Moving Between the Ranks: The Determinants of Relative Earnings Mobility Over the Career and Change Between Cohorts

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Abstract

Recent research on intragenerational earnings mobility has primarily focused on how workers' earnings change in real dollars over their careers. Much less work has considered relative mobility, or workers' chances of changing positions in the earnings distribution. While prior research on intragenerational relative earnings mobility is largely descriptive and atheoretical, I examine how well patterns of relative mobility can be explained by four mechanisms of labor market mobility: discrimination, matching, human capital investment, and job mobility. I develop a novel approach using conditional quantile regressions to model how these mechanisms shape the full distribution of earnings ranks workers may attain through selection effects and career processes. Using PSID data, I show that gender, education, and human capital investment are the most important drivers of relative earnings mobility patterns and their change over time. Yet early-career earnings also directly shape opportunities for mid-career attainment after accounting for selection effects and mediating labor market processes. Over time, downward mobility among high-earners increased largely due to women's growing representation at the top of the earnings distribution and their relatively high risk of downward mobility, while upward mobility remained stable due to a combination rising educational attainment among low-earners and rising returns to education.

Introduction

Scholars of mobility and stratification have long been interested in characterizing the relative "openness" or equality of opportunity in a society by examining how individuals differ in their chances of attaining positions in a system of stratification (Sorokin 1927). Historically, most mobility research has considered economic opportunity through an intergenerational lens and investigated the strength of the association between parents and their children's economic status (e.g. Coleman 1966; Blau and Duncan 1967; Sewell and Hauser 1975; Hout 1988; Erikson and Goldthorpe 1992; Breen and Jonsson 2005; Torche 2015). Recently, however, there has been renewed interest in investigating intragenerational mobility over the career (e.g. Tomaskovic-Devey, Thomas, and Johnson 2005; Fuller 2008; Cheng 2014, 2021; Yaish et al. 2021; Berman 2022). This work follows from the observation that earnings attainment is fundamentally a change process (Sørensen 1975) – pay raises, promotions, and job changes all cause meaningful variation in a worker's earnings over the course of their career. Inequality in how workers experience these labor market processes produces variation in both the level of stratification among workers and in workers' position within the stratification system as they progress through their careers. Developing a full understanding of social fluidity or economic opportunity in a society therefore requires examining patterns of how labor market processes shape individuals' opportunities for earnings attainment over the career.

Most of the research on intragenerational earnings mobility has focused on absolute mobility, or how individuals' earnings in real dollars change over time (e.g. Loprest 1992; Keith and McWilliams 1997; Tomaskovic-Devey et al. 2005; Fuller 2008; Cheng 2014, 2021; Maume and Wilson 2015; Cheng and Song 2019; Doren and Lin 2019; Yaish et al. 2021; Berman 2022). Absolute mobility is clearly an essential element of stratification because it describes the real

income dynamics that directly affect inequality in consumption and savings. But analyses of earnings mobility conducted in real dollars cannot distinguish between earnings mobility due to changes in the shape of the earnings distribution (e.g., rising inequality or rising earnings levels) and mobility due to individuals changing positions in the distribution relative to one another. This distinction is akin to the difference between occupational mobility due to changes to the occupational structure versus changes to mobility rates between occupations (Featherman, Jones, and Hauser 1975; Hauser 1978; Goodman 1979; Logan 1983; Sobel 1983; Erikson and Goldthorpe 1992; Breen 1994). Similar to analyses of occupational mobility, "relative" mobility between positions or ranks in the earnings distribution describes how individuals get ahead of or fall behind one another in economic rank and can be interpreted as an indicator of social fluidity or the openness of the economic stratification system within the labor market.

While recent analyses of absolute earnings mobility over the career have revealed much about how career and life course dynamics give rise to inequality, relative mobility between positions in the earnings distribution remains less well understood. I address three basic sociological questions surrounding relative earnings mobility: 1) how do individuals' early-career earnings shape their opportunity for mobility into different positions in the earnings distribution later in their career? 2) how well do prominent theories of earnings attainment identify the "'holes,' 'staircases,' 'elevators,' and 'channels'" (Sorokin 1927: 164) through which mobility between earnings ranks occurs? and 3) how have historical changes in the economic and institutional forces that structure mobility in the labor market reshaped patterns of relative mobility over the last half century? Surprisingly little work attempts to assess how well different theories of the labor market can explain intragenerational relative earnings mobility (but see Schiller 1977). Instead, the literature has remained largely atheoretical and focused on

describing mobility patterns and historical trends but taken less interest in identifying the mechanisms that underlie movement between positions in the earnings distribution.

I examine the mechanisms that drive mobility between positions in the earnings distribution over the career and how they have changed across cohorts using conditional quantile regressions (CQRs). This new approach to the empirical analysis of relative earnings mobility accounts for three properties of mobility not fully captured by the two methods typically employed in previous studies – the descriptive analysis of transition matrices and ordinary least squares (OLS) regressions of rank earnings on past rank earnings. These properties are: 1) *mobility opportunity*, which describes the full distribution of earnings rank outcomes that individuals may attain (rather than just the average outcomes), 2) *rank-dependence*, or the extent to which the distribution of ranks that individuals may attain in their career depends on their initial earnings rank, and 3) inequality in mobility patterns due to *selection* into early-career earnings levels and due to *career processes* that link early- and mid-career earnings.

While some recent work has examined rank-dependence at the mean in a regression framework (e.g. Bradbury 2018; Carr and Wiemers 2022), this paper is the first to the author's knowledge to examine rank dependence across the full distribution of rank mobility outcomes and characterize variation in mobility opportunity while distinguishing between selection effects and career processes. I use regression adjustment with covariates and instrumental variables to assess the extent to which patterns of relative earnings mobility can be attributed selection into positions in the early-career earnings distribution versus by processes within the labor market. I then decompose between-cohort differences in relative earnings into components due to changes in the labor force and changes in the structural association between early- and mid-career earnings.

Using data from the Panel Study of Income Dynamics (PSID), I demonstrate that the median earnings rank workers attain at age 45 is highly dependent on their earnings rank at age 25, while the lowest and highest earnings rank outcomes are somewhat less dependent on early-career earnings. Much of this association is explained by selection into early-career earnings ranks by gender and education and by the unequal accumulation of valuable work experience and mobility between jobs among low- and high-earners. Female and non-college-educated workers experience limited upward mobility from low ranks and more severe downward mobility from high ranks, while the accumulation of labor market experience and firm tenure primarily protects high earners from downward mobility. Frequently changing employers both reduces upward mobility for low earners and increases downward mobility for high earners, and these effects are amplified when job changes occur within the service sector. After accounting for selection into early-career earnings ranks using IVs, I find that there remains a strong association between early-career earnings and mid-career earnings ranks primarily due to highly compressed mobility from the upper and lower tails of the earnings distribution. Analyses of changes in relative mobility patterns between cohorts reveal marked stability over time. However, I find evidence that in recent cohorts, greater downward mobility from high early-career earnings ranks is largely due to the growing proportion of women among high earners and high earners' diminishing advantage in accumulating general and specific human capital. Apparent stability in the relationship between early-career earnings and upper-tail earnings rank outcomes is undergirded by a simultaneous rise in educational attainment across the earnings distribution and increase in mobility returns to higher education.

Relative Earnings Mobility and Labor Market Opportunity

Research on intragenerational earnings mobility is broadly concerned with how individuals' earnings change over their careers. Most research on intragenerational earnings mobility examines how individuals' earnings trajectories vary due to differences in their exposure to labor market processes such as pay raises, promotions, job changes, and the accumulation of skills and experience, as well as life course events like marriage, childbearing, incarceration, and personal injury (Granovetter 1974; Sørensen 1975, 1977; Spilerman 1977; Abbott 1983; Elder 1985; Dannefer 1987; Huber 1990; Rosenfeld 1992; Mayer 2004, 2009; Western et al. 2012). Heterogeneity in earnings growth causes inequality within cohorts to grow substantially as workers progress through their careers and tends to exacerbate inequalities by educational attainment, gender, race, parental status, and other major dimensions of stratification (Ryder 1965; Borjas 1981; Riley 1987; Loprest 1992; Keith and McWilliams 1997; Alon and Tienda 2005; Tomaskovic-Devey et al. 2005; Lemieux 2006; Fuller 2008; Kopczuk, Saez, and Song 2010; Miller 2011; Cheng 2014; Maume and Wilson 2015; Doren and Lin 2019; Cheng 2021; Berman 2022).

While research on earnings trajectories has considerably deepened our understanding of how earnings inequalities unfold over the career, it remains less well understood how such variation in earnings trajectories might correspond to change or stability in individuals' standing relative to one another as they progress in their careers. Labor markets with the same level of absolute mobility may have very different levels of relative mobility (see Figure 1). In labor markets with low relative mobility, those who begin their careers at the top of the earnings distribution remain near the top as they age and those who earn comparably little remain near the bottom. Such immobility is possible even if all workers experience absolute earnings growth, so long as growth among low earners does not sufficiently outpace growth among high earners.

Labor markets with high relative mobility will exhibit many "crossovers" (Mincer 1974; Schiller 1977) where individuals move ahead of or fall behind other workers over the course of their careers.

[[Figure 1 here]]

Analyses of the association between absolute earnings levels measured over time cannot distinguish between these regimes of earnings mobility because this association is affected by both relative mobility between positions in the earnings distribution and by changes in the shape of the earnings distribution (Chetty, Hendren, Kline, and Saez 2014; Chetty, Hendren, Kline, Saez, et al. 2014; DiPrete 2020). In analyses of earnings mobility that do not account for changing levels of earnings or earnings inequality, it is unclear whether the association between earnings levels at different points in the career is driven by changes in the earnings distribution or changes in individuals' position in the distribution.

Analyses of mobility between earnings ranks isolate relative mobility from changes in the shape of the earnings distribution. Standardizing earnings into percentile ranks allows analysts to compare patterns of earnings mobility over time and across contexts. Relative earnings mobility captures the extent to which individuals' economic status relative to others in the labor market is systematically reproduced over the course of their careers by describing the extent to which individuals tend to maintain their rank in the earnings distribution over their careers. Relative mobility reflects social fluidity, equality of opportunity, or competition for positions in the social structure by describing how an individual's economic position changes over time (Erikson and Goldthorpe 1992; Goldthorpe 2007; Brown 2013). Examining relative earnings mobility reveals the opportunity for individuals to change their economic status over their careers and provides an

avenue to test theories of mechanisms that may enhance or diminish the rigidity of stratification within the labor market.

Although relative earnings mobility has received little empirical attention, evidence from prior studies suggests the relationship between average early- and mid-career earnings ranks is both strong and intensifying over time. Estimates of the correlation between workers' earnings ranks measured a decade or more apart tend to fall around 0.65, roughly double the typical estimate of intergenerational rank-rank correlation (Chetty, Hendren, Kline, Saez, et al. 2014; Gregg et al. 2017; Carr and Wiemers 2022). Earnings rankings are especially sticky at the top and the bottom of the earnings distribution. Around 60 percent of individuals who start in the top or bottom earnings quintile remain in that quintile later in their careers, compared to roughly 35 percent of workers who remain immobile from the 2nd through 4th quintiles (Acs and Zimmerman 2008; Auten and Gee 2009; Bradbury and Katz 2009; Carr and Wiemers 2022). Historical trends in relative earnings mobility are less clear. While some studies find no change over time in persistence within earnings quintiles (Acs and Zimmerman 2008; Auten and Gee 2009), others show rising stickiness at the tails of the earnings distribution (Carr and Wiemers 2022).

The Changing Opportunity Structure for Mobility: Mechanisms and Consequences

Earnings attainment over the career is determined through the interaction of individual workers and firms in the labor market, where workers' opportunity for mobility depends on the set of available jobs and on workers' ability to mobilize their individual resources in competition to fill those jobs (Sørensen 1975, 1977). Over the last 40 years, both the resources held by workers and the sets of jobs available to them have changed considerably. The composition of the labor force

changed substantially as more women and nonwhite workers entered the labor market and workers' educational attainment significantly increased. At the same time, employment relations shifted away from stable, long-term, and full-time employment towards weaker attachments between firms and employees and more part-time and contingent labor, and the occupational structure became more polarized between high- and low-earning occupations.

How have these major economic transformations affected relative earnings mobility? While some research has found that relative earnings mobility declined in recent decades and in more recent cohorts (Bradbury and Katz 2009; Bradbury 2018; Carr and Wiemers 2022), little of this work investigates the mechanisms driving observed mobility patterns or how the role of those mechanisms has changed over time. Moreover, prior research has not examined whether the association between earnings ranks over workers' careers is driven by *selection* where individuals with high-demand skills or traits command higher earnings at both the beginning and middle of their careers versus *career processes* within the labor market that create a structural connection between past and future earnings. Without distinguishing between relative mobility due to selection versus career processes, it is not clear whether high earnings rank correlations and decreasing mobility should be interpreted as changes in how workers are sorted into starting positions at the beginning of their careers versus inequality in economic opportunity for workers at different parts of the earnings distribution.

[[Figure 2 here]]

In what follows, I consider how four prominent explanations of labor market mobility – race and gender discrimination, worker-firm matching, human capital investment, and job mobility – may contribute to relative earnings mobility through selection and career processes and how economic restructuring in recent decades may have changed the role of each mechanism

in shaping mobility. I develop hypotheses about two components of relative earnings mobility (see Figure 2). The first is *mobility opportunity*. Mobility opportunity describes the range of earnings ranks that workers may attain by the middle of their career conditional on the rank where they enter the labor market. The second component is *rank-dependence*, which describes the association between workers' early- and mid-career earnings rank. While mobility opportunity describes the distribution of outcomes for workers of the same rank, rank-dependence describes inequality in mobility opportunity for workers of different starting ranks. Rank-dependence may vary over the distribution of mid-career earnings ranks. For example, median mid-career earnings may be strongly tied to early-career earnings but the top outcomes for workers of all levels of early-career earnings could be more similar.

