Interpreting Trends in Intergenerational Mobility

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Studying a dynamic model of intergenerational transmission, we show that past events affect contemporaneous trends in intergenerational mobility. Structural changes may generate long-lasting mobility trends that can be nonmonotonic, and declining mobility may reflect past gains rather than a recent deterioration of equality of opportunity. We provide two applications. We first show that changes in the parent generation have partially offset the effect of rising skill premia on income mobility in the United States. We then show that a Swedish school reform reduced the transmission of inequalities in the directly affected generation but increased their persistence in the next.

Introduction

The evolution of economic inequality over time is a fundamental topic in the social sciences and public debate. Two central dimensions of interest are the extent of cross-sectional inequality between individuals and its

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persistence across generations, as advantages are transmitted from parents to their children. Both have important implications for individual welfare and the functioning of political and economic systems (see Erikson and Goldthorpe 1992; Bénabou and Ok 2001). The rise in income inequality starting from around 1980 in developed countries is well documented (Katz and Autor 1999; Atkinson, Piketty, and Saez 2011), but less is known about trends in intergenerational mobility (see Solon 1999, Black and Devereux 2011, and Mogstad and Torsvik 2021 for reviews). Yet we do know that income mobility differs substantially across countries, and the observation that those differences appear negatively correlated with cross-sectional inequality has received much attention (e.g., Corak 2013). A central theme in the recent literature is thus whether inequality has not only increased but also become more persistent across generations.[1]

But how should trends in mobility be interpreted—do they reflect changes in the effectiveness of current policies and institutions in promoting equal opportunities? Our main contribution is to provide a dynamic perspective to this question. We show that contemporaneous shifts in income mobility can be caused by events in a more distant past, as structural changes generate transitional dynamics in mobility over multiple generations. Such dynamic responses are of particular importance in the study of intergenerational persistence, since even a single transmission step—one generation—corresponds to a long time period.

The interpretation of mobility trends therefore benefits from a dynamic perspective, but existing theoretical work focuses instead on the relation between transmission mechanisms and the steady-state level of mobility. In contrast, we examine the dynamic implications of a simultaneous-equations model of intergenerational transmission (e.g., Conlisk 1974a). Motivated by the observation that earnings are influenced by multiple dimensions of skill (Heckman 1995), we deviate from previous work

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[1] In countries such as the United States, it is now frequently argued that the combination of rising inequality and low mobility threatens social cohesion and the notion of "American exceptionalism." Exemplary articles are the "Moving Up: Challenges to the American Dream" series in the *Wall Street Journal* (May 2005), "The Mobility Myth" in the *New Republic* (February 2012), "The American Dream of Upward Mobility Is Broken" in the *Guardian* (March 13, 2021), and the "Great Divide" series in the *New York Times* (2013–14). Alan Krueger, former Chairman of the Council of Economic Advisers, warned that mobility should be expected to decline further as of the recent rise in income inequality (speech at the Center for American Progress, January 12, 2012).

also by allowing income to depend on a vector of skills rather than a single factor.

We first show that the level of intergenerational mobility depends not only on contemporaneous transmission mechanisms but also on the joint distribution of income and skills in the parent generation—and thus on past mechanisms. This result has a number of implications. First, a onetime policy or institutional change can generate long-lasting mobility trends. The resulting shifts in mobility are not necessarily largest in the first affected generation, but they can amplify in magnitude over later generations. As a consequence, contemporaneous shifts in mobility might stem not from recent structural changes but from events in the more distant past. We focus on differences over time, but the argument extends: mobility differences across countries, or across groups within countries, may reflect the consequences of past instead of current policies or institutions.

Second, we find that a broad class of structural changes cause nonmonotonic transitions between steady states: the response in mobility at some point switches sign, and mobility in the first affected generation and in the steady state may shift in different directions. The dynamics in cross-sectional inequality may contribute to such nonmonotonic transitions, and they may affect different mobility measures differently. The initial mobility response may thus be a poor indicator of the long-run consequences of a structural change, both qualitatively and quantitatively.

In particular, some changes in the economic environment alter the prospects of some families relative to others, generating transitional mobility. For example, a shift toward a more meritocratic society—a rise in the importance of own skill relative to that of parental status—is to the advantage of talented children from poor families. But while mobility increases in the first affected generation, it is bound to decline again in subsequent generations, if the more highly rewarded skills of the newly rich are passed on to their children. Even structural changes that are mobility enhancing in the long run can therefore cause negative trends over some generations. Similar transitional mobility gains can occur in response to changing skill returns in a model with multiple skills.

Our main analysis relies on a generation-specific framework, abstracting from the fact that a theoretical generation consists of many cohorts that can be differentially affected in both current and previous generations by shifts in the transmission system. Empirical research instead studies mobility trends across calendar years or cohorts, with a within-family definition of generations. While we note this limitation of our analysis, we highlight the more gradual responses of cohorts both theoretically and in our empirical applications.

We illustrate our main arguments in two applications. First, we revisit the evidence on mobility trends in the United States and discuss their interaction with changes in income inequality and skill premia. Using data from the PSID (Panel Study of Income Dynamics), we demonstrate that mobility trends over recent birth cohorts also reflect important changes in the parent generation. While rising skill returns may have depressed income mobility, such an effect was (at least partly) counteracted by the mobility-enhancing effects of decreasing educational inequality among the parents of those birth cohorts. Indeed, a simple quantification suggests that had the parental schooling distribution stayed constant, the intergenerational elasticity of income could have risen by 20%–25%, all else equal.

Finally, we examine a Swedish compulsory-school reform to provide causal evidence for our key theoretical argument—that shocks in the economic environment in the parent generation can still affect mobility trends in the next generation and that those transitional dynamics can be pronounced and complex. Exploiting administrative data covering three generations, we first show that by reducing the transmission of income and educational inequalities, the reform increased mobility in the first generation (as in Holmlund 2008). But the same reform then decreased mobility in the next generation. Shifts in the variance of education and income are central to understand this pattern.

Our work contributes to both the theoretical and the empirical literature on intergenerational mobility. Most theoretical studies examine only the steady-state relationship between transmission mechanisms and mobility. An early exception is Atkinson and Jenkins (1984). While they show that failure of the steady-state assumption impedes the identification of structural parameters, we instead consider the dynamic effects of changes in such parameters on mobility. There are a few papers using utility-maximizing frameworks to analyze the dynamics of intergenerational transmission. For example, Solon (2004) examines how structural changes affect mobility in the first affected generation, and Davies, Zhang, and Zeng (2005) note that the observation of mobility trends may help to distinguish between alternative causes of rising cross-sectional inequality. Our paper also relates to Becker and Tomes (1979) and the related literature on individual income processes. While they analyze the dynamics of individual outcomes within families, we study how such processes relate to the dynamics of aggregate measures of intergenerational mobility.

The empirical literature is broad. Many studies examine occupational and class mobility over time (see Breen and Luijkx 2004; Hauser 2010; Long and Ferrie 2013; Modalsli 2017). A more recent literature studies mobility trends in income or educational attainment, how those trends differ between groups, and how they are affected by institutional aspects. Such studies face substantial data requirements, and the evidence is still debated.[2] A central concern in many of these papers and in public debate

[2] For example, Hertz (2007), Lee and Solon (2009), and Chetty (2014a) find no major trend in income mobility in the second half of the twentieth century in the United States,

is that mobility may have declined in conjunction with the recent rise in income inequality. Various potential causes—such as educational expansion, rising returns to education, or immigration—have been proposed (e.g., Levine and Mazumder 2007 and other articles in the same issue). Common to most is that they relate trends to recent events that directly affected the respective cohorts. We argue that their cause might also lie in the more distant past.

The paper proceeds as follows. In the next section, we present our model of intergenerational transmission. We derive current and steady-state mobility levels in terms of its structural parameters and summarize our main propositions on transitional dynamics in section II. Section III presents a set of simple cases to illustrate our main results. We study the interrelation between cross-sectional inequality and mobility in section IV, which also includes a discussion of mobility trends in the United States. Section V presents our Swedish application, and section VI concludes.

I. A Model of Intergenerational Transmission

In this section, we describe a simple dynamic model of intergenerational transmission based on a system of linear difference equations. We summarize the dynamic implications of the model in section II before discussing specific cases and applications that illustrate our main arguments.

A. Measuring Intergenerational Mobility

In our main analysis we focus on the intergenerational elasticity of income (IGE), the most popular descriptive measure in the economic literature. Consider a simplified one-parent, one-offspring family structure, with $y_{i,t}$ denoting the log lifetime income of the offspring in generation t of family i and $y_{i,t-1}$ the log lifetime income of the parent. For ease of exposition, we here emphasize generations and abstract from potential cohort differences within a generation. The IGE is given by the slope coefficient in the linear regression

$$y_{it} = \alpha_t + \beta_t y_{i,t-1} + \epsilon_{it}. \quad (1)$$

while Davis and Mazumder (2020) show that mobility has fallen over the 1950s cohorts (corroborating related evidence by Levine and Mazumder 2007 and Aaronson and Mazumder 2008). A decline has also been found for the United Kingdom (Nicoletti and Ermisch 2007; Blanden, Gregg, and Macmillan 2013), while mobility was stable or even increased in the Nordic countries (Pekkala and Lucas 2007; Björklund, Jäntti, and Lindquist 2009; Pekkarinen, Salvanes, and Sarvimäki 2017; Markussen and Røed 2020).

The IGE β_t captures a statistical relationship, so the error ϵ_{it} is uncorrelated with the regressor by construction. Under stationarity of the variance of y_{it}, it equals the intergenerational correlation, which adjusts the IGE for changes in cross-sectional inequality. The IGE captures to what degree percentage differences in parental income, on average, transmit to the next generation, with a low IGE indicating high mobility. We refer to mobility (or "persistence") primarily in terms of the IGE, but we also illustrate how our core arguments extend to alternative measures, such as the intergenerational and sibling correlations.

B. Main Model

As motivated below, we model intergenerational transmission as a system of stochastic linear difference equations, in the tradition of the simultaneous-equations approach developed by Conlisk (1969, 1974a) and Atkinson and Jenkins (1984). While Becker and Tomes (1979) and related models (e.g., Solon 2004) explicitly consider the roles of preferences and constraints, we show in appendix A.1 (the appendix is available online) that the pathways represented by these equations can be derived from such utility-maximization frameworks (see also Goldberger 1989). The structural equations of our model are

$$y_{it} = \gamma_{y,t} y_{it-1} + \boldsymbol{\delta}_t' \boldsymbol{h}_{it} + u_{y,it}, \tag{2}$$

$$\boldsymbol{h}_{it} = \boldsymbol{\gamma}_{h,t} y_{it-1} + \boldsymbol{\Theta}_t \boldsymbol{e}_{it} + \boldsymbol{u}_{h,it}, \tag{3}$$

$$\boldsymbol{e}_{it} = \boldsymbol{\Lambda}_t \boldsymbol{e}_{it-1} + \boldsymbol{\Phi}_t \boldsymbol{v}_{it}. \tag{4}$$

From equation (2), the income y_{it} of an individual of family i in generation t is determined by parental income y_{it-1}, own human capital $\boldsymbol{h}_{it}$, and market luck $u_{y,it}$. The parameter $\gamma_{y,t}$ captures a direct effect of parental income that is independent of offspring productivity. We model human capital as a $J \times 1$ vector $\boldsymbol{h}_{it}$, reflecting distinct skill dimensions such as formal schooling, health, and cognitive and noncognitive skills, which are valued on the labor market according to the $J \times 1$ price vector $\boldsymbol{\delta}_t$. The random-shock term $u_{y,it}$ captures factors that do not relate to parental background. For our analysis it makes no difference whether these are interpreted as pure market luck or as the impact of other characteristics that are not transmitted within families.

