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The Taller the Ladder, the Tougher the Climb?

Essays on the Impact of Income Inequality on Intergenerational Mobility

Erik Liss

LINKÖPING UNIVERSITY

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Essays on the Impact of Income Inequality on Intergenerational Mobility

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POPULÄRVETENSKAPLIG SAMMANFATTNING

Studiet av inkomstojämlikhet har en lång historia inom nationalekonomi och andra samhällsvetenskaper. Mer nyligen har en växande mängd litteratur undersökt intergenerationell inkomstmobilitet, dels för att studera i vilken mån inkomstskillnader består mellan generationer, men också för att undersöka om samhället lyckas ta till vara förmågorna från alla samhällsskikt. Denna avhandling utforskar sambandet mellan inkomstojämlikhet och intergenerationell inkomströrlighet.

Artikel 1 undersöker hur relativ inkomströrlighet påverkas av inkomstojämlikhet mellan regioner inom Sverige. Relativ inkomströrlighet mäter rörlighet som ett nollsummespel där en resa uppåt för någon från lägre socioekonomisk bakgrund innebär en resa nedåt för någon med relativt rikare föräldrar. Studien visar att regionala inkomstskillnader består över generationer, främst på grund av bestående skillnader i individers humankapital mellan olika regioner, vilket resulterar i minskad inkomstmobilitet på aggregerad nivå.

I motsats till relativ mobilitet mäter absolut mobilitet huruvida individer får det bättre i reell levnadsstandard jämfört med sina föräldrar, oavsett om detta innebär att de får en bättre relativ position i inkomstfördelningen jämfört med sina föräldrar. Artikel 2 visar att Sverige har hög absolut rörlighet jämfört med de flesta jämförbara länder. En ny dekomponeringsmetod visar att detta beror på Sveriges generellt låga inkomstojämlikhet.

Artikel 3 utforskar hur utbildning potentiellt kan öka inkomströrligheten i samhället. Detta görs genom att undersöka de kausala effekterna av en svensk lärarstrejk 1989 som ledde till skolstängningar. Artikeln visar att strejken hade negativa effekter på skolresultat och drabbade elevers framtida inkomster. Dessa negativa effekter var dessutom större för individer från lägre socioekonomisk bakgrund, vilket innebär att strejken ledde till minskad inkomströrlighet.

Sammanfattningsvis ger denna avhandling både empiriska och metodologiska bidrag till hur vi kan förstå relationen mellan inkomstojämlikhet och intergenerationell inkomströrlighet.

ABSTRACT

The study of income inequality has a rich history within economics and various social sciences. More recently, a growing body of literature has examined intergenerational income mobility to understand not only equality of opportunities but also whether the labor market allocation successfully utilizes the potential abilities from all social strata. This dissertation explores the intricate relationship between income inequality and intergenerational mobility through three distinct research articles.

If we envision the income distribution as a ladder, income inequality can be likened to the relative distance between the ladder's rungs, where greater inequality corresponds to a more stretched-out ladder. Income mobility, on the other hand, is a much more multifaceted concept. The most common way of measuring it is relative mobility, which tries to quantify the mobility between the rungs of the ladder, where an upward jump for one born poor necessarily implies a downward shift for one born richer.

Article 1 studies how relative mobility is affected by income inequality across regions within Sweden. If there are substantial income differences across regions within countries that persist across generations, this will contribute to a more stretched-out ladder, potentially making mobility more difficult. The study demonstrates that these regional income disparities persist across generations, resulting in decreased income mobility. The article then proceeds to examine whether migration patterns between richer and poorer regions mitigate or exacerbate this effect.

In contrast to relative mobility, absolute mobility measures if children end up being better off in the standard of living compared to their parents, regardless of whether they manage to climb to a higher rung on the ladder compared to their parents. Article 2 delves into examining the trend in absolute income mobility for Sweden, measured as the percentage of children earning more than their parents. The novel decomposition method reveals that Sweden has a high level of absolute mobility mainly due to the low level of income inequality.

Article 3 explores the potential of public education to mitigate inequities by examining the causal effects of a 1989 Swedish teacher strike that caused school closures. The article reveals that the strike had both negative short-run effects, measured as student results, and long-run effects, measured as earnings, and the effects were larger for individuals from low-income backgrounds.

In summary, this dissertation provides both empirical and methodological contributions to the intricate relationship between inequality and mobility.

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Embarking on the journey of pursuing a PhD is a great honor. I am fortunate not only to have been given the chance to undertake this challenge, but also to explore a topic that has intrigued me since long before I started studying at university. Doing a PhD is demanding, so I really mean it when I say that this wouldn't have been possible without the generous support of many individuals.

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Stockholm, November 2023

Erik Liss

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1 Introduction

Intergenerational income mobility is crucial for both society and individuals to realize their full potential, underscoring its intrinsic relevance within economic research. While social mobility in general and income mobility in particular has attracted increasing interest in economics (Piketty, 2000; Jäntti and Jenkins, 2015), studying persistence between social and economic status hierarchies has a longer tradition in sociology (Lipset, 1966; Erikson and Goldthorpe, 1992). Income mobility signifies that individuals are not overly constrained by their origins but have the potential to carve out their own life paths. When certain groups are barred from full participation in society or the labor market, there will be no avenues for upward mobility, resulting in low income mobility. Additionally, income mobility serves as an indicator of a society's meritocracy, reflecting how effectively it harnesses its talent pool. It also holds a significant dimension of fairness, as the absence of income mobility can be interpreted as indicative of prevalent corruption, nepotism, and inequality of opportunity (Roemer, 1998; Wooldridge, 2021).

Income mobility is frequently connected to the more extensive research field of income inequality (Corak, 2013). If a significant number of individuals move from lower to higher income levels, and if wealth is mainly earned through effort, risk-taking, education, or entrepreneurship rather than being based on privilege or individual origins, it could be argued that income inequality is not so worrisome for a society. Some of the most upwardly mobile individuals (for example successful entrepreneurs) cause higher inequality through their substantial wealth, but at the same time they also arguably drive economic growth, ultimately benefiting society (Aghion et al., 2017, 2019). From this perspective, inequality could be viewed as a byproduct of income mobility, entrepreneurship, and innovation.

However, the potential trade-off between either income equality or income mobility is revealed as a false premise when looking at most of both the theoretical (Becker and Tomes, 1979) and empirical literatures (Corak, 2013), which have mostly emphasized that lower income inequality is associated with higher income mobility. The fundamental theoretical idea is that a more equitable distribution of incomes results in a fairer playing field, and thus to higher income mobility (Durlauf et al., 2022).