Race and gender discrimination

Race and gender discrimination may affect earnings mobility through both selection effects and career processes. Discrimination may create a spurious link between early- and mid-career earnings where we observe relatively low rates of upward earnings mobility not due to a lack of pathways through which low earners can increase their earnings, but rather because low earners are disproportionately nonwhite and female, and these workers have lower earnings on average than otherwise similar white and male workers (Neal and Johnson 1996; Grodsky and Pager 2001; Carneiro, Heckman, and Masterov 2005; Lang and Lehmann 2012; Fryer, Pager, and Spenkuch 2013). Racial and gender discrimination may also moderate the relationship between early- and mid-career earnings through discriminatory career processes. Discrimination within the labor market accumulates over the career to flatten the earnings trajectories of marginalized workers (Tomaskovic-Devey et al. 2005). Upward mobility within firms is limited for women

and nonwhite workers because they often allocated to lower paying jobs, promoted at lower rates, and evaluated less favorably than their colleagues (Greenhaus, Parasuraman, and Wormley 1990; Greenhaus and Parasuraman 1993; Landau 1995; Petersen and Morgan 1995; Baldi and McBrier 1997; Maume 1999; Cotter et al. 2001; Elvira and Town 2001; Petersen and Saporta 2004; Tomaskovic-Devey et al. 2006; Heilman 2012). Nonwhite and female workers also tend to realize smaller earnings gains from changing jobs than their white male counterparts (Bartel 1980; Ruhm 1987; Alon and Tienda 2005; Pearlman 2018) and are at greater risk of downward mobility from high-earning occupations (Gabriel 2003; McBrier and Wilson 2004; Wilson and Roscigno 2010; Wilson, Roscigno, and Huffman 2013).

Together, these dynamics suggest that some of the association between early- and mid-career rank earnings may be explained by selection on race and gender into earnings ranks. To the extent that nonwhite and female workers are disproportionately represented at the bottom of the early-career earnings distribution, racial and gender earnings inequalities may spuriously suppress upper tail earnings and further diminish lower-tail earnings, resulting in upwardly biased estimates of rank-dependence upper-tail rank earnings and downwardly biasing estimates of rank-dependence in lower-tail rank earnings. If discrimination within the labor market also disproportionately constrains nonwhite and female workers' chances of changing earnings ranks, we should observe that nonwhite and female workers are less likely than white and male workers to climb earnings ranks from low positions in the earnings distribution and are more likely to fall from high positions in the earnings distribution.

It is possible that the effect of gender on relative earnings mobility has declined in recent cohorts. Women are now more likely to occupy the same economic positions as men than in the past. Labor force participation among women has risen (Bureau of Labor Statistics 2021) and the

gender pay gap has decreased since 1970, in part due to women's increased educational and occupational attainment (Blau, Brummund, and Liu 2013; DiPrete and Buchmann 2013; Mandel and Semyonov 2014), perhaps improving women's mobility opportunity. However, it is possible that occupational integration may lead to higher rates of downward mobility from the top of the earnings distribution simply because more women begin their careers towards the top in recent cohorts and highly paid women experience especially large penalties to motherhood (England et al. 2016).

The effect of race has likely either remained the same or grown over time. Educational attainment in the Black population is rising but not at the same rate as among whites (McDaniel et al. 2011; Nichols 2013; National Center for Education Statistics 2022). Racial segregation between occupations has been fairly stagnant since 1980 (Tomaskovic-Devey et al. 2006; Stainback and Tomaskovic-Devey 2012; Mandel and Semyonov 2016), the Black-white earnings gap has held steady among men and grown among women (Mandel and Semyonov 2016), and racial discrimination in hiring has remained fairly stable (Quillian et al. 2017). As changing jobs and employers has become an increasingly important avenue for increasing earnings in recent decades, the race gap in earnings returns to job changes has grown among college graduates (Kronberg 2014). Altogether, this suggests that both selection into lower early-career earnings and unequal opportunity to change earnings ranks by race may have either stagnated or grown in the last 40 years.

Matching on human capital

Another mechanism that may underlie the relationship between early- and mid-career earnings is the matching of highly productive workers to high-paying jobs. Rooted in human capital theory,

matching models of the labor market suggest that a high rank-rank correlation in earnings over the career may persist due to a selection effect where labor markets efficiently sort workers into jobs through a joint-optimization process where firms seek to hire workers with the highest expected productivity and workers maximize earnings. In pure matching models, skills and productivity are stable and mobility occurs when workers and employers learn new information about the quality of their current match (Jovanovic 1979b; Wilde 1979; Farber and Gibbons 1996; Altonji and Pierret 2001) or alternative prospects (Mortensen 1978; Jovanovic 1979a, 1984; Pissarides 1994). The matching model is also broadly consistent with sociological theories of status attainment where individual characteristics like family background, education, and social and cultural capital are converted into career paths (Blau and Duncan 1967; Sewell and Hauser 1975; Kalleberg and Mouw 2018).

While productivity is difficult to observe, education is thought to increase workers' productivity and may also be interpreted as a signal of expected productivity by employers (Schultz 1961; Becker 1962; Spence 1973; Kerckhoff, Raudenbush, and Glennie 2001). Pure matching on education predicts that college-educated workers should have relatively high earnings at the beginning and the middle of their careers compared to non-college-educated workers because they are more productive. Under a matching model, the disproportionate sorting of college-educated workers into high earnings ranks early in the career creates a spurious association between early- and mid-career earnings due to differences in productivity between low- and high-earners early in the career. Controlling for education should therefore reduce rank-dependence and increase mobility opportunity.

Productivity may also moderate the relationship between early- and mid-career earnings. Because skills are assumed to be stable in pure matching models, resorting will occur when

highly productive workers are under-placed at the beginning of their careers and less productive workers are over-placed. This re-sorting provides high-skill workers with greater opportunities for upward mobility. Thus, we should expect that holding a college degree increases mobility opportunity and decreases rank dependence, particularly for those at the bottom of the rank earnings distribution.

The effects of education on relative earnings mobility have likely grown over time. Skill-biased technological change complemented high-skill workers and substituted for routine labor that was characteristic of formerly well-paying blue-collar jobs in sectors like manufacturing (Autor, Levy, and Murnane 2003; Acemoglu and Autor 2011), contributing to rising inequality in earnings and earnings growth by increasing the premium on education (Lemieux 2006, 2008; Cheng 2021). Rising demand for labor in both technical and professional jobs and in service jobs and diminished demand in the middle of the occupational distribution (Autor, Katz, and Kearney 2006, 2008; Autor and Dorn 2013) led to rising inequality in the occupational and earnings trajectories for workers with different levels of education (Altonji, Kahn, and Speer 2014; Cheng and Park 2020; Lin and Hung 2022). Growing inequalities in earnings and occupational trajectories between those with and without college degrees or highly desirable skills suggest that selection on education and career processes that differentiate mobility patterns by education may have a stronger effect in recent cohorts.

Human capital investment

Career mobility patterns and their variation over time may also be driven by changes in how firms and workers invest in human capital over the career. A vast literature has shown that earnings increase substantially as workers accumulate skills and experience in the labor market,

although there is some disagreement over the extent to which earnings growth is driven by the accumulation of generic, transferable skills or investment in human capital that is specific to jobs, firms, occupations, or industries (Mincer 1974, 1988, 1997; Hashimoto 1981; Altonji and Shakotko 1987; Neal 1995; Gibbons and Waldman 2004; Shaw and Lazear 2008; Sullivan 2010; Pavan 2011). Empirical evidence suggests that in general, investment in and returns to occupation-specific skill are especially high in primary-segment occupations such as managers, professionals, and craft workers and much lower among occupations in the secondary labor market like laborers and service workers (Shaw 1984, 1987; Gibbons and Waldman 2004; Kambourov and Manovskii 2009; Sullivan 2010). Because primary segment jobs tend to also have higher pay, it is possible that the relationship between early- and mid-career earnings ranks is mediated by the accumulation of general labor market experience or tenure within a given employer or occupation. Accumulating general or specific skills may also provide workers with greater opportunity for mobility from a given position in the earnings distribution.

The decline of long-term employment relations likely diminished the importance of firm-specific tenure and increased the importance of occupation-specific and general experience in shaping mobility. Through the 1970s, firms relied on internal labor markets (ILMs) that institutionalized pathways for upward intragenerational mobility through a combination of well-defined career ladders, wages that were tied to workers' job titles rather than their individual marginal product, investment in workers' skill development, and insulation from competition from workers outside the firm (Doeringer and Piore 1971; Kalleberg and Sorensen 1979; Kalleberg 1988; Althauser 1989; Osterman 1999). Long-term employment incentivized firms and workers to jointly invest in firm-specific skills, and firms ensured they could retain employees to capture returns on that investment by adopting deferred compensation schemes that

paid employees below their marginal product early on and above their marginal product towards the end of their career (Kalleberg and Sørensen 1979; Lazear 1979; Medoff and Abraham 1980; Akerlof and Yellen 1986; Spilerman 1986; Baker, Gibbs, and Holmstrom 1994). But starting in the 1980s, models of production became less firm-specific and firms' demand for high-level general cognitive skills increased (DiPrete, Goux, and Maurin 2002). At the same time, shareholders demanded that firms reduce labor costs (Fligstein 1993, 2001; Useem 1993; Uchitelle 2006; Fligstein and Shin 2007). Firms responded by moving away from ILMs in favor of external employment strategies, leading to a decline in firm-specific tenure and rise in nonstandard work arrangements (Kalleberg 2009; Farber 2010). As a result, returns to firm-specific tenure declined while returns to general experience grew, particularly for the highly educated (Marcotte 1998; Cappelli 2001; DiPrete et al. 2002; Altonji and Williams 2005). We may therefore expect that the positive effects on mobility opportunity and tempering effects on rank-dependence due to firm-specific tenure have declined while those effects from the accumulation of occupation-specific and general experience may have increased.

Job mobility

Changes in production and the organization of firms have also reshaped the occupational structure and how workers move between jobs. Skill-biased technological change has increased demand at the top and bottom of the occupational distribution while hollowing out the middle and also substantially increased wage inequality between occupations (Autor et al. 2006, 2008; Mouw and Kalleberg 2010; Acemoglu and Autor 2011; Autor and Dorn 2013). In turn, patterns of occupational mobility have become increasingly rigid and access to career lines that promote earnings growth has become more restricted (Cheng and Park 2020; Lin and Hung 2022).

Workers at the bottom of the occupational structure became increasingly mobile between occupations, but such mobility is largely to other low-skill occupations (Kim 2013; Jarvis and Song 2017; Cheng and Park 2020). As such, we may expect to see a growing divergence in the returns to job changes, where job changes in high-paying occupations increase mobility opportunity and decrease rank dependence while job changes in low-paying occupations constrain mobility and increase rank dependence.

Summary of hypotheses

Observed patterns of relative earnings mobility are expected to be explained partially through selection. Workers who are female, nonwhite, and do not have a college degree are expected to have relatively low earnings at any point in their career. Their disproportionate selection into the bottom of the rank earnings distribution early in the career likely creates a spurious association between early- and mid-career rank earnings that corresponds to high rank-dependence in the upper quantiles of their conditional earnings and low rank-dependence in the bottom quantiles. Race, gender, and education are also expected to moderate the relationship between early- and mid-career rank earnings. White, male, and college-educated workers are expected to experience greater upward mobility from the bottom of the rank earnings distribution and less downward mobility from the top. Gender is expected to have a greater effect on earnings mobility in older cohorts than in younger cohorts, although occupational integration by gender may offset this change. Race is not expected to change in its explanatory power. Education is expected to increase in its explanatory power.

I have also proposed some career processes through which relative earnings mobility unfolds. The accumulation of firm- and occupation-specific capital as well as general experience

is expected to increase mobility opportunity and decrease rank dependence. The relative importance of firm-specific tenure is expected to decline with younger cohorts while the effect of occupation-specific and general work experience is expected to increase. Job changes in high-end occupations are expected to increase mobility opportunity and decrease rank dependence while the opposite is expected for job changes in low-end occupations. Job changes are expected to increase in importance in younger cohorts.

Data and Variables

Panel Study of Income Dynamics

Career earnings mobility is modeled using data from the Panel Study of Income Dynamics (PSID). The PSID is a longitudinal panel survey that began collecting data in 1968 from a sample of about 4,800 US households comprised of about 18,000 individuals. As household members aged and formed their own families, the total sample grew to about 80,000 individuals. PSID respondents were surveyed yearly from 1968 to 1997 and biennially since. The PSID collects information from surveys of a reference person (formerly "head of household"). The reference person is defined as the adult household member with the most financial responsibility in the family unit. If this person is female and she has a male spouse or partner, he is designated as the reference person. The PSID collects detailed data from reference persons on their and their spouse's income and employment, as well as demographic, health, family, and other social and economic data.

Sample selection

This study models long-term relative earnings mobility between the beginning of respondents' career and their prime-earning years. The sample is restricted to reference persons and spouse/partners from the core PSID sample who are at least 45 years old by their most recent interview, have positive earnings for some years between ages 22 and 28 as well as between ages 42 and 48. Persons with missing data on analytic variables are dropped from the sample. The sample is also restricted to Black and white respondents due to small sample sizes among respondents of other races and ethnicities that result in prohibitively low statistical power to test differences between races or ethnicities. Longitudinal weights are used to account for attrition. The final analytical sample contains observations from 3,250 PSID respondents.

Variables

Respondents are divided into 10-year *birth cohorts* starting in 1940, 1950, 1960, and 1970. *Earnings* are measured yearly using respondents' total labor income including wages, bonuses, overtime, commissions, professional practice, and the labor part of business income. Earnings are adjusted for inflation to year-2000 dollars. To capture changes in long-term earnings and reduce noise from year-to-year fluctuations, *early-career* and *mid-career* earnings are measured using seven-year averages of earnings centered at age 25 and age 45, respectively. Early- and mid-career *earnings ranks* are determined by ranking individuals in a given year according to their earnings and then translating these ranks into percentiles. These earnings ranks represent individuals' position in the earnings distribution.