From equation (3), human capital is determined by parental income y_{it-1}, own endowments $\boldsymbol{e}_{it}$, and chance $\boldsymbol{u}_{h,it}$. A role for parental income through the $J \times 1$ vector $\boldsymbol{\gamma}_{h,t}$ may stem from parental investment into offspring human capital, and the elements of $\boldsymbol{\gamma}_{h,t}$ may differ if parental investments are more consequential for some types of human capital than for others. Parental income may thus affect offspring income directly (through $\gamma_{y,t}$) or indirectly (through $\boldsymbol{\gamma}_{h,t}$).[3] The $J \times K$ matrix $\boldsymbol{\Theta}_t$ governs how endowments such as abilities or preferences, represented by the $K \times 1$ vector $\boldsymbol{e}_{it}$, affect the accumulation of human capital. Endowments are partly inherited from parental endowments e_{it-1} through the $K \times K$ heritability matrix $\boldsymbol{\Lambda}_t$ and are partly due to chance $\boldsymbol{v}_{it}$. We use the term "heritability" in a broad sense, potentially reflecting both genetic inheritance and family environment. Market luck $u_{y,it}$ and the elements of $\boldsymbol{u}_{h,it}$ and $\boldsymbol{v}_{it}$ are assumed to be uncorrelated with each other and past values of all variables.

For convenience we omit the individual subscript i and make a few simplifying assumptions. As we focus on relative mobility, assume that all variables are measured as trendless indices with constant mean 0 (as in Conlisk 1974a). To avoid case distinctions, assume further that those indices measure positive characteristics ($\gamma_{y,t}$ and elements of $\boldsymbol{\gamma}_{h,t}$ and $\boldsymbol{\delta}_t'\boldsymbol{\Theta}_t$ are nonnegative) and that parent and offspring endowments are not negatively correlated (elements of $\boldsymbol{\Lambda}_t$ are nonnegative), for all t.

Using equation (3) to substitute out $\boldsymbol{h}_{i,t}$, we can simplify the model as

$$y_t = \gamma_t y_{t-1} + \boldsymbol{\rho}_t'\boldsymbol{e}_t + \sigma_t u_t, \tag{5}$$

$$\boldsymbol{e}_t = \boldsymbol{\Lambda}_t\boldsymbol{e}_{t-1} + \boldsymbol{\Phi}_t v_t, \tag{6}$$

where the parameter $\gamma_t = \gamma_{y,t} + \boldsymbol{\delta}_t'\boldsymbol{\gamma}_{h,t}$ aggregates the direct and indirect effects of parental income, the $1 \times K$ vector $\boldsymbol{\rho}_t' = \boldsymbol{\delta}_t'\boldsymbol{\Theta}_t$ captures the returns to inheritable endowments and acquired skills (affected by the importance of endowments in both the accumulation of and the returns to human capital), and $\sigma_t u_t = u_{y,t} + \boldsymbol{\delta}_t' u_{h,t}$ aggregates the luck terms related to income and human capital. As $\boldsymbol{\rho}_t$ captures returns to both endowments and skills, we use these terms interchangeably below.[4] Note that our model allows for strong intergenerational persistence in these underlying skills even if the parent-child mobility in income is high, in line with the pattern observed for some Scandinavian countries (Landersø

[3] The direct effect may arise as a result of nepotism, statistical discrimination, credit constraints, parental information and networks, or (if total income is considered) returns to bequests. The distinction between a direct and an indirect effect may not be sharp in practice; e.g., parental credit constraints might affect educational attainment and human capital acquisition of offspring but might also affect their career choices for a given level of human capital.

[4] We recognize that the multidimensionality and the different layers of the model—with multiple underlying endowments potentially influencing the different types of market-valued human capital—make the concept of returns to human capital rather complex. However, we focus our analysis on the simplified two-equations model in eqq. (5)–(6) and treat the underlying endowments as the main dimension of analysis, abstracting from the implicit human capital channels through which endowments affect income. Further, for simplicity we often impose that all off-diagonal elements of $\boldsymbol{\Lambda}_t$ are zero, such that parental endowments affect only child endowments of the same type.

and Heckman 2017). We normalize the variance of u_t to 1 in all periods, such that changes in the importance of market luck are captured by σ_t.

Our model has a structure similar to that of the model in Conlisk (1974a), which in turn is similar to the statistical framework implied by Becker and Tomes's economic model (Goldberger 1989). But in contrast to the previous literature, we allow for income to depend on human capital through a vector of skill dimensions. This addition is central for some of our findings, but for some arguments it suffices to consider a simpler scalar model with a single skill. Similarity to the existing literature in other dimensions is advantageous, since it suggests that our findings do not arise as a result of nonstandard assumptions. The second deviation from previous work is simply the addition of subscripts t to all parameters, reflecting our focus on the dynamic response to changes in the transmission framework.

Each parameter is a reduced-form representation of multiple underlying mechanisms, and an underlying change may affect multiple parameters at once. For example, an expansion of public childcare may affect the transmission and supply of skills and in turn their returns on the labor market. A behavioral model would endogenize some of these linkages. However, to trace how a shift in one parameter may lead to subsequent shifts in others, while interesting, is not needed to illustrate our main arguments. We therefore provide only examples of such links and assume instead that the economic environment is exogenous.

DEFINITION 1. The economic environment $\boldsymbol{\xi}_t$ consists of the set of transmission mechanisms that generation t is subject to, represented by the parameters $\boldsymbol{\xi}_t = \{\gamma_t, \boldsymbol{\rho}_t, \sigma_t, \boldsymbol{\Lambda}_t, \boldsymbol{\Phi}_t\}$. A structural change is a permanent change in any of the features of the environment in generation $t = T$, such that $\boldsymbol{\xi}_{t<T} = \boldsymbol{\xi}_1 \neq \boldsymbol{\xi}_{t\geq T} = \boldsymbol{\xi}_2$.

For simplicity, we assume that the moments of all variables were in steady-state equilibrium before the structural change occurred and that the system is stable (implicitly restricting the parameter space; see app. A.2).[5] We also normalize the variances of y_t and elements of $\boldsymbol{e}_t$ in the initial steady state to 1.

II. The Importance of Past Transmission Mechanisms

We express intergenerational mobility as a function of our model to illustrate some central implications. The IGE is derived by plugging equations (5)–(6) into equation (1), such that

[5] Jenkins (1982) discusses stability conditions for systems of stochastic linear difference equations.

$$\beta_t = \frac{\mathrm{Cov}(y_t, y_{t-1})}{\mathrm{Var}(y_{t-1})} = \gamma_t + \frac{\boldsymbol{\rho}_t'\boldsymbol{\Lambda}_t\mathrm{Cov}(\boldsymbol{e}_{t-1}, y_{t-1})}{\mathrm{Var}(y_{t-1})}. \tag{7}$$

Thus, β_t depends on current transmission mechanisms (parameters γ_t, $\boldsymbol{\rho}_t$, and $\boldsymbol{\Lambda}_t$), but also on the variance and cross covariance between income and endowments in the parent generation. The intuition is simple: if income and favorable endowments are concentrated in the same families, then intergenerational mobility will be low (the IGE will be high). Two populations currently subject to the same transmission mechanisms can therefore still differ in their levels of mobility, since current mobility also depends on the joint distribution of income and endowments in the parent generation.

The cross covariance between income and endowments in the parent generation is in turn determined by past transmission mechanisms, and thus past values of $\{\gamma_t, \boldsymbol{\rho}_t, \boldsymbol{\Lambda}_t\}$. We can iterate equation (7) backward to express β_t in terms of parameter values,

$$\begin{aligned}\beta_t &= \gamma_t + \frac{\boldsymbol{\rho}_t'\boldsymbol{\Lambda}_t(\boldsymbol{\Lambda}_{t-1}\mathrm{Cov}(\boldsymbol{e}_{t-2}, y_{t-2})\gamma_{t-1} + \mathrm{Var}(\boldsymbol{e}_{t-1})\boldsymbol{\rho}_{t-1})}{\mathrm{Var}(y_{t-1})} \\ &= \dots \\ &= \gamma_t + \boldsymbol{\rho}_t'\boldsymbol{\Lambda}_t\boldsymbol{\rho}_{t-1} + \boldsymbol{\rho}_t'\boldsymbol{\Lambda}_t\left(\sum_{r=1}^{\infty}\left(\prod_{s=1}^{r}\gamma_{t-s}\boldsymbol{\Lambda}_{t-s}\right)\boldsymbol{\rho}_{t-r-1}\right),\end{aligned} \tag{8}$$

where for simplicity we assumed that all off-diagonal elements of $\boldsymbol{\Lambda}_t$ are 0, that the variances remain constant and normalized to $\mathrm{Var}(y_t) = \mathrm{Var}(e_{j,t}) = 1 \;\forall\, j, t$, and that the process is infinite.[6] The current level of intergenerational mobility thus depends on current and past transmission mechanisms.

If no structural changes occur, $\boldsymbol{\xi}_t = \boldsymbol{\xi} \;\forall\, t$, equation (7) implies the following proposition:

Proposition 1 (Steady state). The steady-state IGE equals

$$\beta = \gamma + \frac{(1-\gamma^2)\rho^2\lambda\Phi^2}{\rho^2\Phi^2(1+\gamma\lambda) + \sigma^2(1-\lambda^2)(1-\gamma\lambda)} \tag{9}$$

in the scalar model with a single skill and

$$\beta = \gamma + \frac{(1-\gamma^2)\boldsymbol{\rho}'\boldsymbol{\Lambda}(\boldsymbol{I}-\gamma\boldsymbol{\Lambda})^{-1}(\boldsymbol{I}-\boldsymbol{\Lambda}\boldsymbol{\Lambda}')^{-1}\boldsymbol{\Phi}^2\boldsymbol{\rho}}{\boldsymbol{\rho}'(\boldsymbol{I}-\boldsymbol{\Lambda}\boldsymbol{\Lambda}')^{-1}\boldsymbol{\rho}\boldsymbol{\Phi}^2 + 2\gamma\boldsymbol{\rho}'\boldsymbol{\Lambda}(\boldsymbol{I}-\gamma\boldsymbol{\Lambda})^{-1}(\boldsymbol{I}-\boldsymbol{\Lambda}\boldsymbol{\Lambda}')^{-1}\boldsymbol{\rho}\boldsymbol{\Phi}^2 + \sigma^2} \tag{10}$$

[6] For a finite process, β_t will also depend on the initial condition $\mathrm{Cov}(e_0, y_0)$. If cross-sectional inequality varies over generations or if $\boldsymbol{\Lambda}_t$ is not diagonal, the derivation of eq. (8) requires backward iteration of $\mathrm{Var}(y_t)$ and the variance-covariance matrix of $\boldsymbol{e}_t$.

in the multiskill model. It decreases in the importance of market luck σ^2 and increases in the effect of parental income γ and the variance of endowment luck Φ^2. It increases in the returns to endowments ρ and the heritability of endowments λ in the single-skill model but may decrease in returns ρ_k for some skill k in the model with multiple skills.

Proof. See appendix A.4.1.

The steady-state implications of the scalar model are comparable to those from standard models in the literature, such as Becker and Tomes (1986) or Solon (2004). An increase in the returns to parental income or endowments or in the heritability or variance of endowments increases the IGE, while market luck diminishes it. However, in the model with multiple skills, an increase in the return to one skill has an ambiguous effect on the steady-state IGE and may lower it if the heritability of that skill is low (see sec. IV).