The title of this dissertation—*The Taller the Ladder, the Tougher the Climb*—alludes to this

process. If we imagine the income distribution as a ladder, income inequality can be compared to the relative distance between its "rungs", with greater inequality reflecting a more elongated ladder. While income mobility can be defined and measured in various ways, using the same metaphor, one can conceptualize income mobility as the extent to which individuals move between the rungs of the ladder. Consequently, in more unequal societies, the ladder is taller, making its ascent more challenging and resulting in lower income mobility.

This dissertation explores some specific aspects of the intricate relationship between income inequality and intergenerational mobility through three distinct research articles. It is not intended to substitute the overarching frameworks commonly employed to comprehend this relationship, such as the Becker and Tomes (1979) model, and nor is it an attempt to delineate a comprehensive casual relationship between income inequality and mobility. Instead, I seek to shed light on a few central processes within this relationship.

Below, I summarize the articles before outlining the structure of this introductory chapter. The aim of the introductory chapter is to provide context for the papers, explain some of the most important concepts used in the papers, and summarize the overall contribution of the dissertation. The goal is to ensure that everyone interested in this topic should be able to grasp the content.

Article 1 studies how relative intergenerational income mobility (the most common indicator for income mobility) is affected by income inequality across regions within Sweden. The key idea of the paper is that if there are substantial income differences across regions within countries that persist across generations, this will contribute to such "stretching out the ladder," using the aforementioned analogy, and potentially making mobility more difficult. The study demonstrates that regional income disparities do persist across generations, resulting in decreased income mobility. The article then examines whether migration patterns between richer and poorer regions mitigate or exacerbate this effect.

Relative mobility quantifies the degree to which individuals move between the ladder's "rungs." In contrast, absolute mobility measures whether children attain a better standard of living compared to their parents, regardless of whether they manage to reach a higher rung than their parents did. Article 2 delves into examining the trend in absolute income mobility for Sweden, measured as the percentage of children earning more than their parents. The novel decomposition method reveals that Sweden has a high level of absolute mobility, mainly due to the country's low level of income inequality.

Article 3 explores the potential of public education to mitigate inequities by examining the causal effects of a 1989 Swedish teacher strike that caused school closures. The article reveals that the strike had both negative short-run effects measured as school results and negative long-run effects measured as earnings. Further, the negative effects were larger for individuals from low-income backgrounds, causing declining intergenerational income mobility.

The introductory chapter is structured as follows. First, I explore the historical development of measuring income inequality and discuss the appropriate use of different measures. Second, I delve into the two primary measures of income mobility employed in this dissertation and in

mobility research more broadly—namely, relative and absolute mobility. Various measures are used for both income inequality and income mobility in both this dissertation and the broader economics literature—sometimes without clear justification for the choice made in a particular case. A clear overview of these concepts is therefore needed. Third, I review the theoretical and empirical literature on the relationship between income inequality and intergenerational mobility. Lastly, I provide a summary of the contribution to this literature made by this thesis.

1 Conceptualizing Inequality and Mobility

To be sure, *income inequality* and *income mobility* are not entirely distinct concepts, as incomes can vary for individuals even within short time frames. Using annual incomes to gauge income inequality may overlook the mobility between individuals occurring over a year. The "movies versus snapshots" debate underscores this challenge, revolving around the issues with analyzing dynamic, lifetime income trajectories ("movies") as opposed to static, cross-sectional images of income distribution ("snapshots") (Hart, 1976; Kanbur and Stiglitz, 1986). The permanent income hypothesis deals with the same issue, asserting that consumption and, ultimately, economic welfare are influenced by the permanent expectation of income rather than income in a specific year (Friedman, 1957). Consequently, fluctuations in income over a few years can be viewed as a form of measurement error (Mazumder, 2005; Torche, 2015; Engzell and Hällsten, 2022).

This perspective is consistently applied throughout this dissertation, where lifetime income serves as a proxy for measuring both income inequality and for intergenerational income mobility. The ultimate objects of study are therefore inequality of lifetime income and the extent to which lifetime income is transmitted across generations. The following sections will delve into a more detailed examination of how to measure these concepts and outline when each measurement proves more effective.

1.1 The Historical Development of Studying Income Inequality

The chosen metrics that researchers use to measure income inequality or income mobility are the result of continuous methodological improvement, but also due to historical circumstances and path dependency. I will therefore use a chronological organisation for introducing the main concepts and measures used. Income inequality has been studied in economics for a longer time than income mobility. The most likely reason is that it was not until the end of the 20th century that data sets emerged that allowed for income mobility to be genuinely studied. To study intergenerational income mobility, one should ideally not only have data on incomes for two generations, but also be able to link parents to their children. This latter requirement does not apply to studying income inequality. To be sure, studying income inequality was also long held back by data limitations, since comprehensive population data on household or individual income was scarce and often incomplete. As Piketty (2014, p. 16) notes: "Malthus, Ricardo, Marx, and many others had been talking about inequalities for decades without citing any sources whatsoever

or any methods for comparing one era with another or deciding between competing hypotheses."

The collection of taxes allowed for the creation of tabulated data on the number of individuals in different income brackets, and Wolf (1892) carried out an early analysis measuring income inequality based on these crude tables. Using similar data, Lorenz (1905) developed a graphical method that studied income inequality by transforming the income for each bracket to the cumulative income share of the population from lowest to highest. Figure 1 shows how the Lorenz curve is visually presented. The larger the lens between the perfect equality line and the Lorenz curve (denoted as area A in the figure), the greater the inequality. This method of measuring income inequality has proven to be very flexible and useful, and is still used today (Jenkins and Van Kerm, 2008).

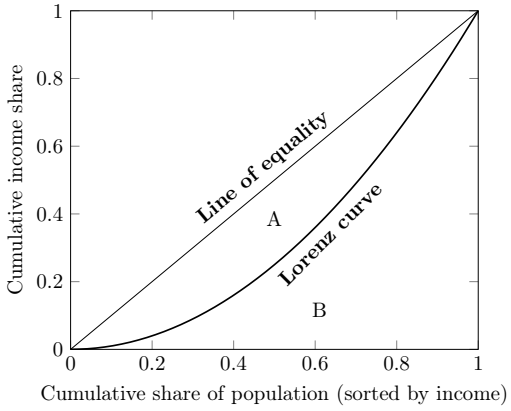

Figure 1: Depiction of a Lorenz Curve

However, data limitations made it difficult to generate Lorenz curves across countries or over time. Over half a century later, Simon Kuznets, in his 1955 examination of the trajectory of U.S. income inequality, candidly remarked of his own paper, "[T]he paper is perhaps 5 per cent empirical information and 95 percent speculation, some of it possibly tainted by wishful thinking." (Kuznets 1955, p.26). Indeed, later works have argued that the data Kuznets used may have underestimated inequality (Piketty and Saez, 2003), but some of his paper's conclusions have still formed important building blocks in understanding trends in income inequality (Milanovic, 2016).