Respondents' *labor market experience* is the number of years a respondent has worked for pay. Experience is only recorded when the household's head or spouse changes. I impute labor market experience based on the number of years a respondent worked for pay between an

interview year and the year in which their labor market experience was recorded. *Employer tenure* records the number of years a respondent has worked for their employer. When employer tenure is missing, I back-fill employer tenure using the most recent non-missing record minus the time between interviews if an individual's detailed industry code has not changed between the two records and the imputed value of tenure is positive.

Occupation is coded using a balanced panel of occupational codes developed by Autor and Dorn (2013). One-digit occupation codes describe the general category of respondents' occupations, and three-digit codes describe detailed occupations. *Occupational experience* reflects how many years through age 45 a respondent worked in a specific occupation. *Occupation change* reflects changes in occupation between interview rounds. Employers are not directly identified in the PSID. Following Brown and Light's (1992) recommendation, I infer an *employer change* when reported tenure is less than the time elapsed between interviews. In cases of missing tenure data, employer changes are inferred using industry changes between interviews.

Black is an indicator variable that takes on 0 if the respondent is white and 1 if the respondent is Black. *Female* is coded 0 for male and 1 for female. *College* indicates if the respondent has obtained a college degree. Fathers' occupations are coded using 1-digit occupation codes based on the 1970 Census occupational coding scheme. Early-career exposure to a *recession* is coded 1 if a respondent worked between ages 22 and 28 during an economic recession.

Analytical Approach

Methodological limitations of prior research

Studies of relative earnings mobility typically rank individuals according to their earnings and then describe relative mobility either by analyzing transition matrices between earnings rank quantiles (e.g. 1st to 25th percentile) or by conducting a regression of destination rank on origin rank and interpreting the slope coefficient on origin rank as an estimate of rank mobility. In the transition matrix approach, analysts estimate the probability of attaining a destination position conditional on starting position and examine how the relative chances of attaining different earnings quantiles differ between starting positions. The main advantage to this approach is that it allows analysts to describe the full distribution of destinations conditional on starting rank. But the transition matrix approach has two key shortcomings. First, information is lost by collapsing continuous earnings ranks into categorical measures to define the rows and columns of the transition matrix. Second, the intragenerational relative earnings mobility literature typically uses this approach for descriptive analysis and does not quantitatively assess the factors that contribute to variation in mobility.

Researchers interested in analyzing the mechanisms that drive earnings mobility often opt to use OLS regressions to model the conditional mean of destination earnings rank, earnings quantile, or change in earnings rank, as a function of origin earnings position as well as demographic, life course, and labor market factors (Auten and Gee 2009; Bradbury 2018; Carr and Wiemers 2022). This approach is analogous to the rank-rank analysis of intergenerational mobility[1] (e.g. Chetty, Hendren, Kline, and Saez 2014; Chetty, Hendren, Kline, Saez, et al. 2014). Analysts interpret the coefficient on origin rank as a measure of mobility, with larger

[1] Alternatively, many analyses of intergenerational mobility examine the intergenerational earnings elasticity (IGE) by regressing the log earnings of adults on the log earnings of their parents. While the IGE is affected by relative mobility, it is not a strict measure of relative mobility because it is influenced both by changes in the shape of the income distribution and mobility between positions in the income distribution (Goldthorpe 2013; Chetty, Hendren, Kline, and Saez 2014; Chetty, Hendren, Kline, Saez, et al. 2014; DiPrete 2020).

coefficients indicating lower mobility. While the regression approach allows for the estimation of rank mobility net of control variables, it only allows researchers to model *mean* destination earnings ranks conditional on initial earnings and other factors, rather than describe the distribution of expected outcomes for individuals who start their career at a given earnings rank or describe how that distribution varies across early-career earnings ranks or population subgroups.

Modeling mobility using conditional quantile regression

I suggest that analyses of intragenerational relative earnings mobility should incorporate three desirable properties. First, they should quantitatively describe the strength of the association between origin and destination positions in the earnings distribution (rank-dependence). Second, they should capture the range of destination positions in the earnings distribution and the chances of attaining those positions given a starting rank (mobility opportunity). Third, analyses should allow for statistical inference that distinguishes between selection into early-career earnings ranks (due to education, demographics, etc.) and differences in mobility opportunities afforded to otherwise similar individuals who start their careers at different earnings ranks. The analysis of transition matrices as employed in the intragenerational relative earnings mobility literature meets the first and second criteria, and the rank-rank regression approach meets the first and third.

Conditional quantile regression (CQR) models of mobility can meet all three criteria. CQRs estimate the expected change in a given quantile of the outcome distribution associated with a one-unit change in a predictor variable for respondents with otherwise equal values for other covariates (Koenker and Bassett 1978; Koenker and Hallock 2001; Rios-Avila and Maroto

2022). For example, in this setting, CQRs can be used to answer the question: "what is the expected difference in men and women's median mid-career earnings rank, conditional on starting their career in the 90th percentile of the early-career earnings rank distribution?"

The CQR models in this paper are specified as:

$$Q_\tau(logit(Y_{it=45}/100)|X, Y_{it=25}, V_i) = \beta_0(\tau) + \beta_1(\tau)Y_{it=25} + \beta_3(\tau)X_i + \beta_4(\tau)Y_{it=25} \times X_i + \gamma(\tau)V_i + \epsilon_i \quad (1)$$

Where $Y_{it=45}$ represents the respondent's rank in earnings averaged over seven years at age 45 and $Y_{it=25}$ represents their rank at age 25. The logit transformation is used on rank earnings at age 45 to accurately model a dependent variable that is bounded between 0 and 100. X_i represents covariates used to test how mobility may vary according to traits such as gender or education. Interactions between $Y_{it=25}$ and X_i allow us to observe how these covariates differentially affect mobility from different ranks in the early-career earnings distribution. V_i represents additional controls that can be incorporated into the model. $Q_\tau(\text{logit}(Y_{it=45}/100)|X, V_i, Y_{it=25})$ is a quantile function representing the logit of mid-career earnings ranks above $\tau\%$ of all observations with the same early-career earnings rank and values on other covariates. The slope on $Y_{it=25}$ ($\beta_1(\tau)$) reflects the rank-dependence of a given quantile of the mid-career earnings rank distribution (e.g. how much median logit mid-career earnings rank changes with early-career earnings rank). The coefficients $\beta(\tau)$ vary between quantiles, allowing us to observe heterogeneous effects of predictor variables on different quantiles of the mid-career logit earnings rank distribution. Since the coefficients $\beta(\tau)$ describe effects on the logit scale, I estimate and report average marginal effects of each predictor variable on the original 0 to 100 rank earnings scale (Williams 2012).

I use predicted values from the CQRs to describe the full conditional distribution of mid-career earnings ranks conditional on early-career earnings and other covariates. This distribution is interpreted as the mobility opportunity for individuals with a given early-career earnings rank and set of values on additional covariates. I also characterize mobility opportunity using the interquartile range (75^{th} percentile - 25^{th} percentile; IQR) of predicted earnings ranks at age 45. I use OLS to model how the IQR of predicted earnings ranks at age 45 varies with earnings rank at age 25 and its square:

$$\hat{Q}_{75} - \hat{Q}_{25} = \beta_0 + \beta_1 Y_{it=25} + \beta_2 Y_{it=25}^2 + \epsilon_i \quad (2)$$

Examination of the IQRs of predicted mid-career earnings ranks suggests that the relationship between early-career earnings ranks and the IQRs is well approximated by a quadratic function. Together, the coefficients β_1 and β_2 describe how the predicted IQR may increase, level off, or decrease with early-career rank.

Testing hypotheses with regression adjustment and instrumental variables in CQRs

I use CQRs to test hypotheses about rank dependence and mobility opportunity in the relationship between early- and mid-career earnings ranks. First, I use a CQR with early-career earnings rank as the independent variable to examine unadjusted patterns of earnings rank mobility over the career. Then, I consider how much of the relationship between early- and mid-career earnings remains after adjusting for selection on education, race, and gender. I examine how the coefficient on early-career rank earnings is further attenuated by including mediating career processes represented by variables such as work experience and job mobility. I then use an instrumental variables (IV) approach to account for selection into early-career earnings ranks on both observable and unobservable characteristics such as skill, access to professional networks,

or affability. I instrument early-career earnings with indicators for whether a recession occurred while a worker was employed from ages 22 to 28 and father's occupation. Appendix A discusses the validity of these instruments in greater detail.

Next, I test how race, gender, education, the accumulation of general work experience, firm-specific tenure, occupation-specific experience, and job mobility may moderate the relationship between early- and mid-career earnings ranks. I use CQRs where early-career earnings rank is interacted with each moderator to examine how the distribution of mobility outcomes varies between groups and how that variation changes depending on where they start their career in the earnings distribution.

Finally, I use a semiparametric decomposition method developed by DiNardo, Fortin, and Lemieux (DFL) (1996) to examine between-cohort differences in rank mobility. The DFL decomposition is a counterfactual weighting procedure that allows for the decomposition of the between-cohort difference in rank-dependence into components explained by cohort differences in the composition of the labor force upon entry into the labor market (composition effect) versus changes in how the labor market itself structures the association between early- and mid-career earnings (mobility structure effect[2]). Weights are constructed such that cohorts have the same distribution on observable covariates, conditional on early-career earnings rank, as the 1940-1949 cohort. Comparing these counterfactual cohorts to the 1940-1949 cohort reveals the mobility structure effect by answering the question "how much would mobility patterns have changed over time if we held the composition of the labor force constant?" and comparing the counterfactual cohorts to their unweighted, observed distribution reveals the composition effect

[2] This effect is typically referred to as the "wage structure effect" in decompositions of wage inequality. I use the term "mobility structure effect" because this application of the DFL method decomposes inequality in earnings mobility rather than wages or earnings themselves.

by answering the question "how much would a cohort's mobility patterns change if its composition were the same as the 1940-1949 cohort?" Importantly, because we are interested in changes in mobility patterns conditional on starting positions, reweighting to achieve the 1940-1949 distribution of covariates *conditional on early-career earnings ranks* allows us to isolate the effects of changes to the mobility structure from changes in the allocation of workers across the earnings distribution at the beginning of their careers.

I construct the weights to generate the counterfactual distributions as follows:

$$\omega = (1 - C) + C * \frac{1 - P(C|X, r, X * r)}{P(C|X, r, X * r)} \quad (3)$$

where C is an indicator variable for belonging to the weighted cohort, X represents a set of covariates to balance on, and r represents early-career earnings rank. I use a probit model to estimate $P(C|X, r, X * r)$ for each individual worker. Conditioning on X, r, and their interaction ensures statistical independence between cohort membership and the distributions of the covariates X, early-career earnings ranks r, and the distribution of X over r. Doing so allows for the estimation of between-cohort differences in the effect of early-career earnings rank on mid-career earnings rank, net of between-cohort differences in worker characteristics and how workers sort on those characteristics into early-career earnings ranks. Before weighting, cohorts differ significantly in their distribution of covariates across early-career earnings ranks. After weighting, the cohorts are balanced on their covariate distributions across early-career earnings ranks (Appendix B).

I construct 8 models for each decomposition. Each model adds an additional covariate to construct weights that are applied to each respondent to realize a counterfactual where workers in each cohort follow the 1940 cohort's distribution on those variables conditional on early-career

earnings rank. Variables are added roughly according to the temporal order which they occur. Demographic variables (gender and race) come first, followed by education, then general work experience, firm tenure, experience in service and managerial and professional occupations, total employer changes, and job changes in managerial and professional occupations. Through this decomposition, I demonstrate the extent to which cohort differences in distributions of each variable and economic returns to each variable contribute to between-cohort inequality in relative earnings mobility.

Results

Descriptive statistics

The analytic sample contains data from 3,250 PSID respondents from four birth cohorts spanning 10 years each beginning in 1940, 1950, 1960, and 1970 respectively (Table 1). Just under 20 percent of the sample is from the 1940 cohort, 37 percent is from the 1950 cohort, 31 percent from the 1960 cohort, and 12 percent from the 1970 cohort. The sample skews slightly female, is about two-thirds white, and about a third hold college degrees. On average, workers in the sample have worked for about 24 years by age 45 and their longest spell with a single employer is 12 years. Workers in the sample have accumulated the most work experience in managerial, professional, technical, and laborer occupations. The average worker has had six employers and job changes are most common within managerial and professional occupations. On average, workers enter the labor market slightly below the median of the earnings distribution and by age 45 are slightly above the median. High standard deviations indicate that workers vary considerably in earnings ranks at age 25 and 45. On average, workers move up 4 percentiles in

the earnings distribution between age 25 and 45, and the high standard deviation indicates that substantial rank mobility is common.

[[Table 1 here]]

Relative earnings mobility in the pooled sample

A transition matrix describing mobility between earnings quintiles between ages 25 and 45 is presented in Table 2. Immobility from respondents' earnings quintile at age 25 is greatest in the bottom and top quintiles, where 38 and 62 percent of respondents remain in the same quintile at age 45, respectively. Persistence is around 30 percent in the middle quintiles. In general, mobility more than one quintile away from one's origin quintile is rare. This results in compression in mobility from bottom of the earnings distribution, where 70 percent of workers remain in their origin quintile or move up one quintile. The same mobility pattern holds for 80 percent of workers who begin their careers at the top of the earnings distribution. For those who begin their career in the middle quintiles, a similar percentage remain in their origin quintile or move one quintile up or down. There is therefore greater variation in mobility outcomes experienced by those who begin their careers in the middle of the earnings distribution than those who begin in the tails.