A. Dynamic Properties of the System

The literature has almost exclusively focused on how changes in structural parameters affect the IGE in steady state, as given by equation (9) or (10). We instead analyze its transition path, as determined by equations (7) and (8). Following a structural change of the economic environment, what can we say about the transition path of the IGE toward the new steady state? We first focus on the single-skill model, before illustrating some further implications of the multiskill model in sections III and IV. Throughout, we assume that all variables were in steady state in $t = T - 1$ when a structural change occurs in generation T, such that $\boldsymbol{\xi}_{t<T} \neq \boldsymbol{\xi}_{t\geq T}$ (see definition 1). We use the normalization that $\text{Var}(e_t) = \text{Var}(y_t) = 1$ for $t < T$ and occasionally consider a constant-variances case in which the variances remain constant for all t. Since we consider one-time, permanent shifts, we use notation such as $\rho_1 = \rho_{t<T}$ and $\rho_2 = \rho_{t\geq T}$ for model parameters. We further use abbreviations such as $\Delta\text{Cov}(e_T, y_T) = \text{Cov}(e_T, y_T) - \text{Cov}(e_{T-1}, y_{T-1})$ for changes in statistical moments. While Δ generally denotes first differences, we use Δ_∞ for the steady-state shift between $T - 1$ and the new steady state (see app. A.3 for details).[7] We relegate most derivations to appendix A.4.

From equation (7), it follows that in the aftermath of a structural change the IGE may not immediately shift to its new steady state. Our next proposition characterizes the conditions for such prolonged transition over multiple generations.

Proposition 2 (Transitional dynamics). Following a permanent structural change in the economic environment $\boldsymbol{\xi}_t$ at $t = T$, the intergenerational

[7] For example, $\Delta\text{Var}(y_\infty) = \text{Var}(y_\infty) - \text{Var}(y_{T-1})$, and so on.

elasticity β_t may shift over multiple generations to its new steady state. Specifically,

a) A structural change triggers convergence over more than one generation iff $\rho_2 > 0$, $\lambda_2 > 0$, and $\Delta\text{Cov}(e_T, y_T)/\text{Cov}(e_{T-1}, y_{T-1}) \neq \Delta\text{Var}(y_T)/\text{Var}(y_{T-1})$. This inequality always holds for changes in σ^2 or Φ^2, and it holds for other parameter changes, except in special cases. Moreover, if either $\gamma_2 > 0$ or $\lambda_2^2 \neq 1 - \Phi_2^2$, convergence is in infinite time.

b) The convergence steps can increase in absolute size ("amplification"). Amplification in period $T + 1$ ($|\Delta\beta_{T+1}| > |\Delta\beta_T|$) always occurs after parameter changes in σ^2 or Φ^2, is possible after a change in ρ or λ, and never occurs after a change in only γ. Amplification in later periods ($|\Delta\beta_{T+k+1}| > |\Delta\beta_{T+k}|$ for some $k \geq 1$) is possible for changes in any parameter.

Proof. See appendix A.4.2 for derivations and case 1 in section III for illustrations.

Proposition 2 has important implications for the interpretation of mobility trends. First, mobility tends to shift over more than one generation toward its new steady state, even if no other changes in the economic environment occur. An observed shift in the IGE today can therefore be due to a one-time structural change that occurred in a previous generation. Indeed, for changes in σ^2 and Φ^2, the IGE shifts only from the second generation onward (see table A.1; tables A.1 and A.2 are available online). For changes in other parameters, the convergence process lasts over at least two generations if the IGE reflects the transmission of skills ($\lambda_2 > 0$) and their effect on income ($\rho_2 > 0$), except in knife-edge cases that shift the covariance between income and endowments and the variance of income in generation T by the exact same proportion ($\Delta\text{Cov}(e_T, y_T)/\text{Cov}(e_{T-1}, y_{T-1}) = \Delta\text{Var}(y_T)/\text{Var}(y_{T-1})$). Second, IGE trends may fail to reflect the impact of a contemporaneous structural change if they are dominated by the ongoing response to another change that occurred in past generations.

The implication of prolonged mobility trends is more than a theoretical curiosity. Even adjustments that fully materialize within two generations can generate long-lasting transitional dynamics over cohorts (see proposition 5). Moreover, the size of the convergence steps can increase after the initial generation T. In particular, proposition 2*b* considers conditions under which the IGE might shift more strongly in generation $T + 1$ than in generation T. For example, an increase in the returns to endowments ($\rho_2 > \rho_1$) is likely to satisfy $|\Delta\beta_{T+1}| > |\Delta\beta_T|$ for low values of ρ_1. In principle, amplification can also occur in later periods ($|\Delta\beta_{T+k+1}| > |\Delta\beta_{T+k}|$ for some

$k \geq 1$), but the parameter values that trigger such delayed amplification appear less plausible (see app. A.4).

The literature often relates observed shifts in mobility to recent policy changes. However, mobility may fail to respond to an apparent change in the economic environment or may shift in response to previous structural changes (which can also affect consecutive generations of a given family, as illustrated in sec. IV of Becker and Tomes 1979). An important challenge in applications is therefore to determine whether mobility trends reflect the response to contemporaneous changes in the economic environment or the ripple effect of structural changes in the past. It follows from equation (7) that the key statistics to distinguish the two are the variances and cross covariance between income and skills or endowments in the parent generation. We return to this implication, in the context of US mobility trends, in section IV.

Proposition 2 implies that transitional dynamics can obscure the quantitative effects of structural changes on mobility. Another interesting observation is that structural changes can trigger nonmonotonic transitions of the IGE, also complicating the analysis of mobility trends in a qualitative sense:

PROPOSITION 3 (Nonmonotonicity). Following a permanent structural change in the economic environment $\boldsymbol{\xi}_t$ at $t = T$, the transition path of the elasticity β_t between the old steady state and the new steady state $\beta_{t\to\infty} = \beta_\infty$ can be nonmonotonic:

a) The transition path switches sign in generation $T + 1$ iff $\Delta\text{Cov}(e_T, y_T)/\text{Cov}(e_{T-1}, y_{T-1}) < \Delta\text{Var}(y_T)/\text{Var}(y_{T-1})$ for an initial shift $\Delta\beta_T > 0$ and the reverse inequality for an initial shift $\Delta\beta_T < 0$. These conditions can hold for changes in γ, ρ, or λ but not for changes in only σ^2 or Φ^2.

b) The initial shift can be larger than the steady-state shift ("weak nonmonotonicity"), such that $|\Delta\beta_T| > |\Delta\beta_\infty|$. For a single-parameter change, this condition can hold for a change in γ, ρ, or λ but not for changes in σ^2 or Φ^2.

c) The initial shift and the steady-state shift can have opposite signs ("strong nonmonotonicity"), $\text{sign}(\Delta\beta_T) \neq \text{sign}(\Delta\beta_\infty)$, for a single-parameter change in the multiskill model or if two parameters shift in the single-skill model.

Proof. See appendix A.4.3 for derivations and cases 2 and 3 in section III for illustrations.

The proposition distinguishes different forms of nonmonotonicity. The first two parts consider a weak form of nonmonotonicity, in which the mobility trend at some point changes sign, but in which the initial response $\Delta\beta_T = \beta_T - \beta_{T-1}$ still has the same sign as the steady-state response $\Delta\beta_\infty = \beta_\infty - \beta_{T-1}$. Part *a* considers the first two generations after a structural change, while part *b* considers sign changes in later generations along the transition path. Part *a* implies that a structural change can increase the IGE initially ($\Delta\beta_T > 0$) but subsequently decrease it ($\Delta\beta_{T+1} < 0$), or vice versa, if the initial shift in the variance of income, $\Delta\text{Var}(y_T)$, is large in relative terms. Nonmonotonicity in later generations ($\text{sign}(\Delta\beta_{T+k+1}) \neq \text{sign}(\Delta\beta_{T+k})$ for some $k \geq 1$) is also possible, but less likely. Part *b* generalizes this result to the cumulative response along the transition path.

Under weak nonmonotonicity, mobility trends may be misleading, in that over some generations the IGE shifts in one direction while the steady-state shift in fact goes in the other direction. Case 2 in section III provides an illustration. Numerical analyses show that the scenarios outlined by parts *a* and *b* of proposition 2 are likely for shifts in γ but less common (though possible) for shifts in ρ or λ.

The final part of the proposition distinguishes a strong form of nonmonotonicity in which the initial response $\Delta\beta_T$ and the steady-state response $\Delta\beta_\infty$ have opposite signs. The condition for strong nonmonotonicity cannot hold for single-parameter shifts in the single-skill model, but it can hold if two parameters shift or for a single-parameter shift in the multiskill model. Under strong nonmonotonicity, the cumulative effect of all shifts after the first affected generation dominate the initial shift, such that considering only $\Delta\beta_T$ provides a qualitatively false picture of the long-run effect on mobility. Case 4 in section III shows strong nonmonotonicity for a single-parameter shift in the multiskill model and illustrates that the proposition extends to other mobility measures, such as the intergenerational correlation.

In particular, nonmonotonic transitions are commonplace for changes in the relative strength of different transmission mechanisms in a multiskill model that imply only small steady-state shifts in the IGE:

Remark (Transitional mobility gains). In a model with multiple transmission mechanisms, a change in the strength of one mechanism relative to another tends to temporarily increase mobility (relative to its old and new steady-state levels). Accordingly, the transition path is nonmonotonic if the difference between the old and new steady-state IGEs is sufficiently small.

This result is derived formally in section III (case 6). Intuitively, changes in the economic environment alter the prospects of some families relative to others, such that mobility is particularly high in the generation in which this reshuffling of prospects takes place. For example, when skills are differently distributed across families, then a change in the relative importance of one skill has a stronger effect on some families than on others. Specifically, if the return to a particular skill rises, then the income prospects of families in which this skill is comparatively abundant will rise. If this skill was a relatively unimportant determinant of incomes before the change, then intergenerational mobility will be high. However, as time elapses the newly rich will pass on their advantages to their children, and mobility will return to lower levels. Thus, mobility will tend to be temporarily high in times of changes in the economic environment.

Together, propositions 2 and 3 have important implications for the interpretation of mobility trends. The effect of a structural change on mobility in the first affected generation may not be representative of its long-term impact, either quantitatively or qualitatively.

B. Other Mobility Measures and Cohort Dynamics

While we focus on the IGE, our arguments also apply to other measures of the importance of family background, such as intergenerational correlations (e.g., Hertz et al. 2008), rank correlations (Chetty et al. 2014b), or sibling correlations (Björklund, Jäntti, and Lindquist 2009). We further consider how arguments on the transitional dynamics over generations apply to dynamics over cohorts.

1. Other Mobility Measures

Different measures of intergenerational mobility can exhibit different transitional dynamics, even when their steady-state responses are similar. Comparing the elasticity β with the intergenerational correlation $r_t = \mathrm{Corr}(y_t, y_{t-1})$, the result follows trivially from the observation that $r_t = \beta_t(\mathrm{Var}(y_{t-1})/\mathrm{Var}(y_t))^{1/2}$, such that $r_t = \beta_t$ in steady state but $r_t \neq \beta_t$ when $\mathrm{Var}(y_t) \neq \mathrm{Var}(y_{t-1})$ along the transition path. Moreover, the initial responses can have opposite signs:

PROPOSITION 4 (The intergenerational correlation vs. the elasticity). Following a permanent structural change in the economic environment $\boldsymbol{\xi}_t$ at $t = T$, the initial responses of the IGE β_t and correlation r_t differ if $\Delta\mathrm{Var}(y_T) \neq 0$ and can have different signs if $\Delta\mathrm{Var}(y_T)$ is sufficiently large. Specifically, changes in market luck σ or endowment luck Φ always yield $\Delta r_T \neq 0$ and $\Delta\beta_T = 0$, while changes in the direct effect of parental income γ yield $\Delta r_T \neq \Delta\beta_T$ but $\mathrm{sign}(\Delta r_T) = \mathrm{sign}(\Delta\beta_T)$. For changes in returns ρ or heritability λ, $\mathrm{sign}(\Delta r_T) \neq \mathrm{sign}(\Delta\beta_T)$ is possible, depending on parameter values.

