Multidimensional Equality of Opportunity in the United States*

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Abstract

Are the United States still the land of opportunity? We provide new insights on this question by studying inequality of opportunity for the acquisition of monetary resources over the time period 1983-2014. In contrast to existing literature, we invoke a novel measurement approach that allows us to target the joint distribution of income and wealth. We show increases in inequality of opportunity levels when considering income and wealth jointly. Furthermore, inequality of opportunity has grown over time. This trend becomes particularly apparent when considering the multidimensionality of monetary resources. In sum, our findings suggest that the US have moved further away from a level playing field in recent decades.

JEL: D31, D63, J62

Keywords: Fairness, Intergenerational Mobility, Time Trends, Measurement

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1 INTRODUCTION

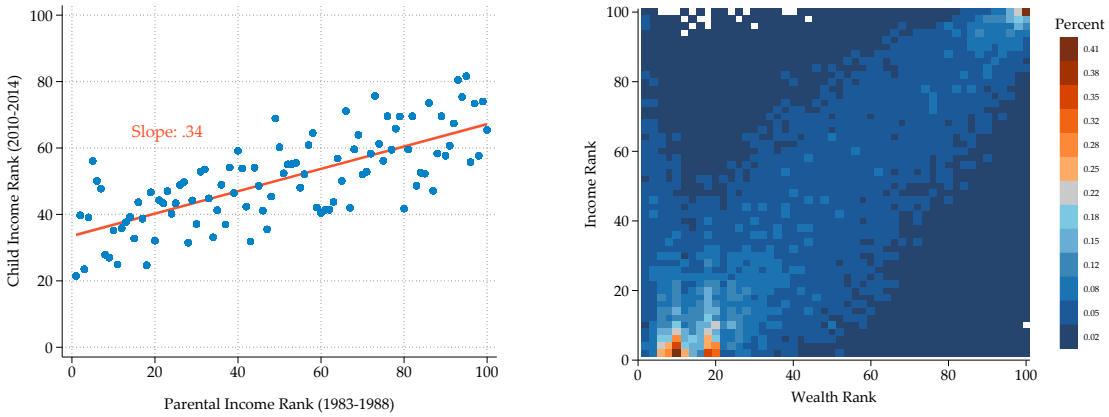
In a fair economy, people act on a level playing field to acquire monetary resources. This idea—oftentimes labeled as *equality of opportunity*—is widely reflected in fairness conceptions of academic philosophers and the general public alike (Alesina et al., 2018; Almås et al., 2020; Arneson, 2018; Cappelen et al., 2007; Cohen, 1989; Fong, 2001; Rawls, 1971; Roemer, 1998). As a consequence, there is an active literature in economics that assesses the satisfaction of the opportunity-egalitarian ideal in different countries at different points in time.[1]

A common feature of these studies is that they focus on income to measure monetary resources. However, this practice provides an incomplete picture of the degree to which monetary resources depend on family background characteristics. On the one hand, well-off parents directly transmit monetary resources to the next generation through bequests and inter vivo gifts (Boserup et al., 2016; Elinder et al., 2018; Wolff, 2002). On the other hand, expected wealth transfers distort the educational and labor supply decisions of children and therefore exert an attenuating effect on income in the next generation (Kindermann et al., 2020; Koeniger and Prat, 2018; Kopczuk, 2013). These empirical patterns have three consequences for analyses of equal opportunities in monetary resources. First, as income and wealth are imperfect correlates, monetary resources are not fully reflected in unidimensional analyses of either income or wealth. Second, an exclusive focus on income understates the association between monetary resources and family background characteristics. Third, both tendencies are particularly relevant for the analysis of time trends as the quantitative importance of inheritances has grown in many Western societies in recent decades (Piketty and Zucman, 2015).

Are these concern relevant to evaluate equal opportunities in the United States? In Figure 1 we use data from the Panel Study of Income Dynamics (PSID) to show that this is the case. In Panel (A), we replicate the well-known finding that child incomes increase with the income of their parents during childhood: an increase of parental income by 10 percentile ranks is associated with an average increase of 3.4 percentile ranks in child income. In Panel (B) a heatmap of income and wealth ranks demonstrates that income and wealth are far from perfect correlates. Taken together, these

[1] For the United States, an extensive literature investigates intergenerational income mobility (among others Chetty et al., 2014a; Davis and Mazumder, 2017; Solon, 1992). Studies aiming at more comprehensive conceptions of inequality of opportunity include Hufe et al. (2018), Niehues and Peichl (2014), and Pistolesi (2009).

FIGURE 1. Intergenerational Income Mobility and the Distribution of Monetary Resources in the United States



(A) Income Transmission

(B) Joint Distribution of Income and Wealth

Data: PSID.
Note: Panel (A) shows a non-parametric binned scatter plot of average child income ranks in the years 2010-2014 by income rank of their parents in the years 1983-1988. All individuals are aged 25-60. Panel (B) shows a heatmap of year-specific income and wealth ranks for the pooled sample of individuals aged 25-60 in the time period 1983-2014. Each data point shows the share of individuals in a fixed two-percentile income (wealth) bin that belong to a particular two-percentile wealth (income) bin. See section 3 for detailed definitions of income and wealth.

patterns suggest that extant studies that focus on income only may miss important information when analyzing the playing field for the acquisition of monetary resources in the US.