[[Table 2 here]]

Results from unadjusted quantile regressions of age 45 earnings rank on age 25 earnings rank from the pooled PSID sample are presented in the first column of Table 3 and Figure 3. These findings are generally consistent with descriptive findings from the transition matrix. Figure 3 plots the predicted earnings rank distribution of workers at age 45 conditional on early-career rank and shows compression in mobility opportunity at the bottom and top of the age 25

earnings distribution. Most workers who enter the labor market at the bottom of the earnings distribution tend to remain near the bottom and a relatively small proportion tend to move into the middle and upper ranks. The opposite is true for workers beginning their careers at the top, who tend to remain towards the top of the distribution and rarely fall very far. The IQR of age 45 ranks is about 15 percentile points larger for workers who begin their careers at the middle of the earnings distribution than for those who begin at the tails.

[[Figure 3 here]]

Table 3 contains average marginal effects on the conditional 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentile age-45 earnings rank for a one-percentile increase in earnings rank at age 25. These marginal effects describe rank-dependence, or how quantiles of the distribution of ranks that respondents attain in the earnings by age 45 changes shape depending on where they fall in the earnings rank distribution at age 25. All quantiles of the conditional earnings rank distribution at age 45 are significantly associated with earnings rank at age 25. The association between age-25 and age-45 earnings rank is strongest at the middle of the distribution, where the median earnings rank at age 45 increases by 0.685 for each one-percentile increase in age-25 earnings rank. This association is weaker but still substantial at the tails of the distribution – 10^{th} and 90^{th} percentile age-45 earnings ranks increase by 0.500 and 0.463 with a one-unit increase in earnings rank at age 25.

[[Table 3 here]]

Table 3 also reports average marginal effects from CQRs that sequentially add sets of variables that correspond to four mechanisms of mobility in the labor market. Model 2 controls for race and gender, resulting in large reductions in rank-dependence across quantiles of the mid-career rank earnings distribution. This suggests selection into early-career earnings ranks by race

and gender accounts for some of the observed immobility between earnings ranks over the career. Controlling for holding a college degree also reduces estimates of rank-dependence across the rank-earnings distribution at age 45 (Model 3). Accounting for differences in the accumulation of general, firm-specific, and occupation-specific experience over the career further attenuates estimates of rank-dependence (Model 4). The inclusion of controls for employer changes and occupation changes within various occupational groups has a smaller effect on estimates of rank-dependence. After adjusting for these controls, mobility from the tails of the earnings distribution is still more constrained than mobility from the middle of the distribution. But the IQR of earnings ranks at age 45 is about 10 percentile points smaller for workers who begin their careers at the median of the distribution than in the unadjusted model, while mobility opportunity does not change much for workers at the tails of the distribution.

Estimates of rank-dependence from IV models tell a slightly different story. While Models 1-3 examine how estimates of rank-dependence are affected by the inclusion of controls for observable pre-market differences between workers who begin their careers in different positions in the earnings distribution, IV models also account for selection on unobservables. The IV estimates of rank-dependence are much higher than the unadjusted and covariate-adjusted estimates at and above the 25th percentile of earnings ranks at age 45. The estimated average marginal effects just under 1 suggest a highly rigid mobility regime where a one-rank increase in early-career earnings is associated with roughly a one-rank increase in rank earnings in the middle of workers' careers. Examining the predicted distribution of earnings ranks at age 45 in Figure 3, we see that the IV models predict much more constrained mobility among workers who begin their careers at the bottom and top of the rank earnings distribution, with IQRs between 0 and 20 percentile points at the tails of the distribution and over 40 in the middle.

These results suggest that a substantial amount of upward mobility from the bottom of the earnings distribution and downward mobility from the top is driven by selection and that earnings determination processes within the labor market produce highly rigid patterns of rank immobility for low- and high-earners.

Next, I consider how mobility patterns differ between groups. Results from CQRs where early-career earnings rank is interacted with each covariate are presented in Table 4 and select predicted mid-career earnings ranks and IQRs are presented in Figure 4. There is little meaningful difference in how the distributions of mid-career rank earnings for Black and white workers change with early-career rank earnings. Rank-dependence is much lower for women while their mobility opportunity is more constrained at the bottom of the earnings distribution and much greater at the top. Compared to men, women who begin their careers at the top of the earnings distribution attain median mid-career earnings ranks that are about 10 percentile points lower, 25^{th} percentile ranks that are 20 percentile points lower, and 10^{th} percentile ranks that are 40 percentile points lower. Consistent with human capital theory, holding a college degree affects rank-dependence primarily at the top of the mid-career rank earnings distribution by reducing the effect of early-career earnings rank on the upper tail of the distribution, thereby increasing the opportunity for upward mobility among workers who start their careers towards the bottom of the distribution.

[[Table 4 here]]

[[Figure 4 here]]

Accumulating general work experience, firm tenure, and experience in managerial and professional occupations increases rank-dependence at the bottom of the earnings distribution, benefitting high-earners by decreasing their chance of downward mobility. Accumulating

experience in service occupations has the opposite effect, depressing workers' opportunity for upward mobility and increasing their chances of downward mobility. The effects of general experience, firm tenure, and service sector experience persist after including controls. Changing employers also tends to inhibit mobility by diminishing workers' chances of upward mobility from low earnings ranks and increasing their chances of substantial downward mobility from high earnings ranks. This effect is particularly pronounced for job changes within the service sector even after including controls.

All told, in the pooled sample, workers' earnings rank at age 45 is highly dependent on their rank at age 25. Selection on race, gender, and education explain some of this association. Inequality in the accumulation of human capital over the career also explains some of this association, but inequality in job change patterns explain less. Early-career rank earnings affect mid-career rank earnings differently between groups. Bottom-tail outcomes for women are much less dependent on early-career earnings than for men. Holding a college degree tends to equalize upper-tail outcomes for low- and high-earners. Accumulating work experience, firm tenure, and experience in managerial and professional occupations tends to equalize upper-tail outcomes and exacerbate inequality in lower-tail outcomes, while experience and job changes in service occupations do the opposite.

Cohort trends in relative earnings mobility

Next, I examine between-cohort differences in relative earnings mobility. Transition matrices for each cohort show that mobility patterns are similar between cohorts, but with stronger persistence at the top and bottom of the earnings distribution in the 1940 and 1970 cohorts (Table

5). Figure 5 shows predicted distributions of mid-career rank earnings by early-career rank earnings for each cohort and produces similar results.

[[Table 5 here]]

[[Figure 5 here]]

Table 6 contains results from the decomposition of between-cohort differences in rank-dependence into mobility structure and composition effects. Rows labeled "observed" contain unadjusted coefficients. Each subsequent row contains results from a separate decomposition where the 1950, 1960, and 1970 cohorts are weighted to match the 1940 cohort's distribution of the listed trait and the traits before it across the early-career earnings rank distribution. For example, the row labeled "Black" describes a decomposition where each cohort is weighted to have the same distribution of Black and female workers at any given point in the age-25 earnings distribution as the 1940 cohort. The composition effect describes the extent to which between-cohort differences in rank-dependence are explained by changes in workers' observed characteristics and how they sort into positions in the early-career earnings distribution, while the mobility structure effect describes between-cohort differences in the determinants of rank mobility, or how rank mobility is structured for otherwise similar individuals. Figures 6 and 7 present plots of selected observed and counterfactual mobility patterns.

[[Table 6 here]]

[[Figure 6 here]]

There is no statistically significant difference in rank-dependence between the 1940 and 1950 birth cohorts at any point of the mid-career rank earnings distribution. The 1960 birth cohort has significantly lower rank-dependence at the 25^{th} and 50^{th} percentiles of the mid-career rank earnings distribution. At the 25^{th} percentile, this difference is entirely explained by between-

cohort differences in labor force composition. Cohort differences in the distribution of female workers across early-career ranks explain nearly 80 percent of the difference in rank-dependence (Figure 6). Differences in the distributions of subsequent balancing variables across early-career ranks explain almost all the remaining difference in rank-dependence. At the 50th percentile, equalizing the 1960 and 1940 cohorts' distributions of female workers explains just under half of the difference in rank-dependence. The composition effect at the 50th percentile is significant at $p<0.10$ after also balancing on race, education, and work experience. The nonsignificant mobility structure effect indicates that the determinants of rank mobility within the labor market have not changed significantly between cohorts.

[[Figure 7 here]]

Differences in rank-dependence between the 1940 and 1970 cohorts are driven by a combination of changes in the labor force and structural changes in mobility opportunity. Compared to the 1940 cohort, the 10th percentile of mid-career earnings ranks increases much less with early-career earnings in the 1970 cohort because high earners are more likely to experience substantial downward mobility. Weighting the 1970 cohort to match the 1940 cohort in its distribution of women across early-career ranks explains the entire between-cohort gap in rank-dependence at the 10th percentile (Figure 7). The 1970 cohort has more women with high early-career earnings than the 1940 cohort, and women are disproportionately likely to move into low mid-career earnings ranks, resulting in lower observed rank-dependence in 10th percentile rank earnings for the 1970 cohort. At the 50th percentile, balancing on gender also explains the entire between-cohort difference in rank-dependence. However, the composition effect is not significant until the cohorts are also balanced on race, education, work experience, and firm tenure.

The 75th and 90th percentiles of the mid-career earnings rank distribution change with early-career earnings at rates that are not significantly different in the 1940 and 1970 cohorts. This apparent stability in rank-dependence is maintained by a combination of changes in the composition of the labor force and in the structure of mobility. If the distribution of workers by education across early-career earnings ranks had not changed between 1940 and 1970, rank-dependence at the 75th and 90th percentile would be much higher in 1970 than as observed in 1940 because the effect of holding a college degree on workers' opportunity to attain higher earnings ranks is much greater in the 1970 cohort than in the 1940 cohort. At the same time, the large composition effect suggests that if the educational attainment of low earners had not improved since 1940, mobility at the 75th and 90th percentile would be more rank-dependent. This effect is only statistically significant at the 75th percentile.

Conclusion

Workers vary considerably in how their earnings change over their career. One important and under-studied dimension of stratification related to career earnings mobility is how workers' point of entry into the labor market constrains their opportunity to change positions in the earnings distribution over their career. Studies of mobility in absolute earnings over the career have revealed patterns of inequality in earnings trajectories over the career (e.g. Fuller 2008; Cheng 2014, 2021; Maume and Wilson 2015; Doren and Lin 2019). Analyses of relative mobility offer a complementary perspective by considering how variation in earnings trajectories may result in mobility between positions in the earnings distribution. Relative mobility describes the rigidity of earnings stratification by describing how workers' opportunity to move up or down relative to others in the earnings distribution is constrained by the position where they

enter the labor market. By focusing on rank mobility rather than absolute mobility, these analyses allow for a comparison of mobility rates net of how the earnings distribution may change shapes over time or between contexts.

In line with previous research (e.g. Carr and Wiemers 2022), I find that workers' position in the earnings distribution when they enter the labor market is a strong determinant of their position in the earnings distribution later in their career. This is especially true for workers who begin their careers at the tails of the earnings distribution. I extend prior research on relative earnings mobility by examining how the entire distribution of mid-career earnings ranks varies with early-career earnings using a novel application of conditional quantile regressions. Using CQRs, I show that the lower and upper limits of the earnings ranks that workers attain are less sensitive to where they begin their career than are their typical outcomes. While I find that some of the observed inequality in mobility by workers' early-career earnings can be attributed to selection on race, gender, and education, IV analyses suggest that the opportunity for relative earnings mobility is tightly constrained for workers who enter the labor market at the tails of the earning distribution.

I find evidence that a substantial proportion of the relationship between early- and mid-career earnings ranks is driven by women's disproportionate risk of substantial downward relative mobility from the top of the earnings distribution. This is consistent with prior research showing especially large motherhood penalties for high-earning women (e.g. England et al. 2016), as nearly all women in the sample become mothers before age 45. I also find that gender plays an important role in explaining changes in rank mobility over time: the bottom of the mid-career rank earnings distribution for high-earners has become increasingly similar to that of low-

earners largely because more women are entering the labor market with relatively high earnings and these women often experience significant downward mobility.

I also find evidence that both premarket human capital and human capital acquired within the labor market are important determinants of rank mobility. Education shapes mobility primarily through its effect on the upper half of the rank earnings distribution. Mobility into higher earnings ranks for workers with college degrees is much less constrained by their early-career earnings than for workers without college degrees. The mobility returns to education have also become much more important over time. Rank mobility at the top of the earnings distribution was stable across cohorts almost entirely due to rising educational attainment among workers who begin their careers towards the bottom of the earnings distribution. If educational attainment had not changed since the 1940 cohort, upward mobility from the bottom of the earnings distribution would have been much more limited because workers without college degrees have much more dismal prospects of upward mobility from low earnings ranks in more recent cohorts. Human capital acquired within the labor market tends to both improve upper-tail outcomes for low-earners and limit lower-tail outcomes for high-earners.

Altogether, I find that the weakened association between early-career earnings and the bottom of the mid-career earnings distribution is driven by changes in the demographic composition of workers who start their careers at the top of the earnings rank distribution and by changes in how labor market experiences differ between workers who begin their careers at the top and bottom of the earnings distribution. Observed stability in the association between early-career earnings and the top of the mid-career earnings distribution was maintained by the offsetting effects of rising returns to education and rising educational attainment among low-earners.

In addition to these substantive findings, this work embraces the notion that the variability of social outcomes, rather than the average, is of considerable importance to social scientists (Duncan 1984), and offers a new method to characterize variation in mobility outcomes using CQRs. I present two metrics that allow researchers to describe the range of outcomes that workers experience and how that range changes depending on where workers begin their careers. This approach provides parsimonious parametric descriptions of mobility and allows researchers to estimate metrics of mobility net of confounding variables. While I focus these analyses on rank mobility, the same approach could be used to study absolute earnings mobility.