Perhaps the most famous of these "speculations" is that the trend in income inequality follows an inverted U-shaped curve during a country's industrialization. The theory suggests that inequality is initially low in pre-industrial societies when general production output is very low, before increasing as economic progress spreads to some individuals and regions more rapidly than others, particularly creating a gap between urban and rural areas. However, once industrialization and urbanization are complete, these internal differences diminish, leading to an overall reduction in inequality.

The increased accessibility of income data in recent decades has significantly improved researchers' capacity to assess income inequality, but has also revealed some of the associated challenges, leading to substantial methodological advancements. This has resulted in various proposed metrics of inequality and insights into the circumstances in which they should be applied. The following section delves into this discussion.

1.2 Choosing an Inequality Measure

One obvious candidate for measuring income inequality would simply be to calculate the variance in income, or the standard deviation of income. The variance is the expected value of the squared deviation from the mean income, and the standard deviation is then the square root of the variance. The development of inequality measures, however, has revealed these measures to be flawed. When selecting from various inequality measures, one can assess them based on their properties (Jenkins and Van Kerm, 2008; Cowell, 2011). Some of these were already mentioned by Lorenz (1905) but were subsequently developed more rigorously, especially by Dalton (1920) but also by Pigou (1912). They were then rediscovered in the 1970s (Atkinson et al., 1970; Bourguignon, 1979; Atkinson and Brandolini, 2015).

First, an inequality measure (or inequality index) should have symmetry (or anonymity). If two people switch incomes, the index level should not change. Next, the measure should be population invariant. If the population is replicated or "cloned" once or more, the inequality index level not change. A larger country should not have higher inequality just because it is more populous. The variance of incomes, meets both of these first two criteria.

Next, an inequality measure should be scale invariant (or mean independent). If all incomes are scaled up or down by a common factor (for example, doubled), the index level should not change. Variance of incomes fails this criterion: doubling all incomes will not only increase the mean, but also its variance. One solution has been to divide the variance by the mean income, which yields another inequality measure, *the coefficient of variation*. Another solution is to transform incomes into log incomes and calculate the variance of logarithms (Cowell, 2011).

The last criterion is that an inequality measure should be fulfill the *transfer principle*, or *the Pigou-Dalton Transfer Principle* (Dalton, 1920; Pigou, 1912; Bourguignon, 1979). If income is transferred from one person to another who is richer, the index level should increase. In other words, in the face of a regressive transfer, the index level must rise. The coefficient of variation does not distinguish where in the distribution this transfer occurs, so a 100€ transfer from someone at the very top to another also in the top of the income distribution but slightly lower yields the same change to the coefficient of variation as if this transfer went to someone in the bottom of the distribution (Cowell, 2011). This leads to misleading results, as a transfer within the highest income bracket typically alters the relative income between two individuals by likely less than a percent. However, the same transfer to the lowest income bracket could result in someone doubling their income, causing a significant change in relative incomes between the top and bottom. Thus, the coefficient of variation is too sensitive to changes in the top of the distribution.

Variance of logarithms could be said to suffer from the opposite problem, being too sensitive to changes to the lower part of the distribution. In some cases this can even lead to undesired results. According to the Pigou-Dalton Transfer Principle, a transfer between two individuals, one richer and one relatively poorer, should lead to inequality decreasing. While this generally is the case for the variance of logarithms, if the transfer happens between two individuals at the top of the distributing, both above 2.7 of mean income, it leads to the exact opposite, such that the variance of logarithms increases. (Cowell, 2011).

To address this, many other inequality measures that fulfills all the criteria above have been developed, such as the *Theil Index* and the *Atkinson Index*, both of which are part of the *General Entropy Index* family (Theil, 1967; Atkinson et al., 1970; Shorrocks, 1980). Perhaps the most famous of all measures of income inequality is the Gini coefficient, which was developed as early as 1912 by Corrado Gini (1912). Following from the Lorenz curve, the Gini coefficient measures income inequality on a scale from 0 to 1, where 0 is perfect equality and 1 is a single person receiving all the income. The Gini coefficient can be calculated using the Lorenz curve as the share of area A of the whole area under the perfect equality line (A+B in Figure 1). More generally, the Gini coefficient can be computed as the covariance within a population between an individual's income (Y) and their income rank (R), where ranks range from the lowest to the highest. This is multiplied by the fraction between 2 and the mean income $\bar{Y}$ (Lerman and Yitzhaki, 1989):

$$\text{Gini Coefficient} = \frac{2}{\bar{Y}} \times COV(Y_i, R_i) \tag{1}$$

The Gini coefficient offers several advantages. First, its connection to the Lorenz Curve and the fact that it ranges from 0 to 1 makes it simple and intuitive. Second, it has a widespread familiarity among researchers, policymakers, and the general public. This also means that estimates for countries, regions, and time periods are already available, facilitating comparative analysis. In this dissertation I use the Gini coefficient extensively, primarily when the purpose is to give a descriptive overview of aggregated inequality for a population.

However, the Gini coefficient has two main limitations. First, while it is compliant with all the criteria previously mentioned, it assigns a strong weighting to income differences in the middle of the distribution (Cowell, 2011). In contrast, the *General Entropy Index* mentioned above is more flexible in that it allows for different weightings to be placed on different parts of the distribution.

Second, it is not possible to decompose the Gini coefficient it into subgroups (Bourguignon, 1979). For instance, if one aims to examine the extent to which income inequality within and between groups of men and women contributes to a nation's overall income inequality, the Gini coefficient is of no help.

1.3 Towards a More Empirical Approach

Despite certain limitations of the Gini coefficient, it continues to be widely employed, and using it is appropriate as long as one is mindful of these constraints. The same also applies to the variance of logarithms, which—notwithstanding its non-compliance with the Pigou-Dalton Transfer Principle—remains the most popular measure of income inequality in labor economics (Atkinson and Brandolini, 2015). This is because it follows naturally from models of wage determination such as the Mincer model and facilitates decomposition into variables or subgroups (Mincer, 1974). The increasing empirical focus in economics and other social sciences from the 1980s onwards has propelled the usage of similar models to explain differences in earnings, and thus the determinants of income inequality. To show this, we can write a simplified version of the Mincer regression:

$$\ln(W_i) = \beta_0 + \beta_1 \mathrm{S}_i + \beta_2 \mathrm{X}_i + \epsilon_i \tag{2}$$

Where $\ln(W_i)$ is log earnings for individual i with S years of schooling and X years of work experience. By estimating β_1 and β_2, the regression helps explain how education and experience determine wage income, which has made it into "the 'workhorse' of empirical research on earnings determination" (Lemieux 2006, p. 2).