In this paper, we address these shortcomings by analyzing the association between family background characteristics and the joint distribution of income and wealth. In particular, we use the PSID to implement a novel measure of multidimensional equality of opportunity developed in Kobus et al. (2020). Our analysis proceeds in two steps. First, we construct an *intergenerational sample* in which we measure equality of opportunity in monetary resources by using parental income rank as the sole proxy variable for socio-economic background characteristics. This practice is consistent with the literature on intergenerational mobility; however, the sparsity of data links across generations prevents meaningful analyses of time trends. Second, we construct an *individual sample* in which we substitute parental income rank by a vector of alternative socio-economic background characteristics. These data are available on an annual basis and allow us to assess equality of opportunity for the acquisition of monetary resources over the period 1983-2014.[2]

[2]Reassuringly, in the *intergenerational sample* both approaches yield virtually identical results.

Our findings can be summarized as follows. First, inequality of opportunity is consistently higher when accounting for the multidimensionality of monetary resources. This finding entails that unidimensional analyses that focus on income only underestimate the extent to which monetary resources are associated with family background characteristics. Second, inequality of opportunity in 2014 is 92% higher than in 1983; hence, the playing field in the US has become more tilted in recent decades. Time trends are markedly different when accounting for the multidimensionality of monetary resources. For example, an exclusive focus on income suggests only moderate declines in equal opportunities in the period 2004-2014. This relative stability, however, is accompanied by strong decreases in the wealth dimension. As a consequence, when accounting for the multidimensionality of monetary resources it is much harder to reject the hypothesis that opportunities for the acquisition of monetary resources have become more unequal in this time period.

The contribution of this paper is twofold. First, we complement recent literature that characterizes the joint distribution of income and wealth in the US (Berman and Milanovic, 2020; Kuhn et al., 2020). This literature focuses on inequalities in outcomes but remains silent on opportunities and intergenerational transmission processes. Second, we extend the literature on equality of opportunity by a multidimensional perspective on monetary resources. In particular, we provide novel insights regarding the development of equality of opportunity in the United States. While existing literature documented relative stability of equality of opportunity after 2000 (Chetty et al., 2014b; Davis and Mazumder, 2017), we show that decreases come to the fore once we account for the wealth dimension.

The remainder of the paper is organized as follows. Section 2 introduces the measurement framework. Section 3 describes the data. Empirical estimates are presented in Section 4. Section 5 concludes the paper.

2 MEASUREMENT

Consider a population $N := \{1, ..., N\}$. Individuals $i \in N$ receive utility from $q \in K$ outcomes that capture monetary resources. Hence, we can summarize the distribution of monetary resources in the economy by a multidimensional vector of outcomes $X := \{x_{1,1}, ..., x_{N,K}\}$ that has population mean X^{μ}. Outcomes are determined by two sets of factors: a set Ω that captures family background characteristics such as parental income ranks, and a set Θ that captures individual choices. We define $\omega_i \in \Omega$ ($\theta_i \in \Theta$)

as a comprehensive description of the family background characteristics (choices) of $i \in N$. The outcome generating function is defined as follows:

$$x_q = f_q(\omega, \theta), \ \forall q \in K. \tag{1}$$

In an equal-opportunity society, outcome differences are determined by individual choices θ but are invariant to family background characteristics ω. There are different ways of translating this idea into measures. Most empirical literature relies on an *ex-ante* approach, which broadly consists of two steps. First, one partitions the population into a set of types $T = \{t_1, ..., t_M\}$ with corresponding type-specific outcome means X_μ. Individuals are member of one type if they share the same set of family background characteristics: $i, j \in t_m \Leftrightarrow \omega_i = \omega_j, \ \forall i, j \in N$. For example, in rank-rank measures of intergenerational mobililty, types are defined by parental income ranks. Second, one summarizes differences in average outcome differences across types by regressing child outcomes on a measure of family background characteristics:

$$x_{iq} = \alpha_q + \beta_q \omega_i + \epsilon_{iq}. \tag{2}$$

In existing literature, there are two prominent ways of summarizing resulting information to obtain measures of inequality of opportunity: i) β_q, which is the standard statistic in the literature on *intergenerational mobility* (Black and Devereux, 2011). ii) $I(\mathbb{E}[x_{iq}|\omega_i])$, where $I()$ is any inequality index. This is the standard statistic in the literature on *equality of opportunity* (Roemer and Trannoy, 2016). Clearly, both measures are isomorphic and capture the opportunity-egalitarian idea: the higher β_q, the more are life outcomes life outcomes x_q predicted by family background characteristics ω_i, and the higher the corresponding measure of inequality of opportunity.

In this paper we follow the tradition of the equality of opportunity literature and summarize outcome differences across types with an inequality index. In particular, we use the measure developed in Kobus et al. (2020) which allows us to account for the multidimensionality of monetary resources.[3] Formally, this measure is given by

$$I(X) = 1 - \left(\sum_{t=1}^{M} \frac{N_t a_t}{\sum_{t=1}^{M} N_t a_t} \frac{U^t[(X_\mu)_1^t]}{U^t[(X^\mu)_1^t]} \right)^{\frac{1}{\sum_{q=1}^{K} r_q}}. \tag{3}$$

[3]See Kobus et al. (2020) for a derivation of the measure from first principles. Note that we use a simplified version of their measure with $\delta_t = 1$, such that $I()$ is insensitive to within-type inequality.