While this paper offers a step towards a fuller understanding of relative earnings mobility, it is not without its limitations. First, because I focus on the relationship between earnings at age 25 and 45, the youngest respondents I can observe were born in the late 1970s and entered the labor market during the 1990s. Although more recent cohorts have entered the labor market since, their longer-term career dynamics cannot yet be examined. Limited sample sizes also preclude the analysis of the careers of Hispanic workers, who comprise a large and growing portion of the labor force. Finally, selection on unobservables appears to be an important determinant of rank-dependent earnings mobility, suggesting that the labor market itself may do far less to promote positional mobility than previously believed. Further research is warranted to uncover mechanisms that may facilitate positional mobility in the earnings distribution after accounting for the nonrandom allocation of workers into starting positions at the beginning of their careers.

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TABLES

Table 1. Desciptive statistics

Variable	% or mean	SD
Birth cohort		
1940-1949	19.72	
1950-1959	37.38	
1960-1960	30.62	
1970-1979	12.28	
Gender		
Male	45.85	
Female	54.15	
Race		
White	65.57	
Black	34.43	
College degree	35.05	
Work experience	23.68	5.04
Longest employer tenure	12.02	7.1
Total years experience within occupation group		
Managerial and professional specialty	5.82	7.58
Technical, sales, administrative support	3.22	5.52
Service	1.79	4.32
Farming, forestry, fishing	0.34	1.83
Precision production, craft, and repair	1.19	3.51
Operators, fabricators, laborers	2.43	5.31
Total employer changes	6.06	3.26
Total occupation changes within occupation group		
Managerial and professional specialty	2.19	2.5
Technical, sales, administrative support	1.82	2.53
Service	0.84	1.46
Farming, forestry, fishing	0.23	0.68
Precision production, craft, and repair	0.69	1.59
Operators, fabricators, laborers	1.08	1.97
Weekly earnings rank age 25	51.49	27.74
Weekly earnings rank age 45	47.44	28.02
Change in weekly earnings rank	4.04	25.52
N	3250	

Table 2. Transition matrix between earnings quintiles for the pooled sample

	Weekly Earnings Quintile Age 45				
Weekly Earnings Quintile Age 25	0-20	20-40	40-60	60-80	80-100
0-20	38.4	30.4	18.9	9.4	3.0
20-40	19.5	27.7	27.6	16.2	9.0
40-60	9.7	21.5	28.3	23.9	16.6
60-80	7.3	9.1	22.0	30.4	31.3
80-100	3.2	4.1	11.4	19.6	61.6

Table 3. Estimated average marginal effects from CQRs of mid-career earnings on early-career earnings

Conditional mid-career earnings quantile	10th Percentile						25th Percentile						50th Percentile					
	(1)	(2)	(3)	(4)	(5)	(IV)	(1)	(2)	(3)	(4)	(5)	(IV)	(1)	(2)	(3)	(4)	(5)	(IV)
Early-career rank	0.500***	0.366***	0.344***	0.201***	0.161***	0.216	0.657***	0.542***	0.462***	0.277***	0.260***	0.865***	0.685***	0.624***	0.499***	0.298***	0.308***	0.947***
Black		0.332	0.911	-1.080	0.00492			-3.107	-4.160*	0.962	0.174			-3.982*	-2.540	-1.854	-0.933	
Female		-15.63***	-18.29***	-12.64***	-12.20***			-12.38***	-15.58***	-12.06***	-12.31***			-6.447***	-11.51***	-14.38***	-12.53***	
College			8.274***	5.332**	4.398**				13.95***	4.619**	3.827**				17.93***	6.543***	6.216***	
Work experience				1.426***	1.307***					0.979***	0.942***					0.687***	0.648***	
Employer tenure				0.621***	0.595***					0.616***	0.611***					0.490***	0.518***	
Occupation-specific experience																		
Manager/professional				0.909***	0.841***					1.189***	1.114***					1.297***	0.983***	
Technical, sales, and admin				0.468***	0.332*					0.548***	0.596***					0.635***	0.532***	
Service				-0.559**	-0.590***					-0.412**	-0.188					-0.247	-0.103	
Farming, forestry, and fishing				-0.445	-0.550					0.0974	-0.165					0.237	-0.194	
Precision production				0.236*	0.267					0.176	0.356**					-0.0182	-0.0502	
Total employer changes					-0.788**						-0.154						-0.0664	
Total occupation changes																		
Manager/professional					0.591						0.860**						1.357***	
Technical, sales, and admin					0.469						0.228						0.287	
Service					0.0870						-1.003						-0.888*	
Farming, forestry, and fishing					2.008*						1.932*						0.737	
Precision production					-0.187						-0.483						0.303	

Conditional mid-career earnings quantile	75th Percentile						90th Percentile					
	(1)	(2)	(3)	(4)	(5)	(IV)	(1)	(2)	(3)	(4)	(5)	(IV)
Early-career rank	0.616***	0.526***	0.414***	0.302***	0.292***	0.896***	0.463***	0.411***	0.321***	0.246***	0.260***	0.841***
Black		-4.536**	-2.210	-0.541	-0.0804			-3.885	-2.936*	-1.158	-0.952	
Female		-9.577***	-10.54***	-12.03***	-11.92***			-8.231***	-9.622***	-9.415***	-9.608***	
College			15.15***	8.948***	7.762***				14.40***	8.242***	6.396***	
Work experience				0.348*	0.321**					0.191	0.169	
Employer tenure				0.405***	0.321***					0.121	0.0679	
Occupation-specific experience												
Manager/professional				1.057***	0.951***					1.045***	1.009***	
Technical, sales, and admin				0.414***	0.491***					0.226	0.208	
Service				-0.323*	-0.0245					-0.139	-0.0798	
Farming, forestry, and fishing				-0.229*	-0.162					-0.358*	-0.327	
Precision production				-0.233	-0.334**					-0.000792	0.0475	
Total employer changes					-0.175						-0.0869	
Total occupation changes												
Manager/professional					1.166***						0.583	
Technical, sales, and admin					-0.109						0.0182	
Service					-0.835						-0.307	
Farming, forestry, and fishing					0.0569						-0.0469	
Precision production					0.603*						0.00274	

Note: +p<0.10 *p<0.05 **p<0.01 ***p<0.001; N=3250

Table 4. Group differences in estimated marginal effects of early-career earnings on mid-career earnings

Conditional mid-career earnings quantile	10th		25th		50th		75th		90th	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Overall	0.500***	0.161***	0.657***	0.260***	0.685***	0.308***	0.616***	0.292***	0.463***	0.260***
Race										
White	0.505	0.161	0.671	0.267	0.679	0.319	0.609	0.302	0.435	0.263
Black	0.414	0.172	0.565+	0.178**	0.679	0.212*	0.565	0.19	0.457	0.197
Gender										
Male	0.552	0.281	0.664	0.36	0.68	0.404	0.537	0.364	0.354	0.276
Female	0.130***	-0.0269***	0.484***	0.154***	0.609	0.215***	0.55	0.230***	0.455	0.219
Education										
Non-college	0.502	0.186	0.598	0.24	0.603	0.244	0.59	0.259	0.509	0.249
College	0.468	0.146	0.694*	0.278	0.623	0.374***	0.471*	0.367**	0.280***	0.271
Work experience										
15 years	-0.0100	-0.0586	0.0594	0.0438	0.301	0.194	0.546	0.185	0.537	0.232
25 years	0.0346*	-0.0240**	0.186***	0.114***	0.447***	0.245***	0.579	0.228+	0.502	0.244
30 years	0.167***	0.0553***	0.380***	0.192***	0.564***	0.292***	0.587	0.266+	0.459	0.253
Employer tenure										
5 years	0.319	0.0801	0.547	0.202	0.654	0.293	0.644	0.266	0.532	0.264
10 years	0.387**	0.132***	0.576*	0.237**	0.638	0.316+	0.604***	0.283+	0.477**	0.261
20 years	0.513*	0.244***	0.602	0.301**	0.585+	0.355+	0.518***	0.311+	0.367*	0.257
Occupation experience: manager/professional										
5 years	0.331	0.151	0.526	0.247	0.608	0.314	0.604	0.318	0.539	0.268
10 years	0.385**	0.165	0.545	0.269+	0.585+	0.33	0.540***	0.32	0.423***	0.251
20 years	0.426*	0.177	0.542	0.285	0.537**	0.339	0.461***	0.315	0.306***	0.227
Occupation experience: service										
0 years	0.511	0.165	0.629	0.27	0.652	0.313	0.586	0.291	0.405	0.246
5 years	0.297	0.176	0.536**	0.220*	0.613	0.286	0.627**	0.306	0.491***	0.276*
10 years	0.133	0.186	0.426**	0.169*	0.537	0.257	0.659*	0.322	0.575***	0.306*
Total employer changes										
0	0.705	0.281	0.732	0.328	0.682	0.418	0.537	0.365	0.376	0.274
5	0.482***	0.183*	0.626***	0.264*	0.645	0.331***	0.571	0.305**	0.424	0.255
10	0.241**	0.0870*	0.469***	0.196*	0.573+	0.228***	0.597	0.235**	0.47	0.235
Occupation changes: manager/professional										
0	0.439	0.161	0.596	0.253	0.666	0.328	0.649	0.315	0.587	0.264
3	0.479	0.164	0.612	0.269	0.624*	0.317	0.536***	0.294	0.395***	0.253
6	0.49	0.167	0.593	0.283	0.536***	0.302	0.400***	0.272	0.224***	0.242
Occupation changes: service										
0	0.523	0.207	0.659	0.287	0.651	0.352	0.571	0.311	0.406	0.267
3	0.0233***	0.0422*	0.359***	0.115**	0.451***	0.114***	0.509	0.136*	0.389	0.202
6	-0.0319***	-0.0973**	0.0898***	-0.0570***	0.134***	-0.166***	0.264*	-0.108*	0.127	0.110

Note: +p<0.10 *p<0.05 **p<0.01 ***p<0.001; N=3250. Each set of rows represents marginal effects obtained from separate regressions where the variable in bold is interacted with early-career weekly earnings rank. Stars indicate statistical significance of difference in average marginal effects between group and reference category.

Table 5. Transition matrices between earnings quintiles by cohort

Birth cohort	1940-1949 Weekly Earnings Quintile Age 45					Birth cohort	1950-1959 Weekly Earnings Quintile Age 45				
Weekly Earnings Quintile Age 25	0-20	20-40	40-60	60-80	80-100	Weekly Earnings Quintile Age 25	0-20	20-40	40-60	60-80	80-100
0-20	39.5	29.8	16.4	12.9	1.4	0-20	35.1	33.9	19.5	9.9	1.5
20-40	19.5	33.4	27.1	14.0	6.0	20-40	17.9	23.7	29.9	15.7	12.8
40-60	8.7	23.3	28.4	25.8	13.7	40-60	10.0	22.6	33.4	20.0	14.0
60-80	5.5	11.1	20.8	30.7	32.0	60-80	4.9	10.6	21.1	30.4	33.1
80-100	1.9	3.1	6.8	22.3	65.8	80-100	2.1	4.2	15.3	18.4	60.0
Birth cohort	1960-1969 Weekly Earnings Quintile Age 45					Birth cohort	1970-1979 Weekly Earnings Quintile Age 45				
Weekly Earnings Quintile Age 25	0-20	20-40	40-60	60-80	80-100	Weekly Earnings Quintile Age 25	0-20	20-40	40-60	60-80	80-100
0-20	39.7	28.4	20.4	7.6	3.9	0-20	42.4	26.6	17.5	6.7	6.9
20-40	22.4	21.9	25.9	21.3	8.6	20-40	17.8	40.9	26.5	10.5	4.2
40-60	10.5	20.1	20.3	28.0	21.1	40-60	8.3	19.9	34.3	22.0	15.4
60-80	8.8	7.1	22.5	30.6	30.9	60-80	13.7	6.0	25.2	29.2	25.9
80-100	3.9	5.9	12.5	19.3	58.5	80-100	6.9	0.2	3.6	19.4	69.9