Thus, the advantage of measuring income inequality as the variance of logarithm is that we can use the variables in the Mincer regression, or any regression with log income as the outcome variable, to explain how much each variable contributes to income inequality. Assuming that the error term ϵ_i is orthogonal to schooling and experience, we can write the variance of logarithm as:

$$\mathrm{Var}(\ln(W)) = \beta_1^2 \mathrm{Var}(\mathrm{S}) + \beta_2^2 \mathrm{Var}(\mathrm{X}) + 2\beta_1\beta_2 \mathrm{Cov}(\mathrm{S}, \mathrm{X}) + \mathrm{Var}(\epsilon) \tag{3}$$

The variance of logarithm of income $\mathrm{Var}(\ln(W))$ is explained by squared β_1 and β_2, each respectively multiplied by the variance of years of schooling S and years of work experience X. If Schooling and work experience are highly correlated this further increases income inequality, captured by the term $2\beta_1\beta_2\mathrm{Cov}(\mathrm{S}, \mathrm{X})$. Lastly, the variance of the error term $\mathrm{Var}(\epsilon)$ captures all the income variance not explained by the model. Thus, the advantage of the variance of logarithm is that it connects directly to the regression-based framework on which most modern science rests.

As is outlined in the next section, this empirical approach is also the most common way to measure intergenerational income mobility. Just as I used years of schooling and years of work experience to explain earnings above, so one can instead use parents' earnings to explain the earnings of the child.

2 Measuring Income Mobility

The methodological development of intergenerational income mobility is, in many aspects, still in progress (Deutscher and Mazumder, 2023; Corak, 2020). Income mobility is more complex than

income inequality in that the latter is a more static concept that let's itself to being descriptively summarized. Of course, one could argue that a merely descriptive measure of income dispersion is not enough for inequality to be meaningful as a concept (Sen, 1995). But inequality typically refers simply to the *structure* within which individuals are distributed, while mobility involves analyzing the *process* through which this particular structure came to be in place (Treiman, 1970).

There is also some ambiguity over what exactly income mobility should capture. This has led to a crucial distinction being drawn between *absolute* and *relative* mobility. Returning to the analogy of income distribution as a ladder, relative mobility tries to quantify mobility between the "rungs," where an upward step for one born poor necessarily implies a downward shift for another who is born richer.[1]

Of course, relative intergenerational income mobility is just one of many approaches studying how family background affects relative income and other outcomes. Researchers have also rather than estimating how incomes co-varies across parents and children, instead studied how they co-vary across siblings, or even twin siblings to more accurately separate the effects of genetic factors from environment factors (Björklund et al., 2002; Solon et al., 1991).

In contrast to relative mobility, absolute mobility measures whether children end up being better off in terms of standard of living compared to their parents (Chetty et al., 2017). Thus, if economic growth is high, it means that the entire ladder is elevated over time, and thus children can be upwardly mobile in absolute terms even if they don't manage to climb to a higher rung than their parents.[2] In this thesis, I study both relative and absolute mobility, so I will discuss both below.

2.1 Relative Mobility

Relative intergenerational income mobility is actually measured by estimating the *absence* of mobility—that is, intergenerational income *persistence*. This is done by regressing how much parent and child incomes co-vary. Historically, the most commonly used measure is the so-called *intergenerational income elasticity* (IGE), which is estimated using the following equation:

$$Y_c = \alpha + \beta Y_p + \epsilon_c \tag{4}$$

where Y_c is the log child income, Y_p is log parent income, ϵ_c is the error term, and β is the estimated elasticity. The elasticity of 0.3 implies that if a parent's income is 10 percent higher than the mean income of their cohort, the child's income is expected to be 3 percent above the cohort mean. Dahl and DeLeire (2008) suggested another measure where the income distribution is converted into percentiles, which they denote as the *rank-rank slope*. This can be written as:

$$R_c = \alpha + \rho R_p + \epsilon_c \tag{5}$$

[1] This has earlier been denoted as *positional mobility*, or as *exchange mobility* (Markandya, 1984; Van Kerm, 2004).

[2] This has also been denoted as *directional mobility* (Fields and Ok, 1996, 1999).

which is essentially the same as equation (4), but log incomes are instead being replaced by child income percentile R_c, and parent income percentile R_p. A similar measure is the intergenerational income correlation (IGC), which for convenience in this introductory chapter can be viewed as having the same properties as the rank-rank slope.

One key difference between IGE and rank-rank slope (and thus IGC) is that the latter removes the effect of changes to the income inequality across a generation that is included in IGE. To explain, it helps to return to the analogy of the income distribution as a ladder. We can imagine two countries, country A and B, both with low intergenerational income mobility. The probability for someone born rich to stay rich is the same in both countries. However, also imagine that there is a big surge in inequality in country A across generation, but not in B. Because the rank-rank slope simply captures persistence as that children born into a higher rung will also have a higher probability of ending up at a higher rung, regardless of how well that rung is paid, mobility measured as rank-rank slope will be the same in both countries. However, income mobility measured as IGE will be lower in country A due to the surge in inequality. This is because not only do the born rich have a higher chance of attaining a high paying rung in the ladder, but because inequality has increased, the expected relative pay of occupying that rung is also higher, which is captures as lower income mobility when using IGE. It is not obvious why one would be better than the other as a measure for income mobility. However, the Rank-Rank slope has as a measure been shown to be much more robust compared to the IGE (Chetty et al., 2014a; Dahl and DeLeire, 2008; Nybom and Stuhler, 2017). IGE tends to overestimate mobility at the top of the distribution, and underestimate it at the bottom of the distribution.

Another benefit with the rank-rank slope is that it allows for more intuitive graphical representations, shown in Figure 2. The horizontal axis represents the parent income rank, while the vertical axis depicts the expected child income rank conditional on parent income. The plotted line, characterized by a slope of 0.4, reflects the rank-rank Slope. The predicted income for a child born into the 0th percentile is an income corresponding to the 30th percentile in the national income distribution, while for a child born into the 100th percentile, the predicted income is an income corresponding to the 70th percentile. If the slope was completely flat (rank-rank slope=0), then parent income would have no influence on the the predicted income in the child generation, while a rank-rank slope of 1 would mean that the parent income rank perfectly determines the income rank of the child.