There are three elements that require further explanation for an intuitive understanding of the measure. First, $r_q < 0$ are *dimension weights* that determine aversion to between-type inequalities in outcome dimension q. The lower r_q, the higher the concavity in the second term of equation 3, and the more sensitive is the measure to between-type differences in outcome dimension q. In our empirical application we choose dimension weights $r_{Income} = r_{Wealth} = -0.2$. Second, $a_t < 0$ are type weights that determine how much the social planner values type-specific outcomes. The lower a_t, the higher the weight attached to type t. In our empirical application we choose linear a_t that are inversely related type ranks in monetary resources.[4] Third, U^t represents type-specific utility from obtaining income and wealth, respectively. Utility functions are concave and of the form $U^t = \prod_{q=1}^{K} a_t (X_{iq}^t)^{r_q}$. Note that inequality of opportunity is minimized if there is perfect equality between types, i.e. $X_\mu = X^\mu \Leftrightarrow I(X) = 0$.

This measure has a number of desirable properties including ratio-scale invariance, sensitivity to Pigou-Dalton transfers between types, and sensitivity to transfers that increase correlations across outcome dimensions. Furthermore, it is bounded in the interval $[0, 1)$. Lastly, it has an intuitive interpretation. For example, a value of 0.5 means that society would be willing to sacrifice 50% of its resources in every dimension $q \in K$ if such sacrifice would lead to perfect equality of opportunity.

3 DATA

Data Source. In this paper we aim to assess the extent of equal opportunities in the US while accounting for the multidimensionality of monetary resources and paying attention to changes over time. Therefore, we require data with detailed information on income, wealth, and family background characteristics that are available for a long period of time. In the US, the Panel Study of Income Dynamics (PSID) is the only publicly available data source that satisfies these criteria.

The PSID is the world's longest running household panel survey, tracking a nationally representative sample of US households from 1968 until today. Since its inception, the PSID collects rich information on income and family background characteristics. Since 1984 it also collects data on wealth.[5] In addition, children who leave the parental

[4] In Supplementary Figures S.2 and S.3 we show that our main conclusions are robust to different choices in r_q and a_t, respectively

[5] Until 1999 wealth information was collected every five years. Since then, the wealth questionnaire is a regular part of every PSID wave.

household become independent units in the PSID sampling frame. As a consequence, it is possible to link data across generations. In its most recent waves the PSID comprises more than 9,000 US households.

Information on income is collected for the year predating the survey year. Hence, we use information over the income reference (survey) period 1983-2014 (1984-2015). We now turn to a description of relevant variables.[6]

Monetary Resources. We consider two dimensions of monetary resources: income and wealth. We measure income as annual disposable household income. It comprises total household income from labor, asset flows, windfall gains, private transfers, public transfers, private retirement income and social security pensions net of total household taxes. We scale all household incomes by the modified OECD equivalence scale and express income in 2015 USD.

We measure wealth as household net worth. It comprises the sum of home equity, other real estate, private businesses, vehicles, transaction accounts, corporate equities, annuities/IRAs and other savings net of any debt. This definition closely mirrors the measure of household wealth in the Survey of Consumer Finances (SCF)[7] In analogy to income, we scale household wealth by the modified OECD equivalence scale and express it in 2015 USD.

Family Background Variables and Types. We consider two alternative ways to measure family socio-economic status and to partition the population into types. First, we use parental income. Parental income is measured as the total income of mother and father averaged over the years 1983-1988. We partition the population into 36 types based on corresponding quantiles in the parental income distribution.

Second, we use a vector of alternative socio-economic background variables. This vector includes parental education (3 categories), parental occupation (3 categories), race

[6]Data preparation follows the protocol outlined in Hufe et al. (2018). For example, we re-weight data to match the Current Population Survey and correct for under-reporting in both government benefits and labor income. Furthermore, we follow their coding protocol for income and family background variables. Please see their data appendix for detailed descriptions.

[7]An overview over the SCF definition of net worth is provided here: https://www.federalreserve.gov/econres/files/networth%20flowchart.pdf. For a detailed comparison in wealth definitions between PSID and SCF see Pfeffer et al. (2016).

(2 categories), and region of upbringing (2 categories). We partition the population into 36 types based on the expression of each of these family background variables.

Estimation Samples. We base our estimates on two different samples. First, we construct an *intergenerational sample*. Leveraging the panel dimension of the PSID, we match all respondents to their biological or adoptive parents. In turn, we drop observations with i) missing links between parents and children, ii) missing information on parental income, iii) missing information on individual income and wealth, and iv) missing information on parental education, parental occupation, race and region of upbringing. Lastly, we restrict observations to children aged 25-60 in years 2010-2014 and parents aged 25-60 in years of 1983-1988.[8] As a consequence, we obtain a sample of 3,729 individuals. The *intergenerational sample* allows us to proxy ω with parental income rank which is common practice in the literature on intergenerational mobility. However, the *intergenerational sample* imposes severe restrictions on the analysis of time trends since one requires information on both parental and child outcomes while allowing for a sufficient time span between these observations.

Second, to investigate time trends we construct an *individual sample*. In contrast to the previous sample, we drop requirements i) and ii). Again, we limit the sample to individuals aged between 25-60. As a consequence, we obtain a sample of at least 4,500 observations in every year over the period 1983-2014. The *individual sample* allows us to monitor the development of equality of opportunity in the US over a 30 year period while proxying ω with a vector of self-reported family background characteristics.