Proof. See appendix A.4.4.

The intergenerational correlation tends to respond more immediately to structural changes because it depends on the variance of income in the current period. In particular, structural changes with a large influence on the variance but a small influence on intergenerational transmission in the first affected generation will have qualitatively different effects on the correlation and the IGE. For example, if the returns to a weakly inheritable skill increases, then the correlation decreases, while the IGE tends to increase marginally. We illustrate these results in section IV. Opposing patterns may also occur if we allow two parameters to change simultaneously. For example, if the effects of market luck and skill returns on income increase at the same time, the initial responses of the correlation and the IGE can have opposite signs. Similar considerations hold for other mobility measures. Sibling correlations depend less directly on conditions in the parent generation and thus respond even more rapidly to changes in the economic environment. For an illustration, see appendix A.5. It is more tedious to analyze the dynamic response of the rank correlation, as it depends on additional distributional assumptions. However, in simulations based on normal distributions, its dynamic pattern closely tracks the dynamics of the intergenerational correlation.

2. Non–Steady-State Dynamics over Cohorts

While the theoretical literature models transmission between generations, empirical studies estimate mobility trends over cohorts. This distinction is not relevant for steady-state analysis and has thus received less attention in the theoretical literature. But it does affect the transitional dynamics and thus the interpretation of mobility trends. Most importantly, the dynamic effect of structural changes on mobility trends will be smoothed out by variation in the timing of fertility around the mean age at which parents give birth. Mobility may therefore shift over multiple decades even when the system converges within a single generation. In contrast, sudden shifts in mobility across child cohorts must be due to contemporaneous events. We summarize these arguments in the following proposition and illustrate them further in section V:

PROPOSITION 5 (Mobility trends over cohorts). While changes in the economic environment can have a sudden impact on mobility in the first affected generation, their effect on mobility trends over cohorts in subsequent generations will be gradual.

Proof. See appendix A.4.5.

The IGE for a given cohort depends on the cohort-specific economic environment and the variance and covariance of income and endowments among parents. However, as parents have children at different ages, parents of a given child cohort will belong to different cohorts and may thus be subject to different economic environments. Mobility levels and trends therefore depend on the current economic environment and a weighted average of the cross covariances of income and endowments in previous cohorts, where the weights depend on the distribution of parental age at birth.[8] The effect of past structural changes on mobility trends in the current generation will therefore be gradual, as earlier generations are subject to different economic environments, depending on the timing of fertility. Parental moments may vary by parental age also because of the selective nature of fertility.

The distribution of parental age is thus a key determinant of mobility trends, and its explicit consideration may help to isolate the impact of past structural changes on current trends. For tractability, we however abstract from staggered fertility and life-cycle dynamics in our theoretical discussion below. While this is an important limitation, the cohort-level dynamics—which effectively "smear" across the generational dynamics studied in our theoretical discussion—are not needed to understand some key main arguments (as summarized in propositions 1–4). Moreover, we consider a cohort-level perspective in section V, showing how variation in the exposure to a school reform among parents shifts mobility across child cohorts, and provide a numerical example of cohort-level mobility trends in appendix A.4.5. These examples illustrate how an explicit consideration of parental age at birth can help researchers to detect the impact of past structural shocks on current mobility trends.

III. Transitional Dynamics

In this section, we illustrate how the IGE shifts in response to different structural changes in the economic environment ξ. Our objective is to illustrate and provide intuition for our analytical results above. We assume again that the structural change occurs in generation $t = T$, such that $\xi_{t<T} \neq \xi_{t\geq T}$, and that all moments were in steady-state equilibrium in generation $T - 1$. We start with simplified versions of our baseline model, considering scalar versions of equations (5)–(6) with a single endowment e, and normalize the preshock variances of y and e to 1. We consider separate shifts in each parameter but also present cases in which two parameters change at once to provide some additional insights. We focus on the response of the IGE and study the joint dynamics of inequality and mobility instead in section IV.

Case 1. A change in the effect of parental income (γ).

Figure 1*A* illustrates the response to an increase in the effect of parental income from $\gamma_{t<T} = \gamma_1$ to $\gamma_{t\geq T} = \gamma_2$. As is intuitive, an increase in the direct effect of parental income unequivocally increases the steady-state

[8] A number of other implications follow. For example, mobility may adjust more quickly to structural changes in populations in which individuals become parents at younger ages, and mobility differentials across groups or countries may be partly driven by different weights on past economic environments because of differences in fertility pattern.

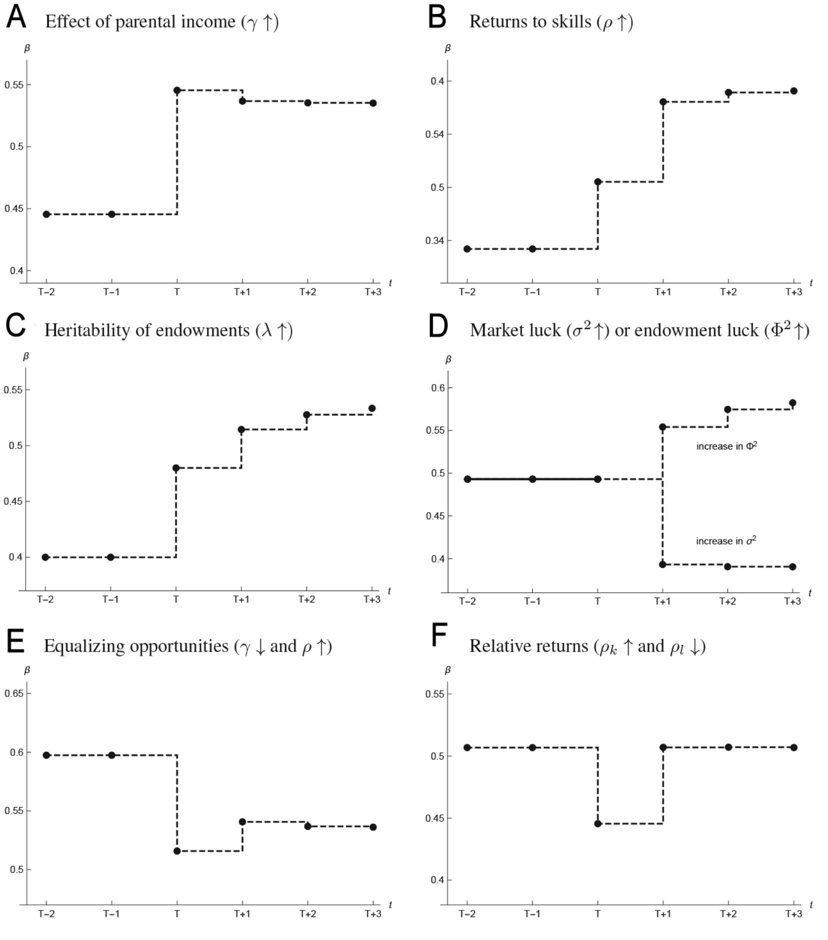

FIG. 1.—Comparative transitional dynamics: numerical examples of trends in the IGE. *A*, In generation *T*, the parental income effect γ increases from $\gamma_1 = 0.2$ to $\gamma_2 = 0.3$ (assuming $\rho = \lambda = 0.6$). *B*, In generation *T*, the returns to skill increase from $\rho_1 = 0.2$ to $\rho_2 = 0.5$ (assuming $\gamma = 0.3$ and $\lambda = 0.8$). *C*, In generation *T*, the heritability of endowments λ increases from $\lambda_1 = 0.5$ to $\lambda_2 = 0.7$ (assuming $\gamma = 0.2$ and $\rho = 0.6$). *D*, In generation *T*, the variance of market luck (σ^2) or endowment luck (Φ^2) doubles (assuming $\gamma = 0.2, \rho = 0.6$, and $\lambda = 0.7$). *E*, In generation *T*, the impact of parental income γ declines from $\gamma_1 = 0.4$ to $\gamma_2 = 0.2$, while the returns to skills increase from $\rho_1 = 0.5$ to $\rho_2 = 0.8$ (assuming $\lambda = 0.6$). *F*, In generation *T*, the returns to skills *k* and *l* increase from $\rho_{k,1} = 0.3$ to $\rho_{k,2} = 0.6$ and decrease from $\rho_{l,1} = 0.6$ to $\rho_{l,2} = 0.3$ (assuming $\gamma = 0.2$ and $\lambda_k = \lambda_l = 0.6$).

IGE (see proposition 1). However, the shift to the new steady-state IGE is in general not immediate (proposition 2*a*) and, depending on initial conditions, can be nonmonotonic (proposition 3), as in the parameterization considered here.

CASE 2. A change in the returns to skills (ρ).

Figure 1*B* illustrates the response to an increase in the returns to endowments or skills from $\rho_{t<T} = \rho_1$ to $\rho_{t\geq T} = \rho_2$. In the scalar version of our model with a single skill and $\lambda > 0$, increasing returns result in a higher steady-state IGE.[9] Again, the shift to the new steady-state IGE is not immediate. Indeed, in our chosen example, the second-generation shift is greater than the first-generation shift ("amplification"; proposition 2*b*). While we focus on transition paths across generations here, figure A.1 (figs. A.1–A.6 are available online) plots the "cohort-level" counterpart to the "generation-level" transition path shown in figure 1*B*. As the timing of fertility varies across parents, the second-generation effect is spread out over many cohorts, providing an illustration of proposition 5.

To understand why amplification is possible, consider a simplified case in which $\gamma = 0$ and the returns to transmittable skills (e) increase relative to other factors that are not transmitted from parents to children (u), such that the variance of y remains constant at their normalized preshock value ($\mathrm{Var}(y_t) = 1$ for all t). The IGE in the first affected generation then shifts according to

$$\Delta\beta_T = \beta_T - \beta_{T-1} = (\rho_2 - \rho_1)\lambda\rho_1, \tag{11}$$

induced by the change in returns for generation in T. The second-generation shift,

$$\Delta\beta_{T+1} = \rho_2\lambda\Delta\mathrm{Cov}(e_T, y_T) = \rho_2\lambda(\rho_2 - \rho_1), \tag{12}$$

is induced by the change in the covariance between income and endowments among the parents of generation $T + 1$, caused by changing returns to those endowments in generation T. This second-generation shift $\Delta\beta_{T+1}$ is larger than the first-generation shift $\Delta\beta_T$, as the correlation between income and endowments is now strong for both generations.

CASE 3. A change in the heritability of endowments (λ).

Figure 1*C* illustrates the response to an increase in the heritability of endowments, which always increases the steady-state IGE (see proposition 1). However, the shift toward the new steady state is comparatively slow, as increases in the variance of e and its covariance with y propagate further in subsequent generations.

CASE 4. A change in the variance of market luck (σ^2) or endowment luck (Φ^2).

Figure 1*D* illustrates the response of the IGE to an increase in the variance of market luck (σ^2) or endowment luck (Φ^2). As is intuitive, an increase in market luck decreases the steady-state IGE (see proposition 1). However, the shift toward the new steady state is delayed, starting only in

[9] This is not generally true in a model with multiple skills, as shown in sec. IV.

generation $T + 1$, while the IGE in generation T remains unchanged. An increase in endowment luck increases the steady-state IGE instead (proposition 1), and the IGE starts shifting only in generation $T + 1$.