Table 6. Decomposition of between-cohort inequality in rank-dependence

Conditional mid-career earnings quantile					**10th Percentile**					
Birth cohort	**1940-1949**	**1950-1959**			**1960-1969**			**1970-1979**		
	Coefficient	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect
Observed	.6144069	.4986244			.4766304			.2673275*		
Female		.5146649	-.099742	.0160404	.5370731	-.0760886	.0604428	.6088796	-.0060902	.3415521*
Black		.5290636	-.0855691	.0303444	.5391471	-.0741839	.0625713	.5798554	-.035692	.3123754*
College degree		.5354564	-.0786506	.0369557	.5549351	-.0581376	.0781582	.5561283	-.0608763	.2881947+
Work experience		.5535177	-.061337	.0545909	.5619579	-.0512886	.0848787	.5944898	-.0227686	.3264769+
Firm tenure		.5501456	-.0647849	.0511914	.5566095	-.0563012	.0798076	.5736073	-.0422577	.3059112*
Experience: manager/professional		.5619315	-.0529306	.0630234	.5825966	-.0298716	.1062519	.5870758	-.0279872	.31961*
Experience: service		.5635876	-.0511701	.0647264	.5933796	-.0191842	.1168428	.6816009	.0662649	.4139569**
Total employer changes		.5847891	-.0297852	.0861309	.5727362	-.0406287	.0956863	.6609182	.0464861	.3935467**
Occupation changes: manager/professional		.5736623	-.0409752	.0749485	.5756093	-.0378949	.0983562	.6601115	.0466308	.3930032**
Occupation changes: service		.5746168	-.0399742	.0759325	.5946322	-.0191449	.1171749	.6606582	.0466899	.3934203**
Conditional mid-career earnings quantile					**25th Percentile**					
Birth cohort	**1940-1949**	**1950-1959**			**1960-1969**			**1970-1979**		
	Coefficient	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect
Observed	.7045054	.6368634+			.5611232**			.6839706		
Female		.6370844	-.067421	.000221	.6785081	-.0203183	.1173849*	.7274275	.025908	.043457
Black		.6386855	-.0664252	.0014085	.6854199	-.0142257	.1239565*	.7280946	.0259633	.0435345
College degree		.6727528	-.0299286	.037136	.6997536	.0018414	.1389753**	.7333351	.0315852	.0489455
Work experience		.6858577	-.016702	.0502619	.7125853	.0156849	.1522012***	.7325918	.0315845	.0488113
Firm tenure		.6864052	-.0164134	.0506322	.7080532	.011348	.1478264**	.7357533	.0359112	.0531307
Experience: manager/professional		.6832108	-.019568	.0474737	.7205967	.0236458	.1603874***	.7600371	.0601367	.077461
Experience: service		.6754231	-.0271428	.0398319	.7199002	.0235314	.1599009***	.7588514	.0598538	.0770186
Total employer changes		.7082683	.0053494	.0724884+	.720371	.023152	.1598738***	.7579747	.0589987	.0762641
Occupation changes: manager/professional		.690761	-.0121024	.0550088	.7203785	.02352	.159983***	.7566615	.0579067	.0752486
Occupation changes: service		.7025938	-.000366	.0667798+	.7233734	.0261367	.1627415***	.752946	.0536472	.0710106
Conditional mid-career earnings quantile					**50th Percentile**					
Birth cohort	**1940-1949**	**1950-1959**			**1960-1969**			**1970-1979**		
	Coefficient	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect
Observed	.7291794	.67519			.6311057*			.672909		
Female		.6732547	-.0559247	-.0019353	.675533	-.0461454	.0444273	.7445746	.0198925	.0716656
Black		.6623331	-.06751+	-.0133514	.6763233	-.0464129	.0445602	.7375439	.0124489	.0643242
College degree		.702343	-.0242334	.0291024	.6887179	-.0317248	.058363	.737159	.014777	.0659573
Work experience		.707525	-.0179342	.0351033	.6955428	-.0230384	.0663549+	.7506865	.0299559	.0806968
Firm tenure		.7083844	-.0173919	.0357216	.6938854	-.0247083	.0646546+	.7927904	.0724829	.123169*
Experience: manager/professional		.7113761	-.0144	.0387136	.6941748	-.0251674	.0644427+	.7722257	.051144	.1020816+
Experience: service		.7111593	-.0144296	.038639	.6905373	-.0278027	.0614333+	.7697793	.0505022	.1009791+
Total employer changes		.7182048	-.008028	.0451936	.6929607	-.0258987	.0636002+	.7696583	.0495158	.1002408+
Occupation changes: manager/professional		.7044438	-.021639	.0315485	.6843182	-.0338874	.0553768	.7707476	.0498663	.1008148+
Occupation changes: service		.7059083	-.0203981	.0328476	.6884291	-.0301948	.0592523+	.7593478	.0380591	.0890979
Conditional mid-career earnings quantile					**75th Percentile**					
Birth cohort	**1940-1949**	**1950-1959**			**1960-1969**			**1970-1979**		
	Coefficient	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect
Observed	.6130908	.623622			.5884744			.6206873		
Female		.6064406	-.0066502	-.0171814	.6116651	.0017637	.0231907	.689111	.0788375	.0684237
Black		.6034923	-.0097555	-.0203376	.5868378	-.0235506	-.0020673	.6883804	.0783328+	.0678511
College degree		.631766	.0199047	.0095184	.608085	-.0012754	.0200958	.7274621	.1206027**	.1100958*
Work experience		.630528	.0197929	.0094146	.6127249	.0045988	.0258232	.7322211	.1265458**	.1160973*
Firm tenure		.6305718	.0197072	.00931	.6118362	.0034307	.0246633	.7326679	.1263158**	.1159778*
Experience: manager/professional		.6293985	.0184928	.0080998	.5857587	-.0233736	-.0020884	.6972684	.0902146+	.0798707
Experience: service		.6295415	.0186513	.0082745	.5814634	-.0270352	-.0058192	.6950879	.0893158+	.0790317
Total employer changes		.6300055	.0186642	.0082697	.5815942	-.0265725	-.0053526	.6827753	.0759279	.0656636
Occupation changes: manager/professional		.6269324	.015731	.005338	.5840089	-.0236979	-.0025193	.6926442	.0846822+	.0744501
Occupation changes: service		.6271077	.0157489	.0053478	.580721	-.0270593	-.0058448	.6867378	.0788625	.0685783
Conditional mid-career earnings quantile					**90th Percentile**					
Birth cohort	**1940-1949**	**1950-1959**			**1960-1969**			**1970-1979**		
	Coefficient	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect	Coefficient	Mobility Structure Effect	Composition Effect
Observed	.4742402	.4795408			.4975974			.5809913		
Female		.4334341	-.0408061	-.0461067	.4541258	-.0209463	-.0434716	.6065978	.1339546	.0256065
Black		.4190447	-.0549983	-.0602375	.4156312	-.0594074	-.0818515	.5998627	.1278634	.0196516
College degree		.4638545	-.0106017	-.0160561	.4240969	-.0509952	-.0736415	.6639475	.1937951*	.0874911
Work experience		.466576	-.0073101	-.0127585	.4444983	-.030312	-.0530123	.6621509	.1922184*	.0865394
Firm tenure		.4664612	-.0073881	-.0128164	.445014	-.0302079	-.05298	.6640766	.1929262*	.0869338
Experience: manager/professional		.4690212	-.0048887	-.0103229	.4150254	-.0607396	-.0835512	.6545451	.1828577+	.0767706
Experience: service		.4385104	-.0354751	-.0409267	.4151418	-.0604612	-.0833093	.6513459	.1800356	.0744894
Total employer changes		.4553464	-.0189034	-.0243439	.4143821	-.0603891	-.083037	.6462136	.1740488	.0680602
Occupation changes: manager/professional		.4580741	-.0160932	-.0215337	.413957	-.0606055	-.0832602	.666837	.1937696*	.0872608
Occupation changes: service		.4580576	-.0161447	-.0215767	.4048428	-.0694198	-.0920075	.6631668	.1905653*	.0840576

FIGURES

Figure 1. Absolute versus relative mobility

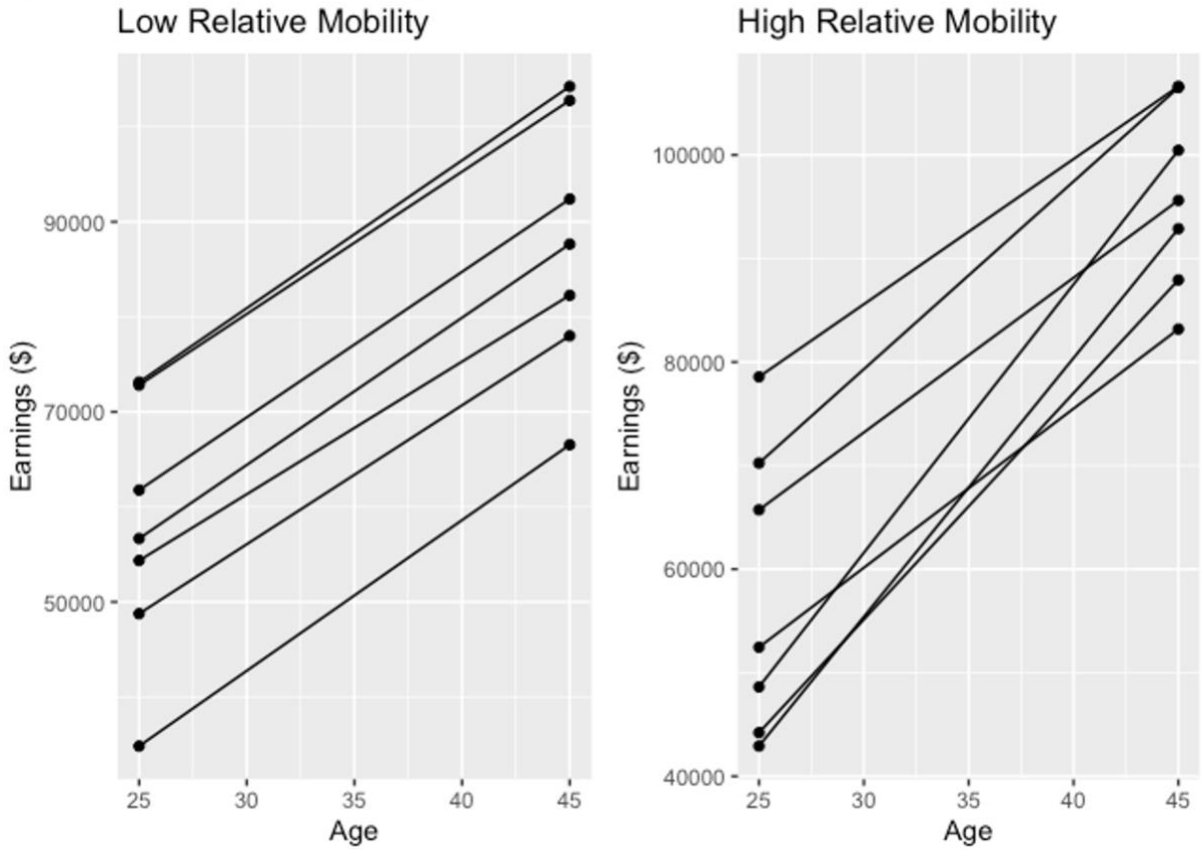


Figure 2. Stylized rank-mobility regimes

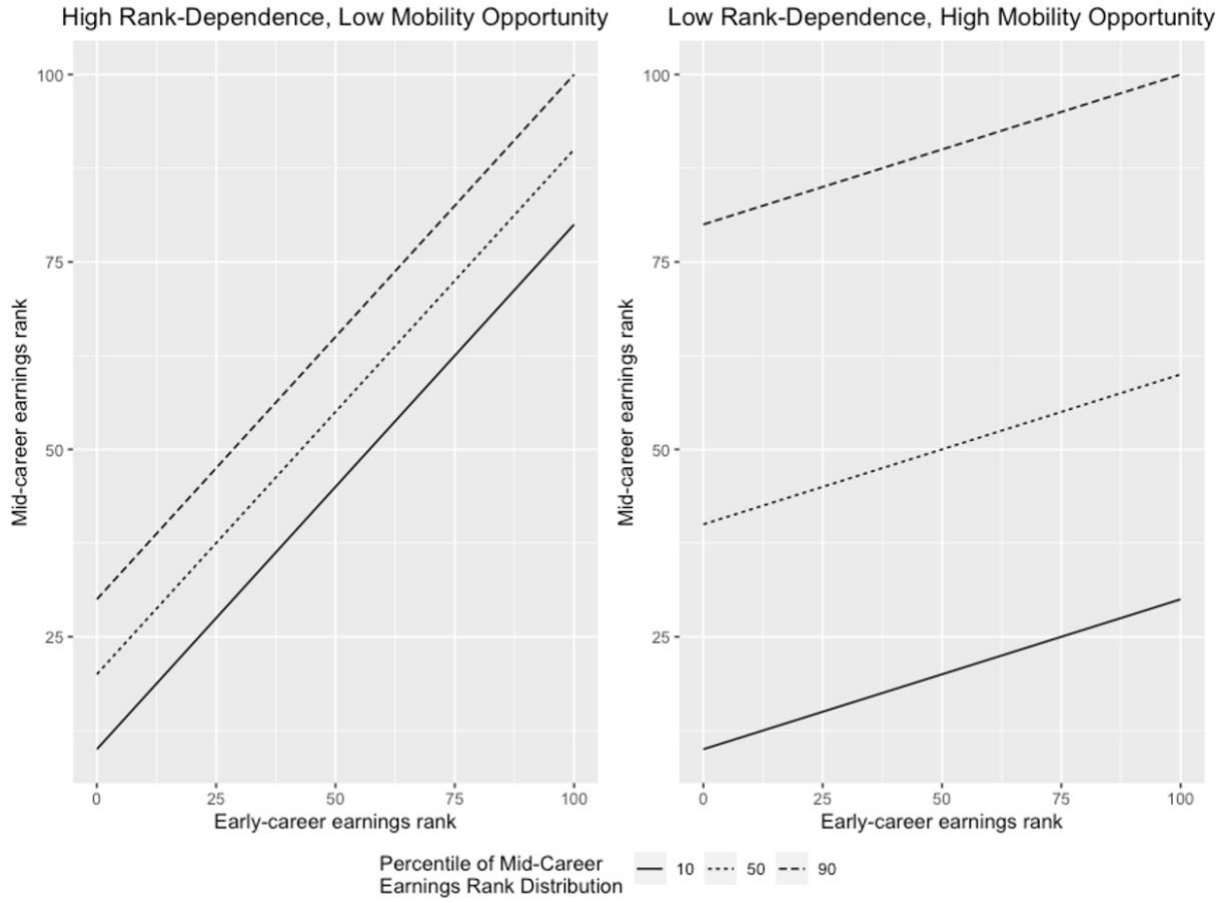
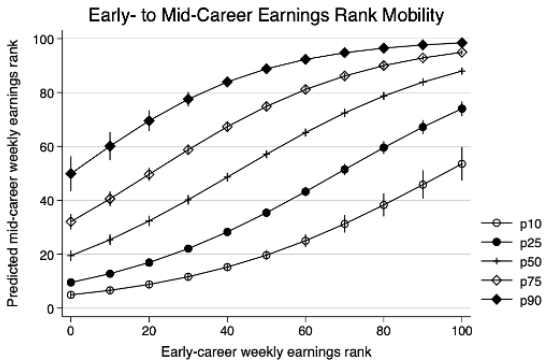
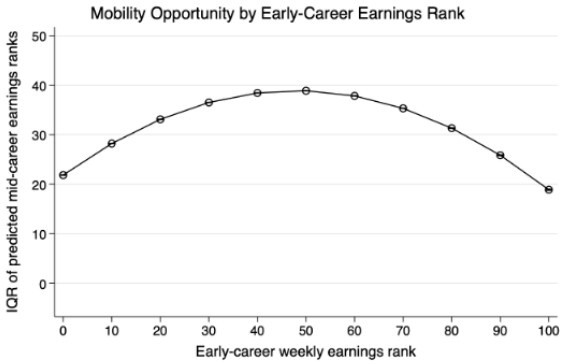