4 RESULTS

Our analysis proceeds in two steps. First, we use the *intergenerational sample* to measure equality of opportunity. Thereby, we either use parental income ranks or the vector of socio-economic background variables to proxy for family background characteristics. We will show that both approaches yield virtually identical results. Second, having validated the use of alternative socio-economic background variables, we use the *in-*

[8]Existing literature documents life-cycle bias in intergenerational mobility estimates (Haider and Solon, 2006; Nybom and Stuhler, 2016). Due to heterogeneity in life cycle earnings profiles, estimates obtained when children are young (old) tend to be downward (upward) biased. This bias is typically minimized by measuring income in midlife. In Supplementary Figure S.1 we show that restricting the child generation to narrower age ranges does not systematically affect our estimates.

dividual sample to analyze time trends in equality of opportunity for the acquisition of monetary resources.

Intergenerational Estimates. Figure 2 shows estimates for inequality of opportunity in the *intergenerational sample* for different combinations of outcomes and family background variables.

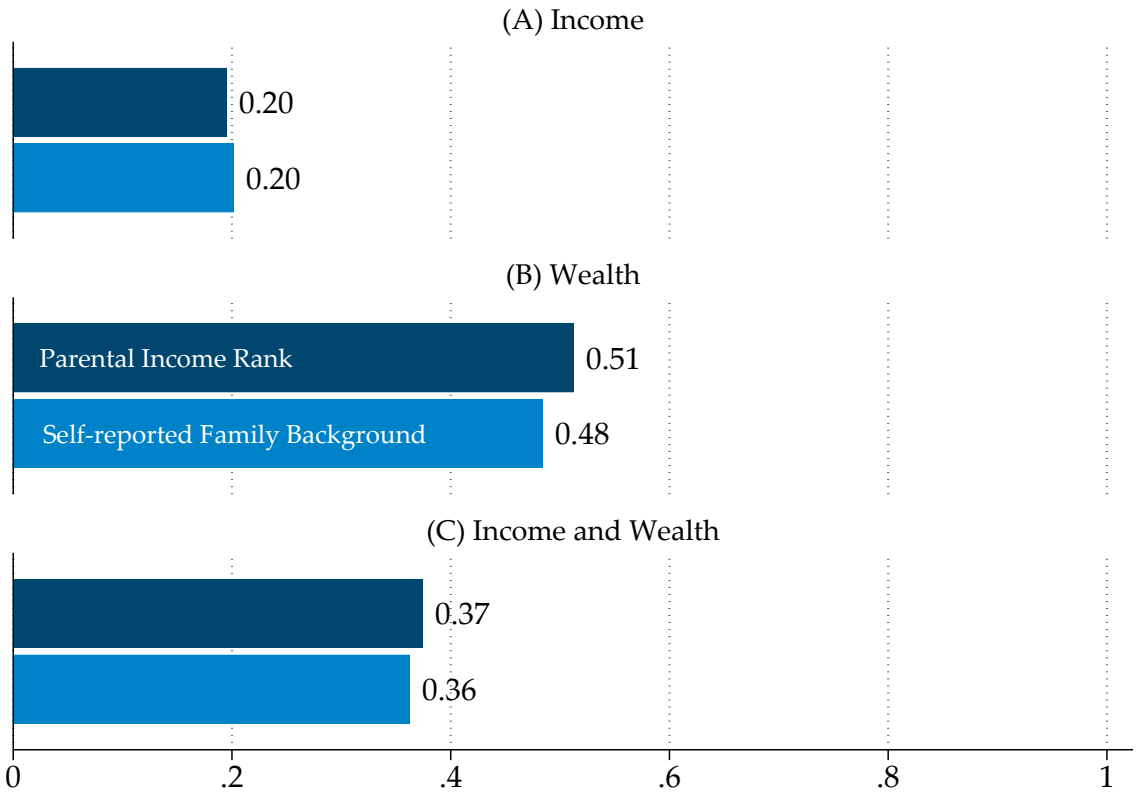
First, we focus on the dark-blue bars that show estimates based on parental income ranks. Therefore, they provide a close analogue to measures of intergenerational mobility. In Panel (a) we measure monetary resources by income only—which is prevalent practice in extant literature. Inequality of opportunity amounts to 0.20, implying that society would be willing to sacrifice 20% of income to achieve perfect equality of opportunity in this dimension. In Panel (b) we measure monetary resources by wealth. As a consequence, inequality of opportunity more than doubles to a level of 0.51. Finally, in Panel (c) we account for the multidimensionality of monetary resources by considering both income and wealth. Inequality of opportunity in monetary resources amounts to 0.37. These results suggest that we tend to underestimate tilt in the playing field when relying on income as the sole proxy for monetary resources.

Second, we focus on a comparison between dark-blue bars and light-blue bars. To estimate the latter, we replace parental income ranks with socio-economic background characteristics. Results are virtually unchanged by this alternation. Hence, we conclude that it is unimportant whether we proxy family background characteristics by parental income ranks or a vector of socio-economic background characteristics. In general, this is an encouraging message since data sets including intergenerational links are much more sparse than data sets including retrospective information on various socio-economic background variables. In the particular case of this paper, it allows us to assess time trends in the statistics of interest.

Time Trend (1983-2014). Figure 3 shows the development of equality of opportunity in the US over the period 1983-2014. The following main patterns emerge. First, in every year accounting for the multidimensionality of monetary resources provides an upward correction in comparison to estimates that focus on income only.