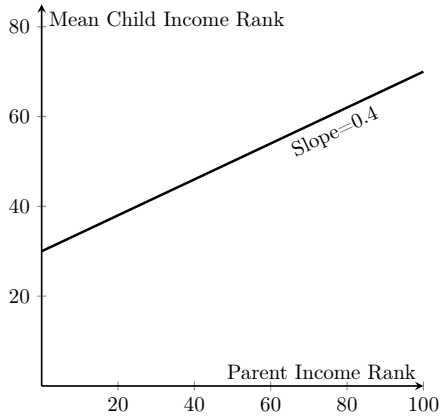

Figure 2: Graphical represenation of the rank-rank Slope

Estimating the IGE or rank-rank slope for a country as a whole allows for a powerful oversight of the aggregated level of income mobility. However, there is no strict necessity to explicitly estimate the aggregate level of income mobility for an entire population when studying the impact of various variables, policy interventions, or processes on income mobility. With a credible casual research design, one can for example estimate the impact of a child moving to a better area or neighbourhood (Nakamura et al., 2016; Chetty et al., 2016) or being exposed to a school reform (Pekkarinen et al., 2009; Nybom and Stuhler, 2023). If there are heterogeneous effects observed between those born rich or born poor, it implies a causal effect on intergenerational income mobility.

2.2 Absolute Mobility

As noted, while relative mobility views mobility as a zero-sum game where upward mobility for the born poor requires downward mobility for the born rich, absolute mobility gauges a child's income in real terms in relation to what their parents earned at the same age, irrespective of whether it entails an improvement in the relative income position or not. However, there have been two distinct approaches to measuring absolute mobility in two seminal papers. One version was proposed in Chetty et al. (2014a), with the purpose of comparing income mobility across commuting zones in the United States. I will in this introductory chapter write this as AM_r. The other form of absolute mobility was suggested by Chetty et al. (2017) to instead measure how United States as a whole fairs in terms of absolute mobility, which I will denote as AM_c.

To compute AM_r, Chetty et al. (2014a) first simply estimates the rank-rank slope as outlined above, but separately for each commuting zone in the U.S. Figure 3 provides a graphical illustration using estimates from Chetty et al. (2014a). Chicago has a steeper slope (0.39) compared to San Francisco (0.25), so relative mobility is lower in Chicago compared to San Francisco.

However, as Chetty et al. (2014a) notes, solely focusing on comparing the rank-rank slope

across regions can lead to counter-intuitive results. For example, a region can have high relative mobility (low rank-rank slope) even if children born in the region are expected to get low incomes, as long as the expected income for both born rich and born poor in that region are relatively equal. That is, the region has high relative mobility because both born rich and born poor are doing bad.

Thus, to get AM_r, one not only estimate the rank-rank slope, but also follow the slope to the 25th parent percentile. Thus, AM_r is defined as the the expected child income rank for children born into the 25th percentile of the national income distribution. The 25th percentile is chosen so that focus is on the born relatively poor in each region. [3]

It therefore not only takes into account that regions with high relative mobility will have a gentler slope and therefore have a higher predicted income for born poor compared to if the slope was steeper, but also assesses how well a specific region is performing in absolute terms in comparison to others. I show this graphically in Figure 3, again using estimates from Chetty et al. (2014a). The gray slope represents the rank-rank slope for San Francisco, and the black slope is the rank-rank slope for Chicago. The dashed vertical line connects the 25th parent percentile to each slope, and the dashed horizontal lines show absolute mobility AM_r for San Francisco and Chicago, respectively. Figure 3 thus shows that absolute mobility AM_r for San Francisco is 44.4, and 39.4 for Chicago. So, in this example, both relative mobility, and absolute mobility AM_r are higher for San Francisco compared to Chicago.

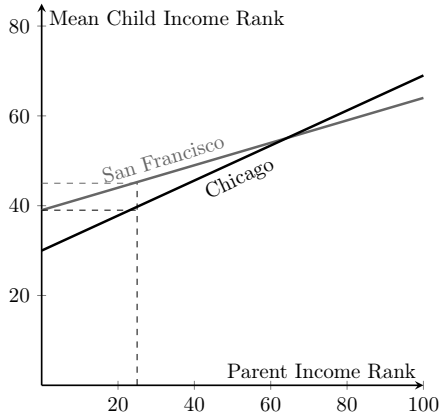

Figure 3: Regional Relative and Absolute mobility

Note: San Francisco Rank-Rank slope: 0.25, Absolute mobility: 44.4.
Chicago Rank-Rank slope: 0.39, Absolute Mobility: 39.4

To repeat, while AM_r focuses on regional absolute mobility, AM_c is instead proposed by Chetty et al. (2017) to measure absolute mobility for a country as a whole over time. This measure is simply defined and computed as the share earning more than what their parents did at

[3]For the equation on how to compute AM_r, see Article 1 in this dissertation

the same age (measured in purchasing power parity earnings). Although both AM_c and AM_r are sometimes mentioned and studied in the same paper, such as in Acciari et al. (2022) and Chuard and Schmiedgen-Grassi (2020), there is to the best of my knowledge no comprehensive analysis of how they theoretically relate to each other. In this dissertation I study AM_r extensively in Article 1, and AM_c is the main focus of Article 2.

While AM_r does measure absolute movements in income for a region, it is not obvious how different rates of regional absolute mobility measured as AM_r impact absolute mobility for the country as a whole measured as AM_c. For example, one region that ensures high incomes for individuals born into that region implies that these individuals will disproportionately be occupying percentiles higher up in the national income distribution, which crowds out individuals from other regions from occupying those same percentiles. High absolute mobility for one region measured as AM_r can thus lead to lower absolute mobility for other regions, potentially causing a decline in absolute mobility for the country as a whole (measured as AM_c).

Further, AM_r does not give any clues as to if higher mobility regions were already richer in the parent generation, which also has implications to how AM_r will impact AM_c. In the first article of the dissertaion, I make a similar remark how sub-group mobility rates relate to nationwide mobility rates, but the focus is instead on nationwide *relative* mobility. A full analysis of the interrelation between AM_c and AM_r is outside the scope of this introductory chapter, but this is an interesting avenue for future research.

Having now introduced all the measures and concepts used in this dissertation, I provide below a brief overview of the literature that has studied the interrelation between income inequality and intergenerational

3 Does Inequality Cause Lower Mobility?

3.1 Theoretical Background

Most of the early literature on the relationship between inequality and intergenerational income mobility was theoretical (Becker and Tomes, 1979, 1986; Loury, 1981), and focused on relative mobility. Economic modeling typically assumes that individuals aim to maximize their utility, often interpreted as maximizing earnings. However, in this context, maximizing earnings and striving to optimize one's relative income rank are essentially equivalent, so it is not obvious what a specific theoretical focus on absolute mobility would entail. One can instead view relative mobility and absolute mobility as capturing different emergent properties of individuals' actions and processes, where absolute mobility is explained by a combination of relative mobility, income growth, and inequality (Ruiz-Castillo, 2004; Van Kerm, 2004).