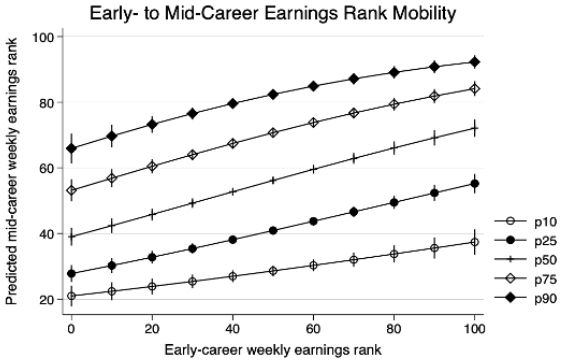
Figure 3. Overall predicted rank earnings and mobility opportunity

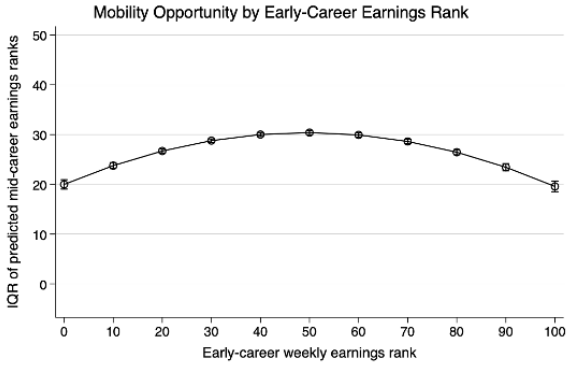
Unadjusted



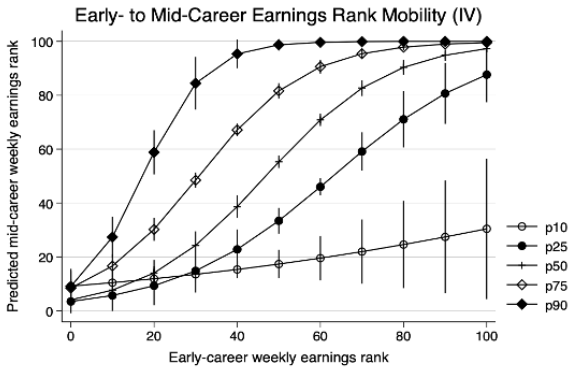


Adjusted





IV



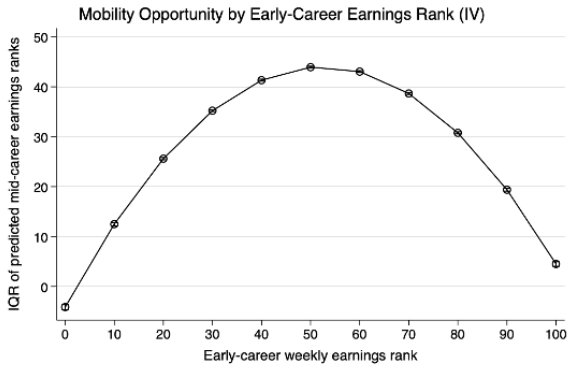
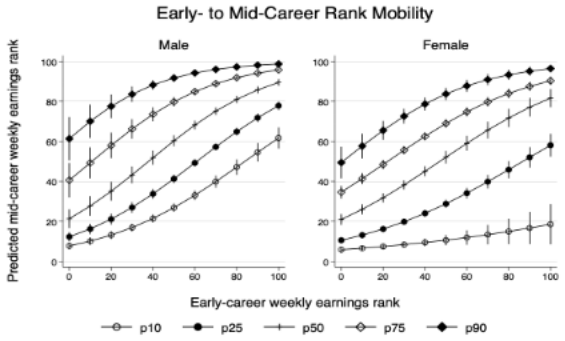
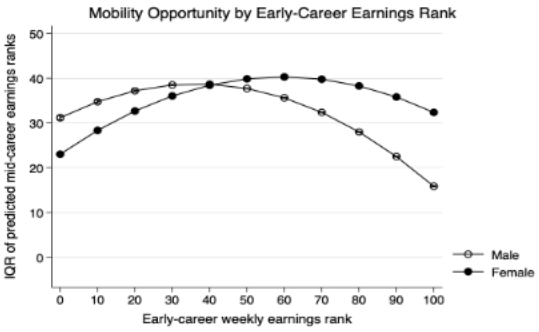


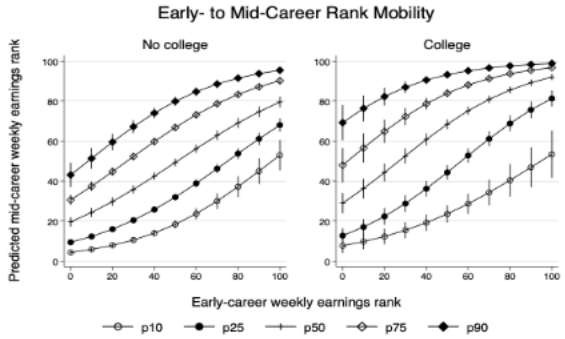
Figure 4. Differences in predicted mid-career earnings rank

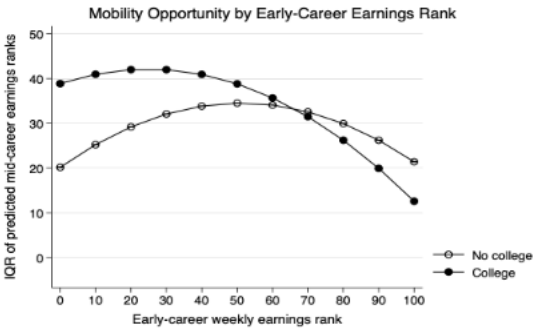
Gender



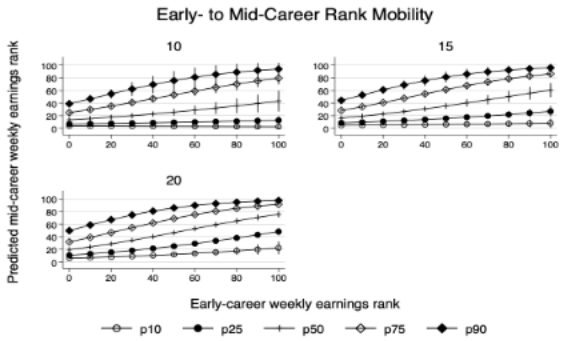


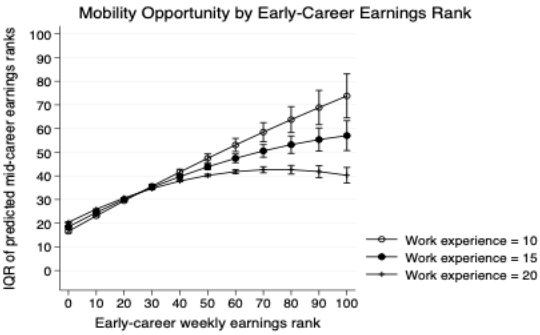
College



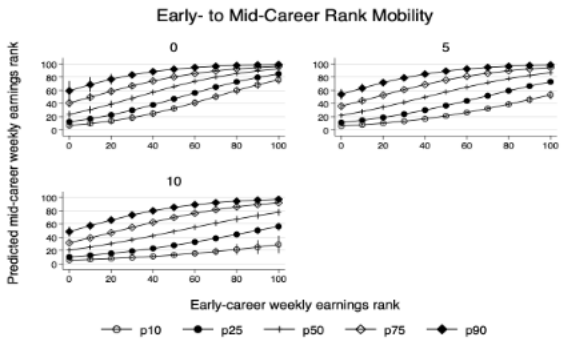


Years Work Experience





Total Employer Changes



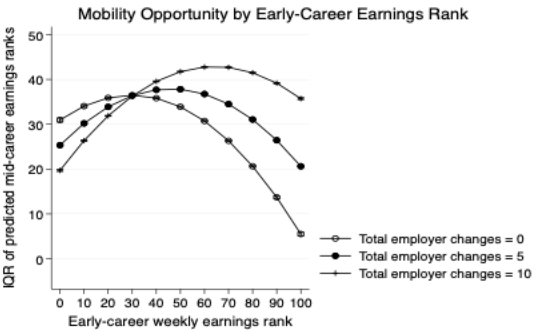
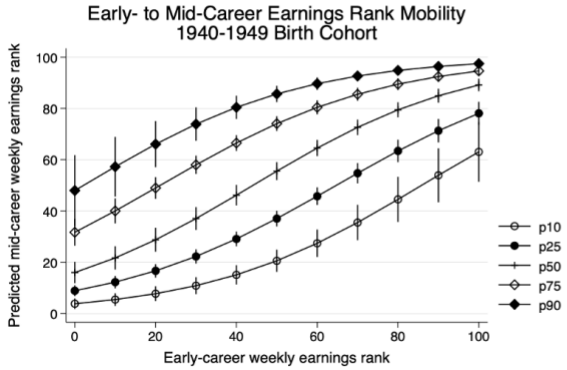
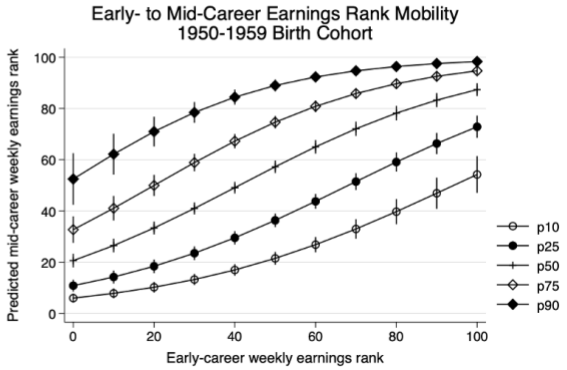
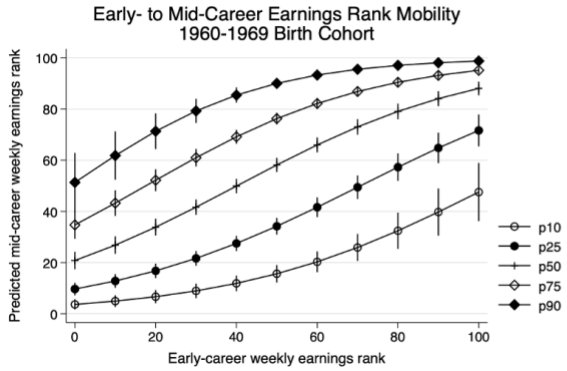


Figure 5. Predicted mid-career earnings rank by cohort







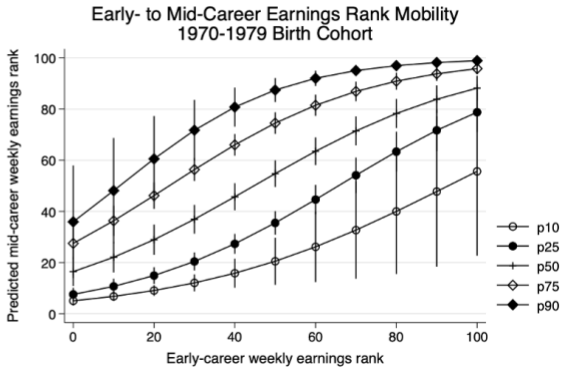
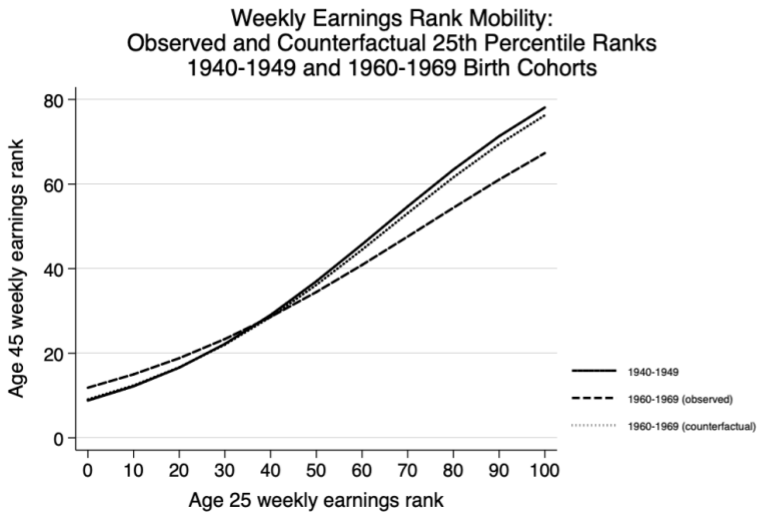


Figure 6. Decomposition of 1940 vs 1960 cohort differences in rank-dependence in 10th and 90th percentile earnings