Second, inequality of opportunity increased strongly over time. Starting at a level of 0.24 in 1983, inequality of opportunity has attained a level of 0.46 in the latest period of observation. Hence, whereas the US population was willing to sacrifice 24% of its mon-

FIGURE 2. Equality of Opportunity in the US Intergenerational Sample

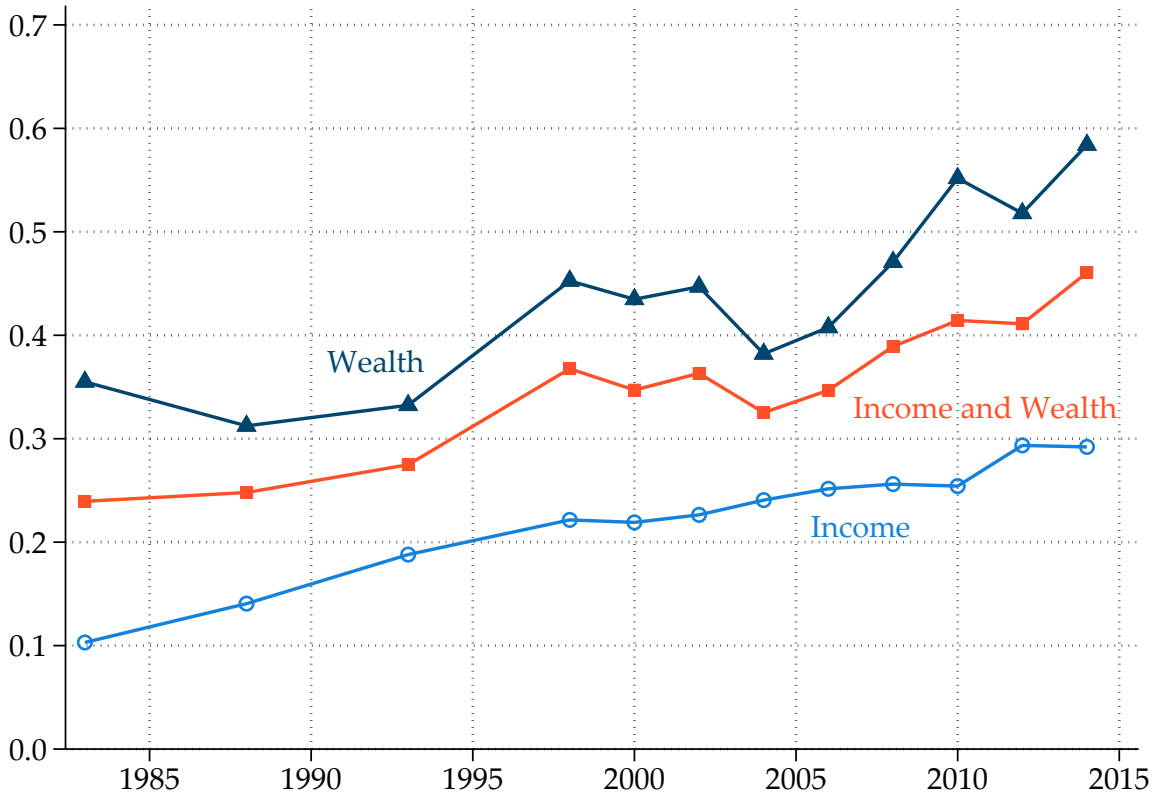


Data: PSID.
Note: This figure shows estimates of inequality of opportunity in the US for the *intergenerational sample*. Panel (A) (Panel [B]) shows results for a unidimensional definition of monetary resources based on income (wealth). Panel (C) shows results for a multidimensional definition of monetary resources based on income and wealth. In each panel, equality of opportunity estimates are based on 36 types according to alternative definitions (Panel [A]: parental income rank, Panel [B]: parental education, parental occupation, race, region of upbringing). Estimates are computed based on equation 3 with dimension weights $r_{Income} = r_{Wealth} = -0.2$

etary resources to achieve a level playing field in 1983, it would be willing to sacrifice 46% of its monetary resources to do so in 2014.

Finally, the general increase is underpinned by oftentimes contradictory inequality of opportunity trends with respect to income and wealth. From 1983-1993, inequality of opportunity in income increased significantly by 82% from 0.10 to 0.19. To the contrary, inequality of opportunity in wealth slightly decreased from from 0.36 to 0.33. The opposite pattern characterizes the time period 2004-2014. While inequality of opportunity in income increased only moderately, inequality of opportunity in wealth rose by 53% from 0.38 to 0.58. Overall, inequality of opportunity for the acquisition of monetary

FIGURE 3. Equality of Opportunity in the US, 1983-2014
Baseline Estimates



Data: PSID.
Note: This figure shows estimates of inequality of opportunity in the US for the *individual sample* over the time period 1983-2014. Equality of opportunity estimates are based on 36 types according to the following socio-economic background characteristics: parental education, parental occupation, race, region of upbringing. Estimates are computed based on equation 3 with dimension weights $r_{Income} = r_{Wealth} = -0.2$.

resources increased by 42% from 0.33 to 0.46. This increase, however, only becomes apparent when accounting for the multidimensionality of monetary resources.[9]