In this section, however, I will focus on the canonical theoretical model for explaining relative mobility. Becker and Tomes (1979, 1986) developed a theoretical model where parents are altruistic and invest parts of their earnings in their children's education. Parents with higher ability and hu-

man capital are assumed to be higher up in the income distribution. This assumption is supported by the results of the Mincer model previously mentioned (Mincer, 1974). Human capital is transmitted from parents to children by parents investing in their children's education. Endowments is what the child receives regardless of the family's conscious investment choices. This includes both inheritance of genetic abilities and cultural inheritance, such as parental role-modelling. The model assumes that richer parents are more endowed, and intergenerational transmission of endowment means that richer children are on average more endowed than the born poor. Last, endowment and investment into education are complementary, so that a brilliant child benefits more from higher human capital investments than a less gifted child.

An earlier version of the model assumes perfect capital markets, which implies that gifted children will regardless of their parents' income be able take loans to secure investments into their human capital (Becker and Tomes, 1979). One policy implication of this is that public investment in education is unnecessary, since the optimal private and social optimal level of investments is already being made. On the contrary, public investment in education has regressive effects, as it is assumed that the born rich, being more endowed, will select more into education. Consequently, public investment subsidizes the education of the born rich.

The steady state level of intergenerational persistence in this version of the model is the result of that richer parents are more endowed, and that these endowments are passed down to the next generation. However, it is important to note that this prediction of persistence does not require an *economic* model, but would arise also with just a mechanical endowment transmission model of intergenerational transmission (for example a genetic model) (Goldberger, 1989). Becker and Tomes also admitted to this: "Indeed, if all parents can readily borrow to finance the optimal investments in children, the degree of intergenerational mobility in earnings essentially would equal the inheritability of endowments" (Becker and Tomes, 1986, page 291).

A later version of the model relaxes the assumption about perfect capital markets (Becker and Tomes, 1986; Mogstad, 2017). A parallel model with a comparable assumption was developed by Loury (1981). Banks are less inclined to provide loans with human capital as collateral compared to assets such as houses. From this, Becker argued that while a mechanical endowment transmission model should regress symmetrically to the mean, this economic model built on credit constraints affecting the poor but not the rich would imply slower regression towards the mean for the born poor than the born rich (Becker, 1989), and would generate a non-linear, concave relationship between parent and child income (Bratsberg et al., 2007).

Further, in the first model, all parents choose to invest the privately efficient amount in their children's human capital, resulting in the marginal return for education being driven down to the opportunity cost of investments. In the second model, credit constraints implies that the born poor will invest less in education. This reduction in the supply of highly educated individuals consequently leads to an increase in the returns to education, increasing inequality.

The key takeaway from this second model for this dissertation is its prediction that countries with higher income inequality will experience lower economic mobility (Durlauf et al., 2022).

The rationale for this is twofold. First, higher income inequality implies a greater disparity in parental resources available for investing in their children's human capital, hampering the born poor from achieving their educational potential. Second, this in turn lowers the supply of highly educated individuals, leading to increasing return on education and therefore to higher inequality. This second point is important in that it blurs the causal link of inequality on intergenerational income mobility by making it a two-way street. When studying this relationship, we should therefore also look for factors that can affect both, such as institutional arrangements in education that both hamper mobility and thereby decrease the supply oh highly educated, increasing the return on education and inequality.

The Becker and Tomes remains the main theoretical model in economics studying intergenerationa income mobility. An influential extension of this model is presented by Solon (2004), showing that the progressively of public spending on education can level the playing field, suggesting that policy interventions can increase income mobility. A model proposed by Bratsberg et al. (2007) point to that policy intervention especially can equalize lower level of human capital formation.

3.2 Empirical Literature

3.3 Trends in Income Mobility

The Becker and Tomes model shown above offers some empirical predictions. For example, if inequality causes immobility, then the rise in inequality observed in many developed countries over the past few decades should have caused a decline in relative income mobility.

However, the extent of this impact hinges on the age at which inequality begins to affect mobility. If the majority of the effect occurs in early childhood, we would need to look back at least 30 years (given that the proxy for lifetime earnings typically begins at age 30) to observe such a decline in mobility. Considering that the surge in inequality began around 1970-1980 in most Western countries, we would only be witnessing the initial stages of the inequality effect. Heckman (2006) shows that differences in cognitive abilities across children emerge in children's very first years, and have largely stabilized already by age 3. Chetty and Hendren (2018) on the other hand show that switching to a better neighbourhood increases a child's future earning, and such improvements remain impactful even when the moves take place in late adolescence. Consequently, while cognitive abilities may stabilize at young age, other factors affecting earnings, such as peers influence affecting educational choices, persist beyond that time-frame.

Therefore, although there are only a few cohorts that have experienced the recent higher levels of inequality from newborn to adulthood, there are now many cohorts that have been exposed to higher inequality during their childhood more broadly. If rising inequality leads to lower mobility, we should, therefore, observe indications of that in the data.

However, the evidence on such a decline in mobility has been inconclusive. Lee and Solon (2009) find no clear trend change for France. Nicoletti and Ermisch (2008) note a decrease in income mobility for the United Kingdom when measured as intergenerational elasticity (IGE),

while stability is observed when measured as intergenerational correlation. Pekkala and Lucas (2007) demonstrate an increase in mobility since the 1950s birth cohort for men, with generally stable estimates for women during the same period. Chetty et al. (2014b) find that U.S relative mobility, as measured by the rank-rank slope, remains essentially unchanged. As does Lee and Solon (2009), also studying U.S. Engzell and Hällsten (2022) find a stable trend for men in Sweden, but decreasing mobility for women. However, this outcome is anticipated, as for older cohorts, mobility rates were inflated due to low labor force participation among women. Thus, if rising inequality were to result in lower mobility, it has not manifested itself in the data yet.

3.4 Cross-Sectional Comparisons

The most straightforward way of exploring the dynamics of income inequality and income mobility is a cross country comparison. Björklund and Jäntti (1997) pointed out that although the U.S is hailed as a land of opportunity, it actually has rather low intergeneratioanl income mobility, and using comparable data showed that mobility is significantly higher in Sweden, which "raises the question as to whether the equality of op- portunity and equality of outcomes are independent of each other" (p.1017). Corak (2013) collected inequality rate measured as the Gini coefficient and intergenerationl income mobility rates for different countries and found that more equal societies also have higher income mobility, a relationship that is since then has been referred to as the 'Great Gatsby Curve'. It was given this name by the economist Alan B. Krueger in a speech to the Center for American Progress (Krueger, 2012). Figure 4 Shows the Great Gatsby Curve. The vertical axis show income persistence measured as intergenerational income elasticity, so countries higher up on the vertical has lower mobility. The horizontal axis shows income inequality measured as Gini coefficient. The figure thus shows that countries with higher inequality has lower mobility. Scandinavian countries such as Sweden have both low income inequality and high income mobility, while many countries in the Americas are immobile and unequal.