25th Percentile	50th Percentile

Balanced on gender



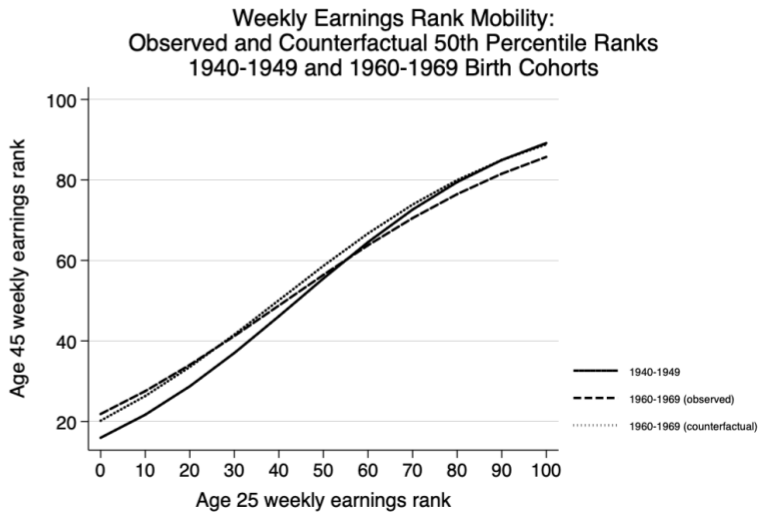
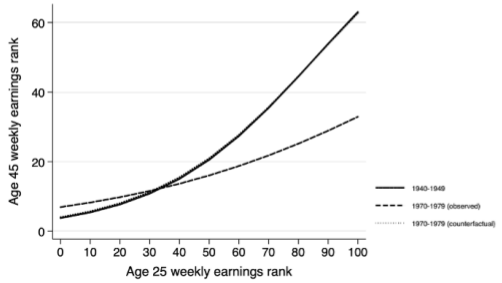
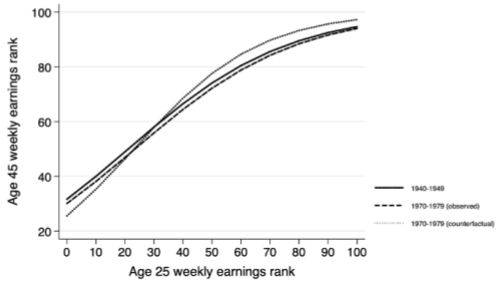
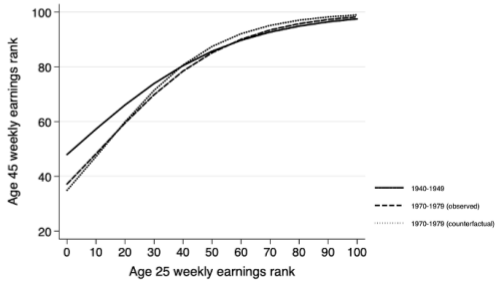
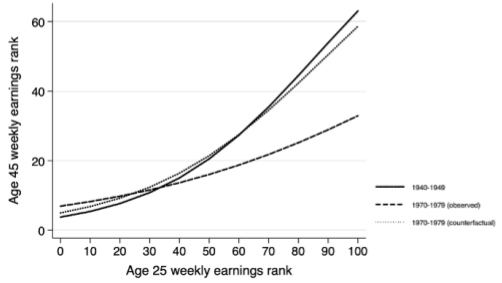
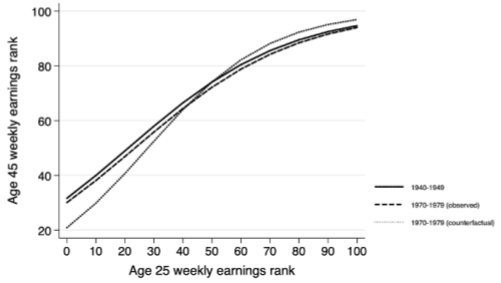
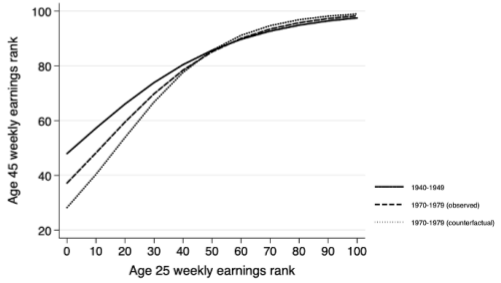


Figure 7. Decomposition of 1940 vs 1970 cohort differences in rank-dependence in 10th and 90th percentile earnings

10th Percentile	75th Percentile	90th Percentile
Balanced on gender		
		
Balanced on gender, race, education		
		

Appendix A. Instrumental Variables Analysis

Instrumental variables (IV) analysis estimates a local average treatment effect (LATE) that describes the causal effect of the treatment on the outcome among individuals for whom the instrument affects their treatment status (Imbens and Angrist 1994). Three assumptions are required for IV estimation: 1) the IV is a strong predictor of treatment (relevance), 2) the IV only affects the outcome through the treatment (exclusion restriction), and 3) there is no confounder causing both the instrument and the outcome (exchangeability). Satisfying all three assumptions allows for an unbiased estimate of the causal effect of a treatment on an outcome. I instrument early-career earnings rank using an indicator for whether a recession occurred while a worker was employed from ages 22 to 28 and father's occupation. I use the -ivreg2- command in Stata (Baum, Schaffer, and Stillman 2007) to conduct statistical tests to assess the extent to which these instruments satisfy the assumptions of IV analysis and present the results of those tests in Table A.1. IV quantile regressions are conducted using the Stata program -sivqr- developed by Kaplan (2022).

1. Relevance

Workers who enter the labor market during a recession experience a considerable reduction in early-career earnings (Altonji, Kahn, and Speer 2016; Oreopoulos, von Wachter, and Heisz 2012; Rothstein 2021; Schwandt and von Wachter 2019). There is substantial variation within the sample in whether respondents experienced a recession while working between ages 22 and 28 and exposure to a recession early in the career is a significant predictor of early-career rank earnings.

Parent socioeconomic status (SES) is a strong predictor of workers' labor market outcomes. In the mobility and status attainment literatures, parent SES is typically operationalized using measures of parents' occupations, education, and income (e.g. Blau and Duncan 1967; Sewell and Hauser 1975). I operationalize parent SES using father's occupation. Father's education was not used because statistical tests indicated that the instrument was redundant. Mother's education was not used because statistical tests suggest the instrument is not orthogonal. Parent income and mother's occupation were not used because these data are not available for many PSID respondents. Father's occupation varies considerably within the sample and is a strong predictor of early-career rank earnings.

When used simultaneously as instruments for early-career rank earnings, the two instruments satisfy the relevance assumption. I conduct a few statistical tests to assess underidentification, weak identification, overidentification, and instrument redundancy. Underidentification is assessed using the Kleibergen-Paap LM statistic. The test statistic is statistically significant, rejecting the null hypothesis that the model is underidentified. Weak identification is assessed using the Cragg-Donald Wald F statistic. The F statistic is greater than 10, which satisfies the rule-of-thumb cutoff of $F>10$ for relevance. The F statistic is also greater than the Stock-Yogo critical value of 6.61 for 20% maximal IV size and just less than the critical value for 10%, meaning that the bias of these IV estimates is limited to 20% of the bias in OLS. The Hansen J statistic of 11.241 and corresponding p-value of 0.2595 indicates that the model is not overidentified. The redundancy test produces acceptably low p-values indicating that father's occupation and the recession indicator are not redundant.

2. Exclusion and Exchangeability

The exclusion restriction and exchangeability cannot be directly tested. But, it seems unlikely that exposure to a recession early in a worker's career would affect the worker's rank earnings 20 years later through any pathway other than its effect on their early-career economic status. It also seems unlikely that an early-career economic recession could be caused by some variable that also affects a worker's rank earnings 20 years later. It is less certain that parent SES satisfies the exclusion restriction and assumption of exchangeability. Well known econometric models of labor force participation (e.g. Heckman 1981) and status attainment models (e.g. Blau and Duncan 1967) suggest that parent SES affects entry into the labor market but has little or no effect on post-entry labor market outcomes. This assumption has been used in other IV analyses of mobility (Cappellari and Jenkins 2004; D'Addio and Rosholm 2005; Cappellari 2007; Mosthaf, Schank, and Schnabel 2014). However, it may be possible that heritable traits that affect productivity could directly father's occupation and workers' mid-career earnings.

Orthogonality can also be assessed using the C statistic, or the difference-in-Sargan statistic, which compares the Sargan-Hansen statistic of a subset of instruments compared to the full set of instruments (including those whose exogeneity is suspect). Failing to reject the null hypothesis indicates that the entire set of instruments are valid. Tests of orthogonality on both the indicators for early-career recession and father's occupation fail to reject the null hypothesis, suggesting the instruments are valid.

Table A.1. Tests of IV assumptions

Statistic	Value	Interpretation
Kleibergen-Paap Wald LM	70.191 ($p<0.0001$)	Model is not underidentified
Cragg-Donald Wald F	10.480	Instruments are relevant; bias between 10% (critical value=11.49) and 20% (critical value=6.61)
Hansen J	11.241 ($p=0.2595$)	Model is not overidentified
Redundancy: recession	3.658 ($p=0.0558$)	Instrument is not redundant at $p<0.10$

Redundancy: father occupation	68.079 (p<0.0001)	Instrument is not redundant
C statistic: recession	3.154 (p=0.0757)	Instrument satisfies orthogonality
C statistic: father occupation	11.241 (p=0.2595)	Instrument satisfies orthogonality

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Appendix B. Balancing between cohorts for decomposition analysis

The goal of reweighting in the DFL (DiNardo, Fortin, and Lemieux 1996) decomposition is to achieve a counterfactual distribution on a set of covariates in a treated group that resembles that distribution in the control group. In this application, the goal is to achieve balance such that each "treated" cohort (the 1950, 1960, and 1970 birth cohorts) resembles the 1940 cohort in its distribution on covariates such as gender and education *and* how those covariates are distributed by early-career rank earnings. These weights are defined as:

$$\omega = (1 - C) + C * \frac{1 - P(C|X, r, X * r)}{P(C|X, r, X * r)}$$

where C is an indicator variable for the weighted cohort, X represents a set of covariates to balance on, and r represents early-career earnings rank, and the propensity score $P(C|X, r, X * r)$ is estimated using the probit regression:

$$\Phi(C) = \beta_0 + \beta_1 X + \beta_2 r + \beta_3 X * r$$

Before proceeding with the decomposition, it is essential to assess that statistical independence between cohort membership and the covariates, early-career earnings rank, and their interaction, was successfully achieved via the reweighting procedure. I do so with linear probability models where the outcome is cohort membership and the predictor variables are the balancing covariate, early-career rank earnings, and their interaction, before (unbalanced) and after reweighting (balanced). From Table AB.1, we see that there is no statistically significant association between any of the predictors and cohort membership after reweighting, indicating that the reweighting procedure successfully achieved the desired counterfactuals.

Table B.1 Regression coefficients from DFL balance tests

Birth Cohort	1950-1959		1960-1969		1970-1979	
Model	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced
Female	-0.00617	-0.0224	-0.193**	-0.0244	-0.191*	-0.0197
Early-career rank	-0.000113	-0.000222	-0.00207**	-0.000130	-0.00285**	-0.0000561
Early-career rank X female	0.00127	0.000347	0.00476***	0.0000243	0.00467**	0.0000503
Black	0.252***	0.00372	0.310***	0.0220	0.297**	0.0380
Early-career rank	0.000373	0.00000473	0.000650	0.000113	-0.000539	0.000164
Early-career rank X Black	-0.00239	-0.0000824	-0.00361**	-0.000155	-0.00195	-0.000509
College	0.212***	-0.00565	0.0630	0.0384	0.358***	-0.0851
Early-career rank	0.00160**	-0.0000433	0.000729	0.000234	0.0000987	-0.000225
Early-career rank X college	-0.00415***	0.000109	-0.00138	-0.000500	-0.00385**	0.00119
Years experience	0.0138**	0.00192	0.0179***	0.00356	0.0139*	0.00431
Early-career rank	0.00819**	0.00141	0.00887***	0.00183	0.00517	0.00278
Early-career rank X years experience	-0.000345**	-0.0000586	-0.000376***	-0.0000749	-0.000268*	-0.000113
Years tenure	0.00225	-0.000387	0.00631	-0.000475	0.00700	0.000476
Early-career rank	0.000617	0.00000891	0.00195*	0.0000933	0.00215	0.000562
Early-career rank X years tenure	-0.0000504	0.00000162	-0.000152*	0.00000298	-0.000237**	-0.0000300
Experience: manager/professional	0.00566	-0.000567	-0.00518	0.00142	0.00577	-0.000941
Early-career rank	0.00129*	-0.0000831	0.000903	0.000215	0.000932	0.000183
Early-career rank X experience: mgr/prof	-0.000152*	0.0000109	-0.0000140	-0.0000200	-0.000185*	0.00000442
Experience: service	0.0000262	-0.00126	-0.00578	-0.00397	-0.0121	-0.00394
Early-career rank	0.0000470	-0.0000445	-0.0000394	-0.0000233	-0.00122	0.0000401
Early-career rank X experience: service	0.000206	0.0000216	0.000362**	0.0000909	0.000692***	0.000208
Total employer changes	0.0165*	-0.00300	-0.00152	0.00145	-0.0342**	0.00183
Early-career rank	0.000813	-0.000306	-0.000206	0.000236	-0.00386**	0.000533
Early-career rank X total employer changes	-0.0000113	0.0000494	0.0000670	-0.0000200	0.000448*	-0.0000904
Occupation changes: mgr/prof	0.0215	0.00182	0.00557	0.00950	0.000799	0.00842
Early-career rank	0.000416	0.0000474	0.000258	0.000386	0.000270	0.000555
Early-career rank X occupation changes: mgr/prof	-0.000243	-0.0000248	-0.0000772	-0.000138	-0.000349	-0.000172
Occupation changes: service	0.0142	-0.00664	0.0131	0.00428	-0.0363	0.0119
Early-career rank	0.000326	-0.0000881	0.000437	0.000167	-0.00137	0.000348
Early-career rank X occupation changes: service	0.000504	0.000221	0.000858*	-0.0000326	0.00172**	0.000195

+p<0.10 *p<0.05 **p<0.01 ***p<0.001

Note: Each set of rows represents coefficients obtained from separate linear probability models where the outcome is an indicator for belonging to the birth cohort corresponding to the column label. The base category is belonging to the 1940-1949 cohort.