These findings relate to an active debate on the development of equality of opportunity in the United States. This discussion mainly centers on intergenerational mobility estimates that focus on income as a single outcome dimension. In general, evidence from this literature is mixed and points in two different directions. A first set of studies argues that equality of opportunity has generally remained constant over the last decades (Chetty et al., 2014b; Hertz, 2007; Lee and Solon, 2009). A second set of studies

[9]We note that the multidimensional measure is not just a mere weighted average of unidimensional measures. The measure is sensitive to correlation increasing transfers, i.e. even if between-type inequality in income and wealth remain constant, the measure increases (decreases) if correlation in between-type income and wealth distributions increase (decrease).

contests this view and argues that equality of opportunity has decreased in the last two decades of the 20th century and then remained constant in the early 2000s (Aaronson and Mazumder, 2008; Davis and Mazumder, 2017; Hartley et al., 2017). With respect to income our findings are consistent with the second set of works for the late 20th century, and with both sets of works for the early 21st century.[10] Nevertheless, to the extent that these works aim to speak to financial opportunities more generally, both camps may miss important information by focusing on income only. Indeed, our evidence shows that it is much harder to reject claims that opportunities in the US have declined after the year 2000 when accounting for the multidimensionality of monetary resources.

Decomposition. To develop a better understanding for these trends, we conduct a Shapley value decomposition based on Shorrocks (2013), i.e. we decompose the trend in equality of opportunity into the contributions from different family background characteristics: parental education, parental occupation, race, and the region of upbringing. The results of this decomposition are shown in Figure 4.

All four family background variables substantially contribute to the existence of unequal opportunities in the US. However, the increase in inequality of opportunity over time is mainly driven by parental education and occupation. 59% of the overall increase in inequality of opportunity can be explained by these components. Furthermore, as these components are the strongest proxy variables for parental income rank.[11] This finding further supports our assumption that time trends would look similar if we had an *intergenerational sample* spanning the entire period of analysis.

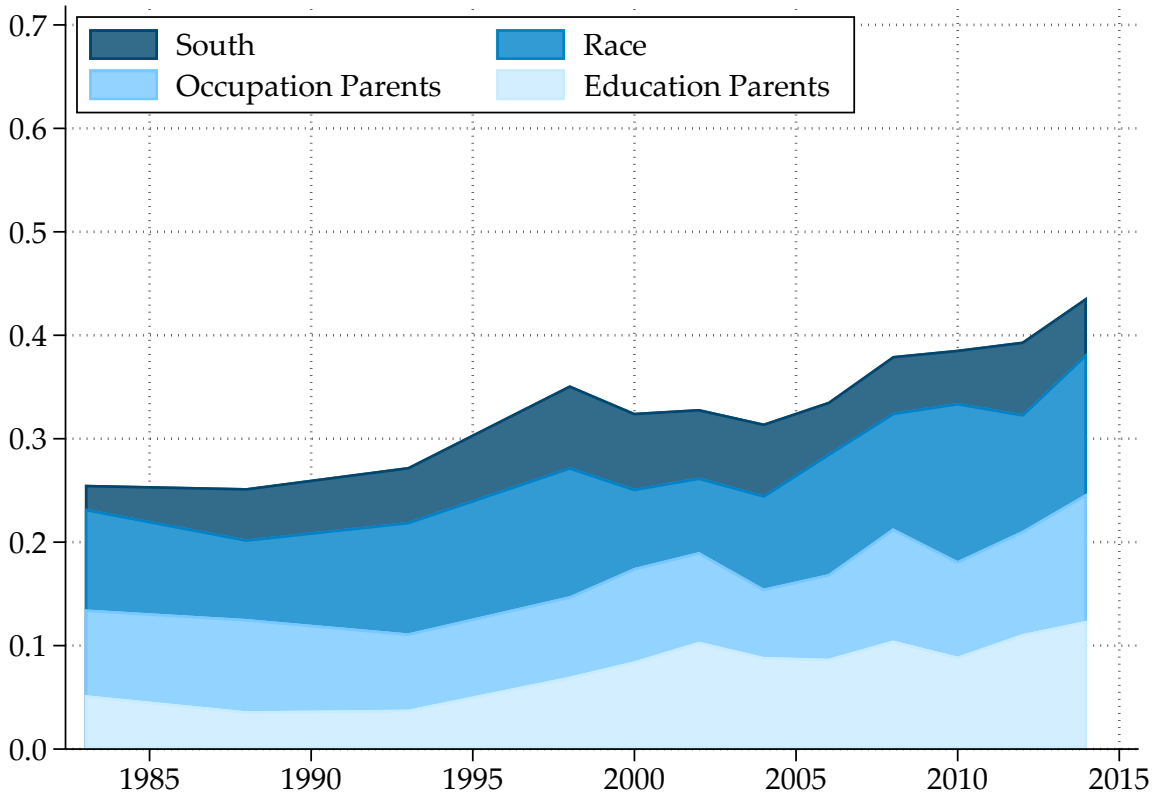
Robustness Analysis. In Figure 5, we document the robustness of our main conclusions to different estimation choices.

First, in Panel (A) we recompute inequality of opportunity for different ways of dealing with non-positive income and wealth. For our baseline estimates, we drop observations with negative income/wealth and set observations with zero income/wealth to 1 USD, respectively. Alternatively, we i) drop all observations with negative and zero

[10] We observe a more pronounced increase in 2013-2015, a time period that is not covered in existing studies (e.g. Aaronson and Mazumder, 2008; Chetty et al., 2014b; Davis and Mazumder, 2017). This increase, however, is not very robust to alternative specifications—see Panel [A] and [B] of Figure 5.