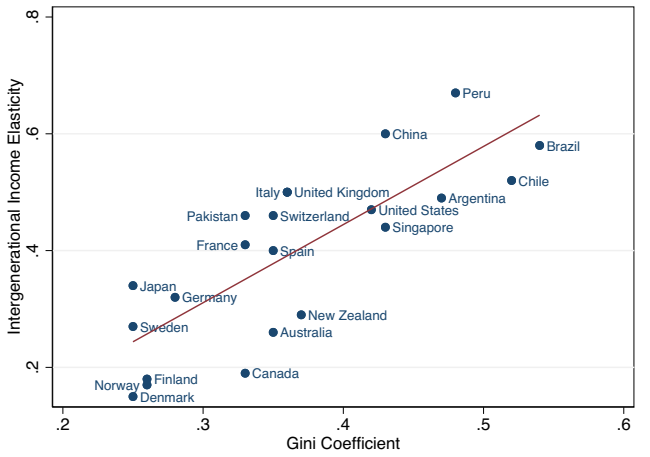

Figure 4: The Great Gatsby Curve

The graph is produced using data from Corak (2013)

Subsequent research has devolved into finding mechanisms explaining this relationship. Blanden (2013) shows that intergenerational income mobility correlates with intergeneratioanl education mobility. Looking at mechanisms, she finds that higher return to education and lower public spending leads to lower mobility, in line with the prediction of the later Becker and Tomes model Becker and Tomes (1986).

The version of the Gatsby Curve shown in Figure 4 includes both high and low income countries, and these are likely not fully comparable in this context. The previously mentioned Kuznets curve predicted that income inequality is higher when a country is industrialising, partly due to a widening gap between urban and rural areas. It is also likely that a country has lower income mobility during this transmission, due to the born urban both being born richer and yielding higher income compared to the born urban.

Further, a certain level of economic standard of a country is likely necessary for a country to reach a certain threshold where the whole population has food security, housing, basic education, and healthcare. This is crucial in order for each child to reach their full cognitive capability Heckman (2006); Maluccio et al. (2009). In poor countries, inequality in cognitive and non-cognitive abilities will be transmitted across generations due to only the rich being able to afford these basic necessities.

Furthermore, there is also a direct mechanical effect between inequality and mobility. Returning to the analogy of income distribution as a ladder, if we reduce the distance between the rungs, this will make it easier to move between them. From this, Berman (2019) is able estimates that 64% of the variance in mobility across the countries in The Great Gatsby Curve above can be explained by this mechanical relationship alone. This is important as, any attempt to establish a causal link between mobility and inequality "will have to be over and above the mechanical

relationship" (p.15).

A better test for if inequality causes lower intergenerational mobility is therefore to compare regions within countries where the different entities are more comparable. Further, this also allows to study not only how relative mobility measured as the rank-rank slope relates to inequality, but also absolute mobility for the region measured as AM_r. Remember that AM_r is a function of both the intercept and the rank-rank slope of a region. If the intercept unlike the rank-rank slope is not mechanically related to inequality, absolute mobility, measured as AM_r is less prone to this mechanical interrelation. However, additional research is necessary to draw such a conclusion.

Testing a Great Gatsby Curve across regions within a country was first done in (Chetty et al., 2014a), finding that income inequality measured as either the Gini coefficient or as the percentage of incomes going to top income earners also predicts lower absolute mobility AM_r among U.S commuting zones. Aghion et al. (2019) have a different take on these results. They show a relationship between innovation and Absolute mobility AM_r for U.S regions, and regions where the top income share has increased the most are also the more innovative, and have higher income mobility.

Acciari et al. (2022) find similar results for Italy. They find a Great Gatsby relationship for Italy measured as the Gini coefficient, but if inequality instead is measured as the share of income going top the richest percent, the relationship is instead reversed. Thus, for regions where the richest are very rich, income mobility is higher. They explain these evidence as that regions with high levels of entrepreneurship create both high incomes for some wealthy, but also lots of mobility due to a more dynamic economic structure.

Brandén et al. (2023) fits a Great Gatsby Curve for Swedish commuting zones measured as rank-rank slope, while Heidrich (2016) does not find one using absolute mobility AM_r. Corak et al. (2017) finds a Great Gatsby relationship across Canadian regions, and Kwon and Jeon (2020) does too across South Korean regions. Deutscher and Mazumder (2023) find no relationship for Australia, and Kenedi and Sirugue (2023) similarly finds none for France.

The results for a Great Gatsby relationship across regions within countries are therefore mixed. The results seems to be sensitive to the choice of the inequality measure. The share earned by top income earners appears to have a less pronounced impact on mobility, whereas the Gini Coefficient yields a more substantial effect. As noted, Gini Coefficient is more responsive to inequality in the middle of the distribution. Thus, while high income shares for the very top may indicate that this group is distancing itself from the rest, their limited size means that they do not significantly impact mobility rates for the entire country. Instead, larger disparities across the entire population, better captured by the Gini Coefficient, have a larger negative effect on relative mobility rates (Durlauf and Seshadri, 2018).

3.5 Causal Effects of Income and Inequality on Mobility

While regional analyses arguably offer a more nuanced understanding of the relationship between income inequality and income mobility compared to cross-country evidence, they should be viewed

more as indicative of such a relationship rather than causal. An emerging literature adopts a more causal approach to study the mechanisms explaining intergenerational income mobility. These studies can be used to better understanding the mechanisms mediating a relationship between inequality and intergenerational mobility.

One obvious mechanism in this context could be the impact of cash transfers on income mobility, since such an effect would imply a that higher inequality is also linked to lower mobility. Lefgren et al. (2012), utilizing an instrumental variable approach with Swedish data, demonstrate that the financial investment in a child's education has a relatively minor impact on their future earnings. This implies for Sweden "that further policies to reduce intergenerational inequality through equalizing financial investments in the next generation will have, at most, modest success" Lefgren et al (2016, p. 274). Cesarini et al. (2016) arrives at similar findings, also using Swedish data. The study examines parents who receive transfers through winning lottery tickets, and concludes that such windfalls do not lead to increased cognitive abilities or better test scores for their children. It's worth noting that this result might be influenced by the fact that inequality in Sweden is already relatively low. However, when studying the United States, Blau (1999) similarly discovers small, if any, causal effects of income on child cognitive abilities.

