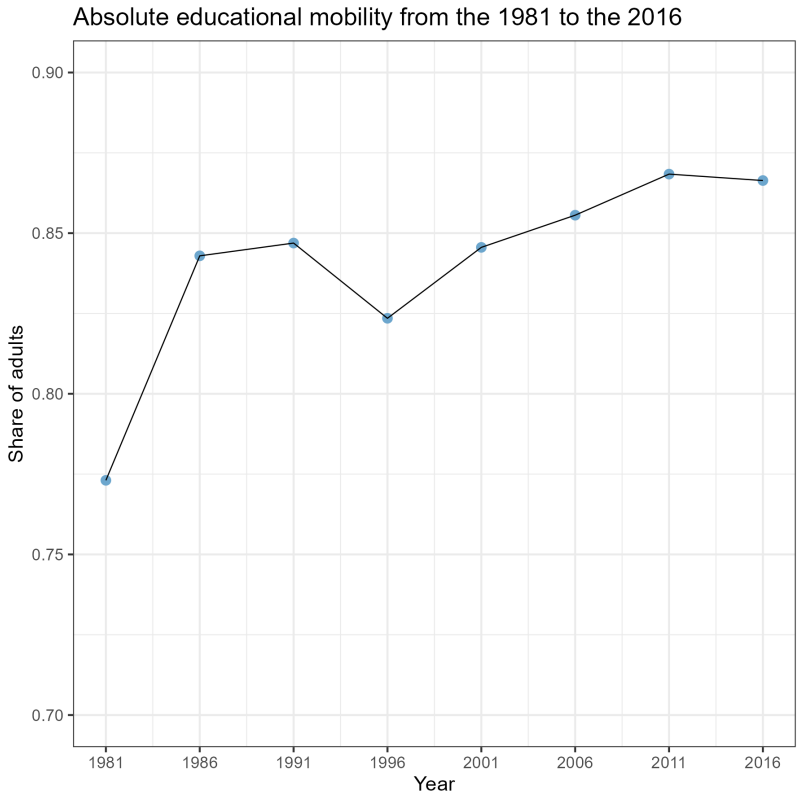

Figure B1: Absolute educational mobility from 1981 to 2016

Figure B2 depicts absolute mobility relative to the education level of parents. As expected, upward mobility decreases from nearly 100% at the less-than-primary level to 0% at the tertiary level. The five colored lines represent data from 1981 to 2016. The most notable change occurred between 2001 and 2011, where absolute mobility significantly decreased for children of parents with upper secondary education while continuously increasing for those with parents at the primary or lower secondary levels.