Which structural parameters should be shifted if the goal is to increase mobility in both the short and long runs? A comparison of figures 1*A*–1*D* illustrates that changes in the effect of parental income γ have the most immediate effect on the IGE, while changes in other parameters tend to have more delayed impacts. Of course, it remains difficult to map this particular result on structural parameters into specific policies. For example, a reduction in tuition fees for college could alleviate credit constraints and reduce the direct impact of parental income on college attendance—which we would interpret as a downward shift in γ. But if the role of parental income weakens, other characteristics might in turn become more important predictors of college attendance, which may have additional implications for intergenerational mobility.

While figures 1*A*–1*D* illustrate the consequences of single-parameter changes, figures 1*E* and 1*F* illustrate the effect of changes in the relative importance of different transmission mechanisms. Consider first an example of "equalizing opportunities":[10]

CASE 5 (Equalizing opportunities). Assume that the direct effect of parental income diminishes ($\gamma_1 > \gamma_2$), while skills are instead more strongly rewarded ($\rho_1 < \rho_2$).

In other words, assume that in generation T the economy becomes less plutocratic and more meritocratic. For example, parental status may become less and own merits more important for allocations into colleges, firms, or occupations. Figure 1*E* provides an illustration, in which the IGE first decreases in generation T and then increases again in generation $T + 1$. To understand why, consider a simplified case in which the parameters shift such that the variance of y remains constant ($\mathrm{Var}(y_T) = \mathrm{Var}(y_{T-1}) = 1$). Mobility then shifts in the first affected generation according to

$$\Delta\beta_T = (\gamma_2 - \gamma_1) + (\rho_2 - \rho_1)\lambda \mathrm{Cov}(e_{T-1}, y_{T-1}), \tag{13}$$

because of both the declining importance of parental income, $\gamma_2 < \gamma_1$, and the increasing returns to endowments, $\rho_2 > \rho_1$. However, the latter effect is attenuated, for two reasons: endowments are imperfectly transmitted within families ($\lambda < 1$), and they explain only part of the variation in parental income, such that $\mathrm{Cov}(e_{T-1}, y_{T-1}) < 1$. Mobility thus tends to initially increase (for similarly sized shifts in ρ and γ). Mobility also shifts in the second generation,

[10] As noted by Conlisk (1974a), "opportunity equalization" is an ambiguous term that may relate to different types of structural changes in models of intergenerational transmission.

$$\begin{aligned}\Delta\beta_{T+1} &= \rho_2\lambda\Delta\text{Cov}(e_T, y_T)\\ &= \rho_2\lambda[(\rho_2-\rho_1)+(\gamma_2-\gamma_1)\lambda\text{Cov}(e_{T-1}, y_{T-1})],\end{aligned} \tag{14}$$

because of shifts in the covariance between parental income and endowments. The relative impact of each parameter change is now reversed, with the change in γ rather than that in ρ being attenuated by $\lambda\text{Cov}(e_{T-1}, y_{T-1})$. Intuitively, a change toward a more meritocratic society increases the correlation between endowments and income, thereby decreasing mobility from the second affected generation and onward.

The example illustrates that the dynamic response of the IGE can be nonmonotonic.[11] Whether the response is weakly or strongly nonmonotonic as defined in proposition 2 depends on parameter values: strong nonmonotonicity with declining mobility in steady state is more likely when λ is high. The pattern stems from the relative gains and losses that the structural change generates. A rise in the returns to own skills relative to parental income is detrimental for children with high-income, low-skill parents. In contrast, it benefits talented children from poor families, providing opportunities for upward mobility that were not available to their parents. Mobility is high when these relative gains and losses occur. But the children of those who thrive under the new meritocratic setting will also do relatively well, because of the inheritance of endowments, so that mobility then decreases.[12]

The example also illustrates how changes that are mobility enhancing in the long run may nevertheless cause a decreasing trend over several generations. A decline in mobility may then not necessarily reflect a recent deterioration of meritocratic principles but rather major gains made in the past. From this perspective, if a country became more meritocratic in the early or mid-twentieth century, mobility should perhaps be expected to decline in more recent cohorts. Of course, the transitional dynamics to such change also depend on behavioral responses, which we do not model here (see, e.g., Comerford, Rodríguez Mora, and Watts 2022).

As we discussed a quite specific structural change, one may expect that nonmonotonic responses are more of an exception than a rule. We next

[11] Specifically, it will be nonmonotonic if $(\gamma_1-\gamma_2)/(\rho_2-\rho_1) > \lambda\text{Cov}(e_{T-1}, y_{T-1}) < (\rho_2-\rho_1)/(\gamma_1-\gamma_2)$, which holds if $(\gamma_1-\gamma_2)$ and $(\rho_2-\rho_1)$ are sufficiently similar in absolute size. While nonmonotonicity here requires changes in two parameters, it can also arise from a change in a single parameter if we allow for dynamic responses in the variances (see proposition 2).

[12] That a shift toward "meritocratic" principles can also have depressing effects on mobility was already noted by the sociologist Michael Young (1958), who coined the term in the book *The Rise of the Meritocracy*. In contrast to its usage today, Young intended the term to have a derogatory connotation.

illustrate that in a model with multiple skills, as in equations (5)–(6), such responses are instead typical:

CASE 6 (Changing returns to skills). Assume that the returns to different types of skills or endowments change on the labor market ($\boldsymbol{\rho}_1 \neq \boldsymbol{\rho}_2$).

Changes in the returns to different skills could stem from changes in relative supply or demand: for example, demand may shift from physical to cognitive skills as a labor market transitions from agricultural to white-collar employment or shift because of automation (e.g., Autor, Levy, and Murnane 2003). Figure 1*F* provides a simple numerical example with two endowments *k* and *l* that are equally transmitted within families, but their returns swap in generation T ($\rho_{k,2} = \rho_{l,1} \neq \rho_{k,1} = \rho_{l,2}$). Mobility first increases, but decreases in subsequent generations.[13] Intuitively, mobility initially increases because the endowment for which returns increase from low levels is less prevalent among high-income parents than the endowment for which returns decrease from high levels. But the endowment for which returns rise becomes increasingly associated with income in subsequent generations, causing a decreasing mobility trend. This result has implications for how we expect institutional or technological change to affect mobility. Previous work suggests that technological progress can lead to nonmonotonic mobility trends through repeated changes in skill premia (Galor and Tsiddon 1997). We find that even a one-time change can generate such trends if comparative advantages in skills or endowments are partially transmitted within families.

To better understand this nonmonotonic response, consider the general case in which the returns to any number of skills change. We assume here a diagonal heritability matrix, while the derivation for nondiagonal $\boldsymbol{\Lambda}$ is given in appendix A.7. The steady-state IGE before the structural change is then equal to

$$\beta_{T-1} = \gamma + \boldsymbol{\rho}_1'\boldsymbol{\Lambda}(\boldsymbol{I} - \gamma\boldsymbol{\Lambda})^{-1}\boldsymbol{\rho}_1, \tag{15}$$

while, if the income variance remains constant, its steady-state level after the change is

$$\beta_{\infty} = \gamma + \boldsymbol{\rho}_2'\boldsymbol{\Lambda}(\boldsymbol{I} - \gamma\boldsymbol{\Lambda})^{-1}\boldsymbol{\rho}_2. \tag{16}$$

The IGE in the first affected generation, $\beta_T = \gamma + \boldsymbol{\rho}_1'\boldsymbol{\Lambda}(\boldsymbol{I} - \gamma\boldsymbol{\Lambda})^{-1}\boldsymbol{\rho}_2$, can therefore be expressed as

$$\beta_T = \frac{1}{2}(\beta_{T-1} + \beta_{\infty}) - \frac{1}{2}(\boldsymbol{\rho}_2' - \boldsymbol{\rho}_1')\boldsymbol{\Lambda}(\boldsymbol{I} - \gamma\boldsymbol{\Lambda})^{-1}(\boldsymbol{\rho}_2 - \boldsymbol{\rho}_1), \tag{17}$$

[13] We have $\Delta\beta_T = -(\rho_{k,2} - \rho_{k,1})^2\lambda/(1 - \gamma\lambda)$, which is negative, and $\Delta\beta_{T+1} = \lambda(\rho_{k,2} - \rho_{k,1})^2 + \lambda[\rho_{k,2}^2 + \rho_{k,1}^2 + (2\rho_{k,1}\rho_{k,2}\lambda\gamma)/(1 - \gamma\lambda)](1/\mathrm{Var}(y_T) - 1)$, which is positive because $\mathrm{Var}(y_T) = 1 - 2\gamma\lambda(\rho_{k,2} - \rho_{k,1})^2/(1 - \gamma\lambda) < 1$. These findings are not due to shifts in cross-sectional inequality; if instead $\mathrm{Var}(y_T) = 1$ (i.e., changes in ρ_k and ρ_l are offset by changes in the variance of u_t), we still have that $\Delta\beta_T < 0$ and $\Delta\beta_{T+1} > 0$.

where the quadratic form in the last term is greater than 0 for $\boldsymbol{\rho}_2 \neq \boldsymbol{\rho}_1$, because $\boldsymbol{\Lambda}(\boldsymbol{I} - \gamma\boldsymbol{\Lambda})^{-1}$ is positive definite. It can therefore be decomposed into two parts, the average of the old and new steady-state IGEs minus a transitional drop. Changes in returns thus cause a temporary spike in mobility (β_T is below β_{T-1} and $\beta_{t\to\infty}$) as long as the steady-state IGE does not shift too strongly, specifically if

$$|\beta_\infty - \beta_{T-1}| < (\boldsymbol{\rho}_2' - \boldsymbol{\rho}_1')\boldsymbol{\Lambda}(\boldsymbol{I} - \gamma\boldsymbol{\Lambda})^{-1}(\boldsymbol{\rho}_2 - \boldsymbol{\rho}_1)\,. \tag{18}$$

This argument also holds if cross-sectional inequality is lower in the new than in the old steady state.[14]

On the basis of our last two cases, we can formulate a more general conclusion that extends on proposition 3. A change in the strength of one channel of intergenerational transmission relative to another affects the prospects of families differently. For example, a decline in the importance of parental income relative to own skills diminishes the prospects of children with high-income parents. Similarly, a decline in returns to a particular skill hurts those families in which that skill is more abundant. Economic and social changes that generate such relative gains and losses will tend to generate transitional mobility in the generation in which they occur—times of change tend to be times of high mobility.[15] Many developed countries experienced greater societal transformations in the first than in the second half of the twentieth century, and those transformations may have increased mobility in those generations that were directly affected but decreased it subsequently. Our analysis suggests that such transitional gains diminish as the economic environment stabilizes.

IV. Joint Dynamics of Mobility and Inequality

We already noted that the transitional dynamics of the IGE and other mobility measures depend also on shifts in the variance of income across generations. We now consider such shifts in cross-sectional inequality, their interrelation with intergenerational mobility, and how evidence on recent mobility trends in the United States can be interpreted in light of our findings.

[14] Equation (17) then includes the additional term $\boldsymbol{\rho}_2'\boldsymbol{\Lambda}(\boldsymbol{I} - \gamma\boldsymbol{\Lambda})^{-1}\boldsymbol{\rho}_2[1 - (1/\mathrm{Var}(y_{t\to\infty})]$, which is negative if $\mathrm{Var}(y_{t\to\infty}) < \mathrm{Var}(y_{T-1}) = 1$.

[15] This argument extends to other contexts. For example, assume that the vector $\boldsymbol{e}_t$ includes the location of individuals, "inherited" with some probability from their parents. We can then relate our argument to Long and Ferrie (2013), who argue that US occupational mobility was high in the nineteenth century as a result of exceptional geographic mobility. Our result illustrates that not only internal migration itself but also its underlying causes may increase intergenerational mobility, if local shocks affect parents and their (nonmigrating) children differently.