The *marginal* effect of income on income mobility is therefore likely low. This is however not to say that income cannot contribute to lower mobility. These casual effects only captures the effect of rising income for a single individual, holding everything else constant. This is not the same as income inequality increasing on macro level, which leads to many other outcomes at the same time. For example, it allows for segregation to another extent than what is possible if income differences are very low. Durlauf and Seshadri (2018) builds a theoretical model focused on U.S circumstances, where the main assumption is that local school funding is dependent on local public tax revenue. Richer neighbourhoods therefore have more school funding, leading to incentives for parents to select into neighbourhoods with richer parents. However, this ability to reside in such neighborhoods is limited to affluent parents due to the associated high housing prices. This leads to larger differences in school funding and lower income mobility.

This perspective of specifically focusing on school funding may seem unfamiliar for some parts of the world where school funding is centralized, and relatively equality distributed, as is in Sweden Ahlin and Mörk (2008). However, one can imagine other factors influencing parents' choices of neighborhoods, contributing to better outcomes for children, such as the presence of stronger peer effects. There is also in Scandinavia strong sorting of parents into neighbourhood based on education and income Heckman and Landersø (2022). So while incentives for segregation is likely prevalent everywhere, differences in institutional factors will mean that these have different magnitude.

This illustrates how institutional factors affect both income inequality and income mobility. For example, if funding is constructed in such a way that it increases the incentives for sorting, then this will both hamper mobility but can also reduce the supply of highly educated, increasing return on education and inequality. Thus, while causal effects of income on intergenerational

mobility have been proven important in exploring the exact mechanism of income on mobility, they do not capture the full effect of inequality on intergenerational mobility. In this dissertation, I aim for a more comprehensive approach to understanding some aspects of the relationship between these two.

4 Contribution of This Thesis

To repeat, the purpose of this dissertation is not to estimate an explicit causal relationship between income inequality and income mobility. But the papers have contributions on some aspects of this relationship. Below I go into more detail into each article's contribution.

Article 1 investigates the impact of income inequality across regions on relative mobility within Sweden. If there are substantial income differences across regions within countries, and individuals generally stay where they are born, these income differences will be inherited across generation, contributing to lower income mobility. The results show that income differences across birth regions converge slower across generations compared to what they do within regions. In other words, individuals born poor within a region have a higher likelihood of surpassing those born relatively rich within the same region compared to the chance that all children born in a poor region have to exceed the income of children born into a richer region.

Thus, incomes differences across regions persist across generations and contribute to lower intergenerational income mobility. However, I also show that individuals leaving their birth regions mitigates this effect. Here, two mechanisms are working in opposite directions. The fact that individuals move from poorer to richer regions increases income mobility, but the fact that it is primarily the born rich within regions that move and realise higher incomes leads to lower income mobility. However, I demonstrate in a novel decomposition that the first of these two effects is larger than the second. As a result, inter-regional moving patterns have a net positive effect on intergenerational income mobility. This could potentially be a contributing factor to why Sweden exhibits relatively high intergenerational income mobility compared to many other countries, as Sweden boasts one of the highest rates of geographical labor mobility in the European Union (Bonin et al., 2008).

Disparities in income across regions may stem simply from self-selection of more productive workers into some specific regions, so called *worker effects*, sometimes as a result of decision made already by distant ancestors. Using a framework reminiscent of that proposed by Becker and Tomes (1979), this suggests that richer parents concentrate in certain regions, leading to higher investments in human capital in their children as compared to less affluent areas. However, regional income differences can also be attributed to *regional wage premiums*, where identical workers earn different wages based on their labor market region. In the article, I estimate how much of regional income difference are due to worker effects and regional wage premiums, respectively, and how much they explain to income differences being transmitted across generations. The analysis reveals that worker effects exert a more substantial influence in this context.

Article 2 delves into examining the trend in absolute income mobility for Sweden, measured as the percent of children earning more than their parents. The study utilizes full-population data to examine trends in intergenerational absolute income mobility in Sweden for 11 cohorts born between 1972 and 1983. Absolute mobility, defined as the ratio of children earning more than their parents, increases from 72% to 84% for men and from 76% to 86% for women during this period, higher than in many other countries Chetty et al. (2017); Manduca et al. (2020).

The article introduces a novel decomposition that explains the rate of absolute mobility, and its trend. Absolute income mobility is typically broken down into three components; income growth, relative mobility, and income inequality Van Kerm (2004). However, the article also shows that while previous research has taken into account *changes* in income inequality across generation, the general level of income inequality already in the parent generation also has to be considered. All else equal, higher income inequality in the parent income distribution implies that more growth is required to ensure that children who move downward relative to their parents still earn more in absolute terms.

This can be explained with the following example: A child with parents at the top of the income distribution who end up with a relatively lower-paying job can still out-earn their parents if the growth during the time between when the parents are working and the child is working is high enough. In such cases, a lower-paying job in the child's generation may be better paid in real terms compared to the higher-paying profession when the parents were working. However, in a scenario with high income inequality, more growth is required to compensate for this, as the downward trajectory becomes more significant when income inequality is high.

The article then demonstrates the substantial impact this can have on absolute mobility by comparing simulated absolute mobility rates on income distributions for Sweden, which has low income inequality, against those of the United States, characterized by higher income inequality. The Gini coefficient for the U.S. distribution is just over 0.4, which, with an annual growth rate of 2%, translates into an absolute mobility of 70%. Applying the identical growth rate to Swedish male birth cohorts with a parent distribution Gini coefficient of 0.18 yields 90% absolute mobility. This highlights that the steady-state absolute mobility difference between the Swedish and U.S. income distributions becomes as large as 20 percentage points, solely due to different inequality levels in the parent generation. While previous literature has primarily focused on how income inequality affects relative mobility, this article underscores that it can also have a substantial impact on absolute mobility.

Article 3 investigates the enduring consequences of unexpected disruption in schooling, focusing on a unique case—the 1989 teacher strike in Sweden. Employing a so called difference-in-differences design, the study reveals that the strike caused short-term learning deficits, particularly affecting boys from disadvantaged homes, with persistent effects lasting up to 5 years. In the long run, exposed students encounter a 1.8% reduction in earnings, more pronounced among disadvantaged groups. The study also shows using quantile regression that inequality in academic achievements and earnings increased as a results of the strike. The strike, therefore, serves as a case in which an

exogenous variable concerning the relationship between inequality and intergenerational mobility impacts both of these factors.

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2 Essays

Papers

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