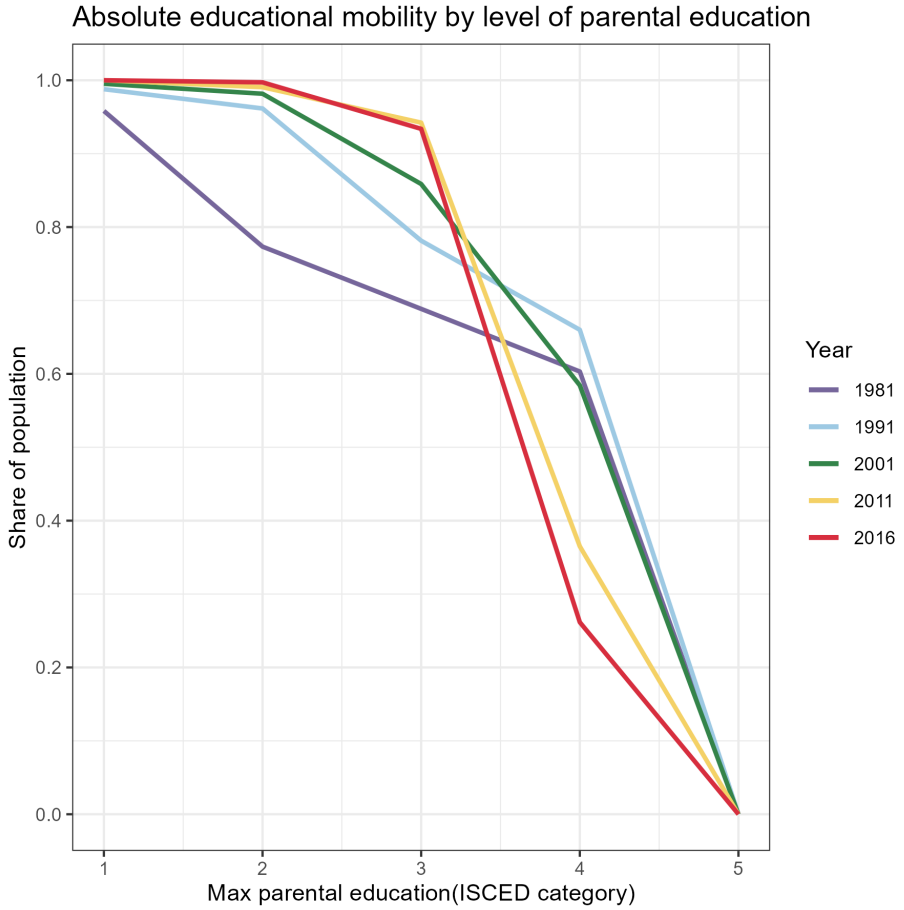

Figure B2: Absolute educational mobility by level of parental education

Figure B3 shows the trend in average relative educational mobility, measured by $1 - \beta$, where β is the correlation coefficient between parents' and children's years of education. Since direct measures of years of education are unavailable, we used the extrapolation method from van der Weide et al. (2024), which maps years of education to ISCED categories as follows: ISCED 1: 6 years; ISCED 2: 9 years; ISCED 3: 12 years; ISCED 4: 13 years; ISCED 5: 15 years; ISCED 6: 16 years; ISCED 7: 18 years; ISCED 8: 21 years. Relative mobility increased from 1981 to 1991, declined back to the 1981 level by 2011, and has stabilized since then.

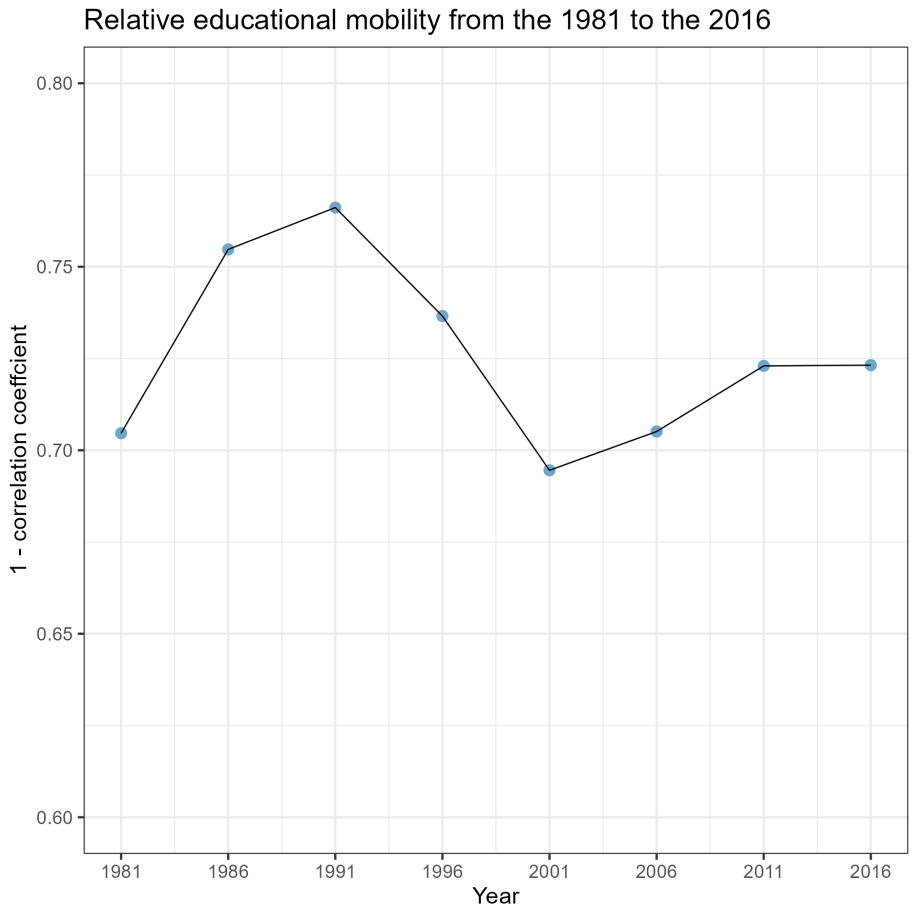

Figure B3: Relative educational mobility from 1981 to 2016