A. Transitional Dynamics in Cross-Sectional Inequality

The steady-state relationship between cross-sectional inequality and intergenerational persistence was emphasized by Becker and Tomes (1979), was studied further by Solon (2002), Davies, Zhang, and Zeng (2005), and Hassler, Rodríguez Mora, and Zeira (2007), and was recently reviewed by Durlauf, Kourtellos, and Tan (2021). The transitional dynamics of inequality and mobility are also intertwined. Note first that as a result of intergenerational mechanisms, changes in cross-sectional inequality tend to propagate across generations. For example, in response to a shift in the variance of market luck from σ_1^2 to σ_2^2 in generation T, the variance of income initially shifts by the same amount ($\Delta\text{Var}(y_T) = \sigma_2^2 - \sigma_1^2$), but then continues to shift in future generations according to (see app. A.3):

$$\Delta\text{Var}(y_t) = \gamma^2\Delta\text{Var}(y_{t-1}) \quad \forall\ t > T. \tag{19}$$

In this example, the variance of income will transition in infinite time toward its new steady state if $\gamma > 0$. Such transitional dynamics in cross-sectional inequality also affect aggregate measures of mobility, and they affect the transition paths of different mobility measures differently (see proposition 4). In particular, the variance of market luck has no effect on the covariance between endowments and income in equation (7) and thus no initial effect on the IGE. However, the IGE shifts in generation $T + 1$, according to (see app. A.3)

$$\Delta\beta_{T+1} = \beta_{T+1} - \beta_T = -\frac{\rho^2\lambda}{1 - \gamma\lambda}\frac{\sigma_2^2 - \sigma_1^2}{1 + \sigma_2^2 - \sigma_1^2}. \tag{20}$$

Other mobility measures, such as the intergenerational or sibling correlation, shift already in generation T.[16] We next illustrate how these insights affect the interpretation of mobility trends.

B. Rising Skill Premia and Income Mobility

Interest in the relationship between inequality and mobility has been spurred by two observations. First, the United States and other rich countries have experienced rising skill premia and an increase in income inequality since around 1980. Second, many studies find a negative correlation between cross-sectional inequality and intergenerational mobility across (Corak 2013) and within (Chetty et al. 2014a; Güell et al. 2018; Connolly, Corak, and Haeck 2019) countries, a relation now popularly

[16] See proposition 4 for a discussion of the intergenerational correlation. Appendix A.5 analyzes the transitional dynamics of the sibling correlation.

known as the "Great Gatsby Curve."[17] But despite this association, and the prediction from standard models that rising skill premia decrease intergenerational mobility (Solon 2004), it remains debated whether and to what extent mobility actually deteriorated in recent decades. Lee and Solon (2009) reject large changes in PSID data up until around 2000, and Chetty et al. (2014b) find stable mobility in tax data over cohorts born in the 1970s and early 1980s, while Justman and Stiassnie (2021) find a mobility decrease in more recent waves of the PSID. Davis and Mazumder (2020) incorporate data on earlier cohorts, finding a drop in mobility that occurred just before the cohorts observed in the PSID.[18]

Why was there not a more pronounced decrease of income mobility in more recent decades, despite rising returns to skill and inequality? Our framework points to three potential explanations. First, in a multiskill model, rising skill returns do not necessarily decrease intergenerational mobility in steady state (see also proposition 1). Second, the transitional dynamics of inequality and mobility can deviate strongly from their steady-state relationship. In particular, the effect of rising skill returns can be very different from the first to the second affected generation. Third, contemporaneous mobility trends in the United States might also be affected by structural changes that predate and offset the recent increase in skill returns. Of course, that increase could also be offset by other contemporaneous structural changes, such as a decrease in the direct influence of parental income. For example, Lee and Solon (2009) note that the mobility-depressing effect of increasing skill returns could have been offset by more progressive public investment in children's human capital. We illustrate the first two arguments, using our theoretical model, and then provide evidence from the PSID supporting our third argument in section V.

1. Rising Skill Returns and Steady-State Mobility

In a model with multiple skills or endowments, an increase in skill returns has ambiguous effects on steady-state mobility. For illustration, consider the following example:

[17] The name was coined by Alan Krueger in his 2012 speech at the Center for American Progress; he later noted that "based on the rise in inequality that the United States has seen from 1985 to 2010 and the empirical evidence of a Great Gatsby Curve relationship, I calculated that intergenerational mobility will slow by about a quarter for the next generation of children" (Krueger 2016). See also footnote 1 and Durlauf, Kourtellos, and Tan (2021) for a more theory-focused discussion of the Great Gatsby Curve.

[18] To identify this shift, Davis and Mazumder (2020) compare cohorts who entered the labor market before and after the sharp increase in inequality around 1980, which is not possible to do well in the PSID but can be done in datasets like the National Longitudinal Surveys. Other recent papers on US mobility trends include Palomino, Marrero, and Rodríguez (2017) and Jácome, Kuziemko, and Naidu (2021).

CASE 7 (Transitional dynamics in the "Great Gatsby Curve"). Assume that children inherit two endowments k and l from their parents. In generation T, the return to endowment k increases, while the return to endowment l remains unchanged.

Figure 2 plots, for four different environments (or "countries"), the transition paths of the IGE, the correlation, and the variance of income.[19] While otherwise characterized by the same environment, the initial returns to endowment k ($\rho_{k,1}$) and thus inequality are higher in countries A and C. Moreover, its heritability λ_k is lower in A and B than in the other two countries. We find that the same absolute change in the returns to endowment k decreases steady-state persistence in A and B but increases it in C and D. A sufficient condition for a nonincreasing steady-state IGE after an increase in returns ρ_k is $\beta_{T-1} \geq (\gamma + \lambda_k)/(1 + \gamma\lambda_k)$, which holds if the heritability of k is sufficiently low relative to other determinants of the IGE.[20] This observation contrasts with the prediction from standard models with a single skill, in which increasing returns unambiguously increase the IGE (Solon 2004). It further suggests that the same structural change can have opposing effects on steady-state mobility if countries differ in initial conditions. For example, steady-state persistence increases the most in C, where endowment k is both strongly inheritable and yields high returns. This is intuitive, since it speaks to a case where rich families in the past were rich because of the same endowment that drives increasing inequality in current times.

2. Rising Skill Returns and Transitional Dynamics

Most relevant for the recent debate, however, is the effect of rising skill returns on mobility in the first affected generation. Figure 2 illustrates that the initial response in the first affected generation can be small if the preshock return to that endowment is small (cases B and D). More generally, the transition path that countries take through the Gatsby diagram can be complex: while the path of inequality is monotonic, the paths of the two mobility measures can be nonmonotonic. In some cases,

[19] Inequality measures may mix information from multiple generations and may therefore lead to a temporal aggregation problem, as illustrated in Working (1960). We consider the average of the variances in the parent and child generations here. To measure inequality in a cross section with overlapping generations may lead to stronger transitional dynamics, in particular if average incomes change across generations.

[20] This condition is derived in the proof of proposition 1 in app. A.4.1. The result extends to settings with more than two skills: an increase in the return to a single endowment decreases steady-state mobility only if its heritability is high relative to the combined importance of other determinants of income. The arguments can be easily understood by noting that a nonheritable skill is akin to market luck, which increases mobility.

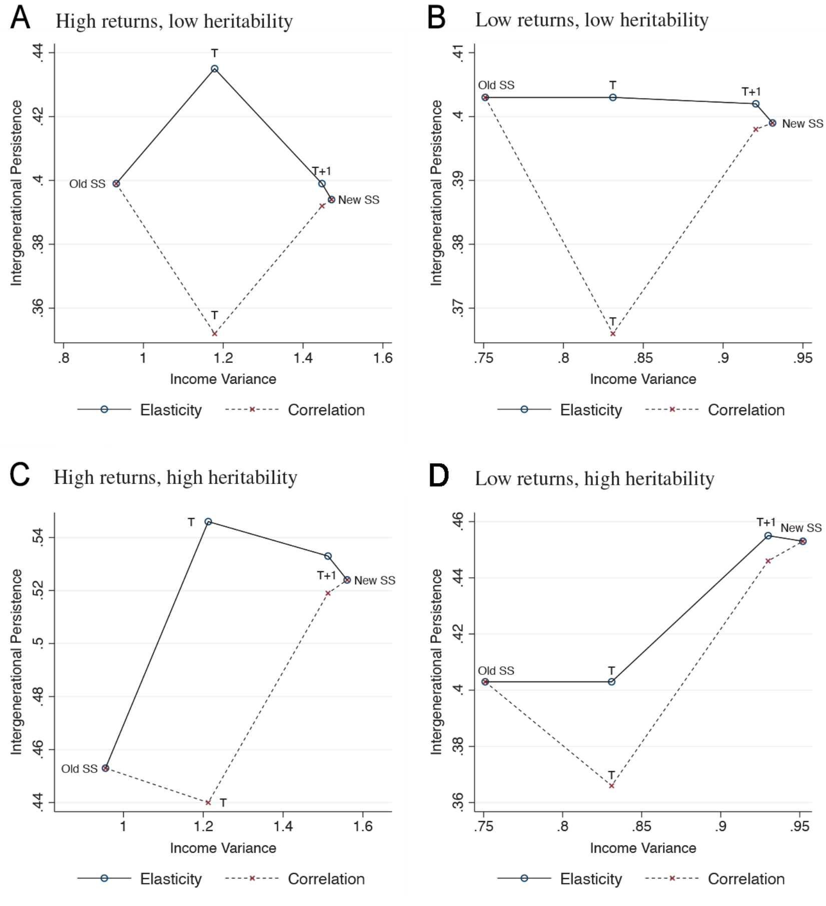

FIG. 2.—Increase in the returns to a single skill: transitional dynamics of the IGE (solid line) or correlation (dashed line) and the average of the variance of income in the parent and child generations. Parameters are $\gamma = 0.2$, $\lambda_l = 0.8$, $\mathrm{Var}(u_t) = 0.5$, and $\rho_l = 0.4$; $\lambda_k = 0.2$ in *A* and *B*, and $\lambda_k = 0.5$ in *C* and *D*; $\rho_{k,1} = 0.4$ in *A* and *C*, and $\rho_{k,1} = 0$ in *B* and *D*. In generation *T*, the returns to skill *k* increase by $\rho_{k,2} - \rho_{k,1} = 0.4$ in all cases. See appendix A.5 for a corresponding numerical illustration of the dynamics of the sibling correlation.

such as in *A*, the first-generation and steady-state shifts have different signs ("strong nonmonotonicity"; see proposition 3). Even if the steady-state response is in line with the static Gatsby diagram, the first-generation effect may not be (case *D*). An understanding of transitional dynamics is thus useful not only for the interpretation of mobility trends but also for their relationship to cross-sectional inequality.

Can these observations help us understand mobility changes in recent decades? In particular, does rising inequality primarily reflect a rising importance of skills that are not strongly transmitted within families or were not very important in the parent generation? Some recent evidence would be in line with this interpretation. For example, Deming (2017) and Edin et al. (2022) find substantial increases in the earnings returns to socioemotional skills over the past decades, which appear to be less strongly transmitted within families than cognitive skills (e.g., Loehlin 2005). Yet the gap in the transmission of cognitive and socioemotional skills would have to be very large to explain why a rise in returns to the latter would have no initial effect on the IGE, leading us to believe that this cannot be the main explanation.[21]

Figure 2 also plots the intergenerational correlation (IGC), which tends to react quite differently from the IGE during the transition. In all examples, the IGC decreases in the first affected generation. Because the IGC decreases in the contemporaneous variance of income, an increase in returns tends to decrease the IGC, unless the affected skill was the dominant determinant of the intergenerational income correlation before the change. Different measures of mobility therefore follow different transitional dynamics, especially in the first affected generations (illustrating proposition 4).[22]

C. *Evidence on US Mobility Trends*

We finally study whether US mobility trends might be influenced by structural changes that predate and offset the recent increase in income inequality. As reflected in equation (7), the IGE is a function not only of the current economic environment but also of the covariance of income and endowments in the parent generation. A decrease in this covariance, for example, might counteract a mobility-depressing effect of rising skill prices.