[11] In Supplementary Table S.1 we run a horse-race regression of income ranks on these variables. We find that parental education and parental occupation are indeed the strongest predictors of parental income rank.

FIGURE 4. Equality of Opportunity in the US, 1983-2014
Shapley Value Decomposition

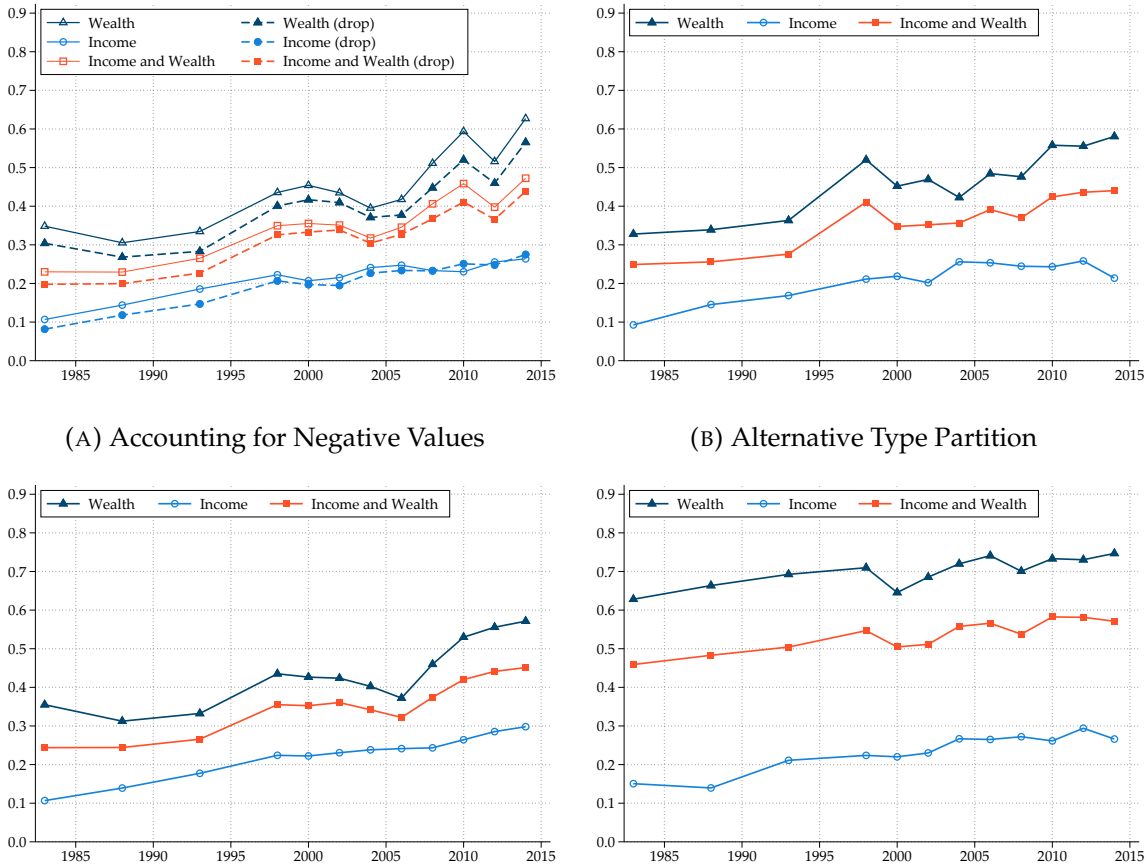


Data: PSID.
Note: This figure shows a decomposition of inequality of opportunity in the US for the *individual sample* over the time period 1983-2014. Equality of opportunity estimates are based on 36 types according to the following socio-economic background characteristics: parental education, parental occupation, race, region of upbringing. Estimates are computed based on equation 3 with dimension weights $r_{Income} = r_{Wealth} = -0.2$. The decomposition is based on the Shapley value procedure proposed in Shorrocks (2013).

income/wealth, or ii) retain all observations with negative and zero income/wealth in the sample. In spite of slight level changes, time trends are very similar regardless of alternations in these specification choices.

Second, in Panel (B) we recompute inequality of opportunity for different partitions into types. To this end, we code three additional variables and add them to the vector of family background characteristics: the number of siblings (11 categories), a dummy indicating whether at least one parent is foreign born and a dummy indicating if the respondent grew up with both of his parents. In turn, we follow Brunori et al. (2021) and let a regression tree algorithm decide on the optimal type partition. We re-estimate the optimal type partition in each year of our analysis. Again, time trends are very similar

FIGURE 5. Equality of Opportunity in the US, 1983-2014
Robustness Analysis



(A) Accounting for Negative Values

(B) Alternative Type Partition

(C) 5-Year Averages

(D) Labor Income and Inherited Wealth

Data: PSID.
Note: This figure shows the sensitivity of inequality of opportunity in the US for the *individual sample* over the time period 1983-2014. In Panel (A) we keep zero income and wealth without adjustment (solid line) or drop individuals with zero income or wealth (dashed line). In Panels (B) we let a regression tree determine the underlying type partition. In Panel (C), we take a 5-year moving average of income and wealth. Panel (D) displays our estimates for the sub-components of labor income and inherited wealth. Estimates are computed based on equation 3 with dimension weights $r_{Income} = r_{Wealth} = -0.2$.

to our baseline estimates suggesting that our conclusions are robust to alternations in type partitions.