1. Data

To explore this hypothesis, we analyze trends in income mobility in the PSID. Our sampling choices are guided by Lee and Solon (2009) and further

[21] Moreover, Grönqvist, Öckert, and Vlachos (2017) show that the heritabilities of cognitive and noncognitive/socioemotional skills are quite similar once measurement error is taken into account.

[22] The latter argument may also help to explain why Levine and Mazumder (2007) find a sharp increase in sibling correlations since 1980, while there is less evidence of an increase in intergenerational persistence. The steady-state response to growing skill returns in our model is similar in both measures. But sibling correlations respond more immediately (if $\gamma = 0$, they respond fully in generation T), because they depend less directly on returns in the parent generation (see app. A.5).

described in appendix A.8. We first identify parent-child pairs and construct income and skill measures for both generations. Specifically, we measure the household income of parents as an average over the years when the child was age 15–17. We measure annual household incomes in the child generation when the son or daughter was age 30–35, which allows us to include the 1980s birth cohorts in our analysis and facilitates comparability with both Lee and Solon (2009) and Chetty et al. (2014b).[23] While the IGE (in lifetime income) will be understated in this age range, our objective is to measure its trend rather than its level.

2. Results and Interpretation

Panel A of table 1 reports estimates from a regression of log child income on log parent income, year and age controls, and an interaction between child age and log parental income to control for life-cycle effects (see app. A.8). We estimate this regression separately for four groups of birth cohorts born in the 1950s, 1960s, 1970s, and 1980s. We find no dramatic changes in the IGE over this period (with $\hat{\beta}$ at or slightly above 0.4).[24]

In panel B, we report the corresponding trend in income inequality in the parent and child generations. Consistent with prior evidence, the variance of income increases substantially over cohorts. Perhaps more surprisingly, this trend affects the parent and child measures similarly. This observation is primarily due to the fact that—like other studies—we measure parents' income at a later age than the income of their children. This asymmetry reduces the gap in calendar time between the measurement of parent and child incomes and amplifies measures of income inequality in the parent generation (as age-income profiles tend to diverge over age). For comparability with previous research, we retain this asymmetry here.[25]

In panel C, we report trends in the skill premium, as approximated by a regression of log incomes on years of schooling (again controlling for year and age). We consider schooling as a proxy measure of e in our single-skill model.[26] Consistent with prior evidence, we find that the premium increased over the child cohorts in our sample. Other things equal,

[23] For simplicity and data reasons, we use years of schooling as our measure of skill and do not consider multiple skills.

[24] As mentioned above, our estimates here do not capture a potential decline in mobility relative to earlier cohorts that are not well captured by the PSID (Davis and Mazumder 2020).

[25] Transitional dynamics in income inequality therefore have a less mechanical effect on standard estimates of the IGE than one might otherwise expect. The same argument could explain why both the IGE and measures based on adjusted distributions, such as Pearson or rank correlations, can remain stable over time.

[26] The estimated skill premia are lower but exhibit a similar trend when parental income is controlled for, a specification that corresponds more closely to our structural eq. (5).

TABLE 1
INCOME MOBILITY IN THE UNITED STATES OVER 4 DECADES

	Birth Cohort			
	1950s	1960s	1970s	1980s
	A. IGE			
IGE	.421	.419	.427	.400
	(.040)	(.039)	(.036)	(.042)
Individuals	1,094	1,011	1,111	902
Individual × year observations	5,829	3,874	2,975	1,788
	B. Income Inequality			
SD INC_{it}	.67	.62	.70	.83
SD $PINC_i$	.58	.58	.68	.80
SD INC_{it}/SD $PINC_i$	1.15	1.07	1.03	1.04
	C. Returns to Schooling			
$\hat{\rho}$ (child generation)	.122	.121	.160	.178
	(.010)	(.010)	(.011)	(.016)
$\hat{\rho}$ (parent generation)	.088	.098	.122	.148
	(.005)	(.006)	(.008)	(.010)
SD EDU_i	2.21	2.08	2.07	2.05
SD $PEDU_i$	3.36	2.89	2.36	2.35
SD EDU_i/SD $PEDU_i$	.66	.72	.88	.87
	D. Covariances among Parents			
Corr($PEDU_i$, $PINC_i$)	.513	.486	.425	.436
	(.028)	(.027)	(.029)	(.030)
Cov($PEDU_i$, $PINC_i$)	1.03	.83	.68	.82
Cov($PEDU_i$, $PINC_i$)/Var($PINC_i$)	3.08	2.46	1.49	1.29
	E. Counterfactual IGE with Constant Covariance-Variance Ratio			
Counterfactual IGE	.421	.439	.503	.492

NOTE.—See app. A.8 for sample and variable definitions. Panel A reports IGE estimates from a regression of log child family income (INC_{it}) on log parent family income ($PINC_i$), year and age controls, and an interaction between child age and $PINC_i$, estimated separately for cohorts born in the 1950s, 1960s, 1970s, and 1980s. Panel B estimates income inequality in the parent and child generations, with INC_{it} measured when the child was age 30–35 and $PINC_i$ measured as an average when the child was age 15–17. Panel C reports skill premia in the parents and child generations based on regressions of log incomes on years of schooling (EDU_i or $PEDU_i$), controlling for year and age. Panel D shows correlations and covariances between parental education and parental income and the ratio of the covariance between parent education and income and the variance of income, as a proxy $\mathrm{Cov}(e_{t-1}, y_{t-1})/\mathrm{Var}(y_{t-1})$, as featured in sec. II. Panel E reports a counterfactual IGE had the ratio Cov($PEDU_i$, $PINC_i$)/Var($PINC_i$) stayed constant at the level of the 1950s cohort group (see footnote 27). Standard errors, in parentheses, are clustered at the individual (child). Source: PSID.

we would expect this rising skill price to increase the IGE (see app. A.3), in particular since schooling is relatively persistent between generations (Hertz et al. 2008). However, the variance of schooling in the parent generation drops strongly for the 1960s cohorts and again for the 1970s cohorts, while remaining more constant in the child generation. As noted by Hilger (2015), this evolution is driven by rising high school attainment among the parents of the cohorts born in the mid-twentieth century.

Moreover, panel D shows that the correlation between parental education and parental income also decreased over cohorts. That being the case, the ratio of the covariance between parent education and income and the variance of income, corresponding to $\mathrm{Cov}(e_{t-1}, y_{t-1})/\mathrm{Var}(y_{t-1})$, as featured in our decomposition of the IGE in section II, falls substantially—it is less than half as large for the 1980s as for the 1950s cohort. Finally, the last row in table 1 illustrates how the IGE would have evolved over cohorts had the ratio $\mathrm{Cov}(e_{t-1}, y_{t-1})/\mathrm{Var}(y_{t-1})$ stayed constant. Instead of the observed marginal decrease from 0.42 to 0.40, the IGE would have increased by 20%, to 0.50.[27]

This evidence therefore suggests that important changes in the parent generation offset the effect of the rise in skill prices: rising skill premia did depress mobility, but this effect was counteracted by the mobility-enhancing effects of an increasingly compressed distribution of schooling in the parent generation. Of course, our analysis here ignores general equilibrium effects, such as the effect of changes in skill supplies on skill returns (Katz and Murphy 1992), but it does illustrate that observing a largely stable IGE does not necessarily imply that the transmission system itself has remained stable.

Researchers should therefore consider both current and more distant events when interpreting contemporaneous trends in intergenerational mobility. The variances and covariance of income and education in the parent generation are key statistics to consult in this regard. With richer data on parents, researchers may extend this analysis to other parental characteristics, such as cognitive and noncognitive skills (for an example, see Markussen and Røed 2020).

V. The Dynamic Effects of a Compulsory-Schooling Reform

Our theoretical analysis suggests that a single structural change can generate trends in intergenerational mobility across multiple generations.

[27] Separately for each cohort group (decade) c, we estimate ρ and λ using the single-skill counterparts of eqq. (5)–(6). Combining these estimates with our estimates of $\mathrm{Cov}(e_{t-1}, y_{t-1})/\mathrm{Var}(y_{t-1})$ (panel D of table 1), we compute the counterfactual IGE as

$$\tilde{\beta}_c = \hat{\beta}_c + \hat{\rho}_c\hat{\lambda}_c\left(\frac{\widehat{\mathrm{Cov}(e_{1950,t-1}, y_{1950,t-1})}}{\mathrm{Var}(y_{1950,t-1})} - \frac{\widehat{\mathrm{Cov}(e_{c,t-1}, y_{c,t-1})}}{\mathrm{Var}(y_{c,t-1})}\right),$$

where $\hat{\beta}_c$ is the original decade-of-birth-specific IGE estimate reported in panel A of table 1. All estimates are conditional on calendar year and child and parental age (where applicable) and normalized to child age 33 (see also app. A.8).

We now aim to provide causal evidence on such long-lasting dynamics, a task that is demanding in terms of both data coverage and identification. We consider the Swedish compulsory-schooling reform, first studied by Meghir and Palme (2005) and outlined in Holmlund (2007). Gradually implemented across municipalities from the late 1940s, the reform raised compulsory schooling from 7 (or 8) to 9 years and postponed tracking decisions (see app. A.10 for details).

This application is interesting for three reasons. First, education is a key mechanism for the transmission of income (Becker and Tomes 1979), and educational reforms are thus potential determinants of mobility trends (e.g., Machin 2007). Reforms similar to the Swedish one were enacted in many Western countries during this period and did indeed raise mobility in the directly affected generation (Holmlund 2008; Pekkarinen, Uusitalo, and Kerr 2009; Karlson and Landersø 2021). Second, we have access to an unusually rich dataset. While we cannot use these data to analyze the role of skill multiplicity, they do cover long-run outcomes and parent-child linkages of three generations. Third, the reform's gradual implementation across areas allows separation of the reform from regional or time-specific effects.[28]

A. Data and Descriptive Evidence

Our sample is based on a random 35% draw of the Swedish population born 1943–55 (the directly affected cohorts), their parents, and their children. We add income data from tax declaration files and years of schooling from an education register. For further data details, see appendix A.11.

Figure 3 illustrates the timing of the reform. The share of children subject to the reform increases sharply in cohorts 1943–55 (gray area). These individuals become parents themselves from the 1960s, but their share among all fathers (black area) increases only slowly over child cohorts, as a result of variation in the timing of fertility. As summarized in proposition 5, the dynamic effect of structural changes on mobility trends should thus be gradual from the second affected generation onward.[29] Figure 3 also shows that the rollout of the reform coincides with a large drop in the slope coefficient in a regression of child's years on father's years of schooling. The degree to which differences in schooling

[28] A number of studies exploit this characteristic to assess the reform impact on individual outcomes in directly affected or subsequent generations (see, e.g., Meghir and Palme 2005; Holmlund, Lindahl, and Plug 2011; Meghir, Palme, and Schnabel 2011). We examine instead its effect on summary measures of intergenerational mobility.

[29] Since we observe schooling only for those born in 1911 and later, we restrict our estimation sample to fathers who were 33 years or younger at the birth of their child. Our results will therefore understate the longevity of the reform's effect on mobility measures.

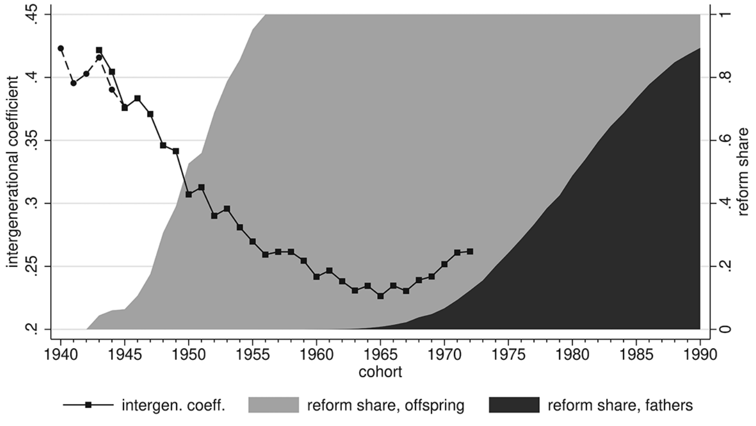

FIG. 3.—Reform coverage and trends in the intergenerational educational coefficient. The figure shows intergenerational educational coefficients (left-hand y-axis), that is, coefficients from regressions of years of schooling of offspring in the respective birth cohort on years of schooling of their fathers, based on intergenerational sample (fathers aged below 33 at birth, solid line) and subsample (fathers aged below 30, dashed line). It also shows the shares of offspring (gray area) and fathers (black area) subject to school reform over offspring cohorts in source data (right-hand y-axis).

are transmitted to the next generation declines by more than a third, consistent with our theoretical expectation.[30] However, after its large decline, the coefficient starts to gradually rise again among cohorts born in the late 1960s. The trend line is similar to the one based on the sibling correlation in Björklund, Jäntti, and Lindquist (2009), although the initial drop is larger and the subsequent rebound occurs somewhat earlier in their study (in line with our expectations from app. A.9).

B. The Reform Effect on Intergenerational Mobility

We exploit the rollout of the reform to estimate its causal impact, adapting a difference-in-differences approach, as in Holmlund (2008). The specification is easier to describe as a two-step procedure.[31] In a first step, consider, for each cohort c and municipality m, the regression model

$$y_{cmt} = \alpha_{cm} + \beta_{cm} y_{cmt-1} + u_{cmt}, \tag{21}$$

[30] The impact of a compulsory-schooling policy on educational and income mobility can be predicted from a variant of our theoretical framework (see app. A.9). Our model predicts a drop in the intergenerational coefficient in education and income in the first affected generation and a gradual increase in the next.

[31] We thank an anonymous referee for this suggestion.

where y_{cmt} is a measure of the socioeconomic status of the child in generation t of family i (subscript suppressed), y_{cmt-1} the corresponding measure of the father, and β_{cm} a measure of intergenerational persistence (e.g., the IGE). Our interest centers on the second-step model

$$\beta_{cm} = \boldsymbol{\alpha}_1' \boldsymbol{D}_c + \boldsymbol{\alpha}_2' \boldsymbol{D}_m + \gamma R_{cm} + v_{cm}, \tag{22}$$

which allows for mobility differences across cohorts and municipalities (captured by indicator vectors $\boldsymbol{D}_c$ and $\boldsymbol{D}_m$). The indicator R_{cm} equals 1 if the reform was in place for cohort c in municipality m, and γ captures the reform effect.

We estimate this reform effect in both the first affected generation and the subsequent one.[32] In the former (cohorts born 1943–55 and their fathers), subscript c refers to the child's cohort, while in the latter (cohorts born 1966–72) it refers to the father's cohort and treatment status—while all children of this generation attended reformed schools, only some of their fathers did (see fig. 3). The identifying variation is local changes in mobility after introduction of the reform. While controlling for fixed cohort and area effects, a common concern with this type of strategy is differences in area-specific trends. Moreover, the reform indicator is potentially measured with some error, which may introduce attenuation bias. Appendix A.12 provides sensitivity analyses, showing that our main results are robust to both these and a set of other potential concerns.

Panel A of table 2 reports estimates of the reform effect γ on the intergenerational coefficient in years of schooling and log income (the IGE).[33] Upon introduction of the reform, persistence in both schooling and income decreased by about 10%. In line with Holmlund (2008), we thus find that the reform raised mobility in the first affected generation. But our main question is whether the reform caused prolonged dynamics in later cohorts. Figure 3 shows that after its long decline, the intergenerational coefficient starts rising again among cohorts born in the late 1960s, the first cohorts in which some fathers had attended reformed schools. Indeed, figure A.2 shows that the coefficient increases only for fathers who were sufficiently young to be exposed to the reform. The estimates in table 2 confirm that the persistence in both schooling and income indeed increased in response to the reform in the previous generation.

[32] As the dependent variable in eq. (22) is estimated, its sampling distribution must be taken into account to obtain standard errors and efficient estimates of γ (see Hanushek 1974). In practice, we estimate both steps at once, pooling across cohorts and municipalities and interacting the intercept and regressor of eq. (21) with each of the regressors in the second-stage equation.

[33] As we measure average incomes when the children are young (age 30–35) but the fathers older (age 53–59), our baseline estimate understates the IGE in lifetime income (Nybom and Stuhler 2016). Moreover, our estimates capture mobility within areas, which do not aggregate immediately to mobility at the national level (see Hertz 2008).

TABLE 2
Reform Effect on Educational and Income Mobility

	Generation 1		Generation 2	
	Education	Income	Education	Income
Observations	220,335	199,340	111,173	110,317
	A. Regression Slope			
	Years	Log	Years	Log
Baseline	.422***	.139***	.294***	.244***
	(.0075)	(.0162)	(.0041)	(.0093)
Reform effect	−.037***	−.020**	.066***	.041*
	(.0072)	(.0100)	(.0128)	(.0216)
	B. Standardized Slope			
	Years	Log	Years	Log
Baseline	.362***	.106***	.402***	.191***
	(.0063)	(.0126)	(.0059)	(.0073)
Reform effect	−.040***	−.015*	.080***	.033*
	(.0074)	(.0087)	(.0163)	(.0173)
	C. Rank-Rank Slope			
	Rank	Rank	Rank	Rank
Baseline	.420***	.117***	.410***	.213***
	(.0078)	(.0115)	(.0061)	(.0062)
Reform effect	−.023***	−.009	.053***	.014
	(.0088)	(.0087)	(.0147)	(.0155)

Note.—The table reports estimates of γ in eq. (22) based on child cohorts 1943–55 (first generation) or 1966–72 (second generation) and their fathers, using years of schooling or log income as status measure (panel A), standardized (panel B), or percentile ranked (panel C) within each child and father cohort. Clustered (municipality level) standard errors are in parentheses.
* $p < .10$.
** $p < .05$.
*** $p < .01$.

The estimates of γ are larger for the second than for the first generation, for two reasons. The first is the timing of fertility (see sec. II.B.2): among cohorts born in the 1960s, only young parents can themselves have been subject to the reform. As young parents tend to have less schooling, the reform's impact on this group was large. Second, these parents are more likely to have been born in the early 1940s than later. As for the secular rise in average schooling over time, the minimum-schooling restriction was more binding in these earlier cohorts—the reform effect is heterogeneous across first-generation cohorts.

The reform compresses the distribution of schooling and income, and the IGE is particularly sensitive to such variance changes. However, this sensitivity can extend to other mobility measures for which the link to cross-sectional inequality is less obvious. To show this, we standardize the variance of our status variables before estimation or transform them into percentile ranks within the national distribution of each cohort (as in Chetty et al. 2014a). The sign and magnitude of the estimated reform effect on the standardized (i.e., correlation) coefficient (panel B of table 2) are together similar to the effect on the regression coefficient. Intuitively, by standardizing variables within the national distribution of a cohort we abstract from broad changes in inequality but not from changes in inequality that occur within areas or subgroups. The magnitude of the reform effect on the rank-rank relationship (panel C) is smaller, and it is statistically significant only for education.

These findings support and illustrate some of our key theoretical results. First is the existence of transitional dynamics: as also illustrated for the United States, recent mobility trends can indeed be caused by events that occurred in previous generations (proposition 1). Second, our findings confirm that transitions can be nonmonotonic (proposition 2), and illustrate the close relationship between the dynamics of cross-sectional and intergenerational inequality.

VI. Conclusions

We examined the dynamic relationship between intergenerational mobility and its underlying structural factors, leading to four key theoretical results. First, changes in the economic environment affect mobility not only in the directly affected generation but also in subsequent generations; policy or institutional changes may therefore generate long-lasting mobility trends. Second, these transitional dynamics can be nonmonotonic. Mobility shifts in the first affected generation may therefore give a misleading picture of the long-run consequences of structural changes. Third, such changes can lead to relative gains and losses that generate transitional mobility; times of change therefore tend to be times of high mobility, and negative mobility trends may stem from gains in equality of opportunity in the past. Fourth, mobility measures interact with the transition path of cross-sectional inequality, and different mobility measures can exhibit quite dissimilar transitional dynamics.

We illustrated the first two results empirically, by studying US mobility trends as well as the effects of a Swedish compulsory-schooling reform on parent-child mobility across multiple generations. We first showed that changes in the parent generation may be key to understand why mobility seems to have remained fairly stable across recent decades in the United States. While rising skill returns did put downward pressure on mobility, a substantial compression of the parental schooling distribution counteracted this effect, resulting in a roughly constant IGE for cohorts born between the 1950s and the 1980s. We then showed that the Swedish schooling reform increased income and educational mobility in directly affected cohorts (see also Holmlund 2008). But the reform's impact in the subsequent generation went in the opposite direction, suggesting that its long-run effect on mobility may have been small.

Our model is of course stylized, and its application to other settings may require careful treatment of issues that we did not address. These include the timing of intergenerational transmission mechanisms over an individual's life cycle and their potential endogeneity to changes in the economic environment (see Heckman and Mosso 2014), as well as the difficulties that hinder reliable estimation of mobility trends. In general, it is a difficult task to track how events in past generations affect mobility across multiple generations. Still, we illustrated how a consideration of transitional dynamics may be fruitful in the interpretation of mobility trends related to both specific events (such as the Swedish schooling reform) and broader structural change (such as the constancy of income mobility vis-a-vis rising skill returns in the United States).

In addition, our results point to a number of specific implications that we discussed only briefly. We noted that rising skill premia shift intergenerational measures over at least two generations, suggesting that the overall effect may not yet be fully visible in current estimates. Other measures of the importance of family background respond more quickly, potentially explaining why sibling correlations in earnings did increase (Levine and Mazumder 2007). We further noted that causes of geographic mobility may also generate transitional gains in intergenerational mobility, as is possibly relevant in settings in which both forms of mobility are high (as in Long and Ferrie 2013).

Promising avenues for future research include the observation that different causes of mobility shifts or different transmission models could be distinguished by their divergent dynamic implications or that the effect of past events on current mobility trends could be detected by conditioning mobility measures on parental age at birth. Perhaps the most immediate implication of our work is that the covariance between income, skills, and endowments in the parent generation should be a key object of interest in mobility studies, as it plays a central role for the evolution of income mobility over cohorts and generations.

Data Availability

Codes replicating the tables and figures in this article can be found in Nybom and Stuhler (2023) in the Harvard Dataverse, https://doi.org/10.7910/DVN/OQR0KM. The project pulls from two data sources: survey data from the PSID and restricted-access data from Swedish administrative registers. The replication package provides all codes used to generate the results and instructions for how to obtain the source PSID data and the restricted-access data from Swedish administrative registers.

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