Third, in Panel (C) we recompute inequality of opportunity while smoothing transitory changes in income and wealth. In particular, we replace annual values of income and wealth with their 5-year averages. As a consequence, outcome variables provide better proxies for the long-term income and wealth potential of individuals (Solon, 1992). However, time trends are again very close to our baseline estimates and do not overturn our main conclusions.

Fourth, in Panel (D) we recompute inequality of opportunity using alternative definitions of income and wealth. One may argue that our baseline specification creates a mechanical relationship between income and wealth since wealth enters household income through capital returns. Reversely, savings from household income may increase wealth in a given time period. To divorce both concepts, we replace total household income and total household wealth with labor income and inheritance wealth, respectively. The trend in inherited wealth is less pronounced than in total household wealth. This result is driven by very high initial levels of inequality of opportunity in inherited wealth that raise the bar for further marginal increases in our measure. As a consequence, the overall increase in inequality of opportunity for the acquisition of monetary resources is more moderate than in our baseline estimates. We nevertheless detect an increase of 24% over the time period 1983-2014.

We conclude: while the level of inequality of opportunity and the magnitude of its increase vary with different measurement choices, all main conclusions from our baseline estimates remain in place.

5 CONCLUSION

In this paper we study inequality of opportunity for the acquisition of monetary resources in the US over the time period 1983-2014. In contrast to existing work, we account for the multidimensionality of monetary resources by targeting the joint distribution of income and wealth. This extension provides important new insights about the economic playing field in the US: first, we document a more unequal distribution of opportunities when complementing income with the wealth dimension. Second, there are strong and consistent increases in inequality of opportunity over time. This trend is driven by both income and wealth to varying extents depending on the time period.

We look forward to future research that extends the multidimensional approach taken in this paper beyond the domain of material resources by focusing on other dimensions of individual well-being including health and social participation.

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Equality of Opportunity in the United States: A Multidimensional Approach

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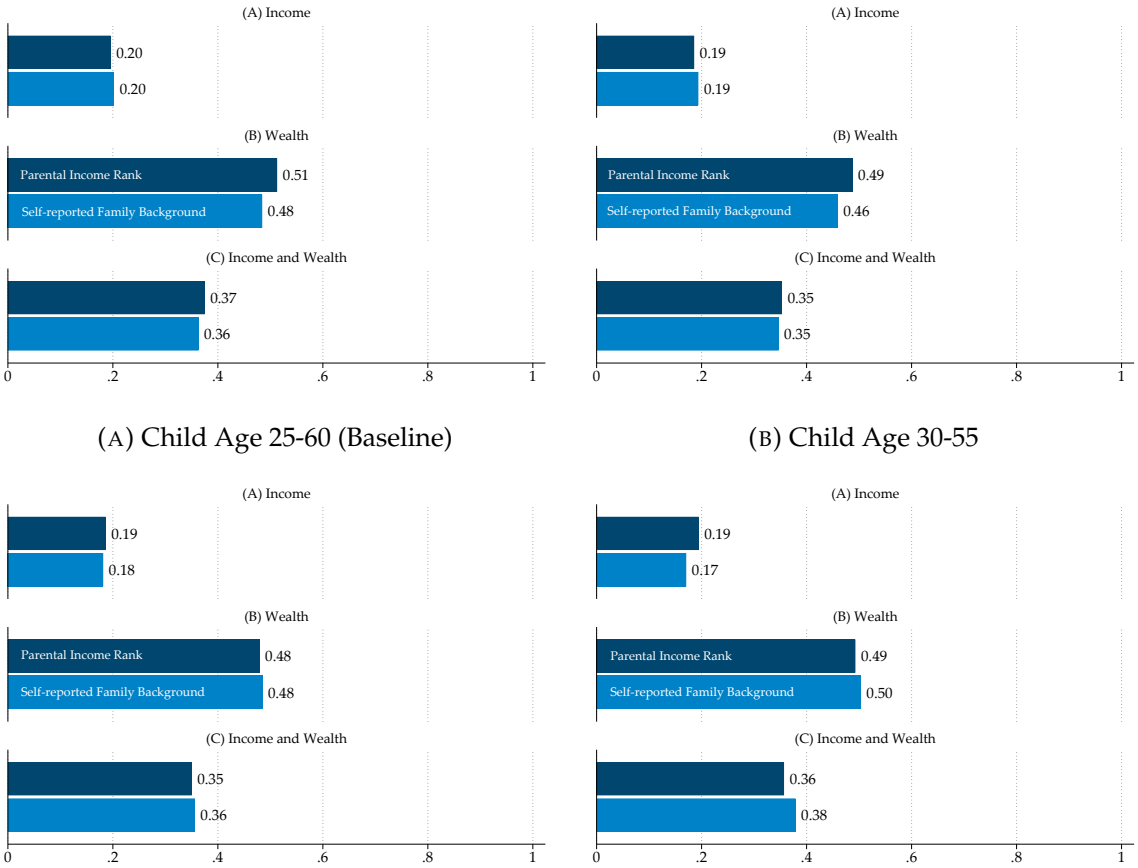
Supplementary Material
September 3, 2021

A ADDITIONAL FIGURES AND TABLES

FIGURE S.1. Equality of Opportunity in the US
Varying Age Restrictions



(A) Child Age 25-60 (Baseline)

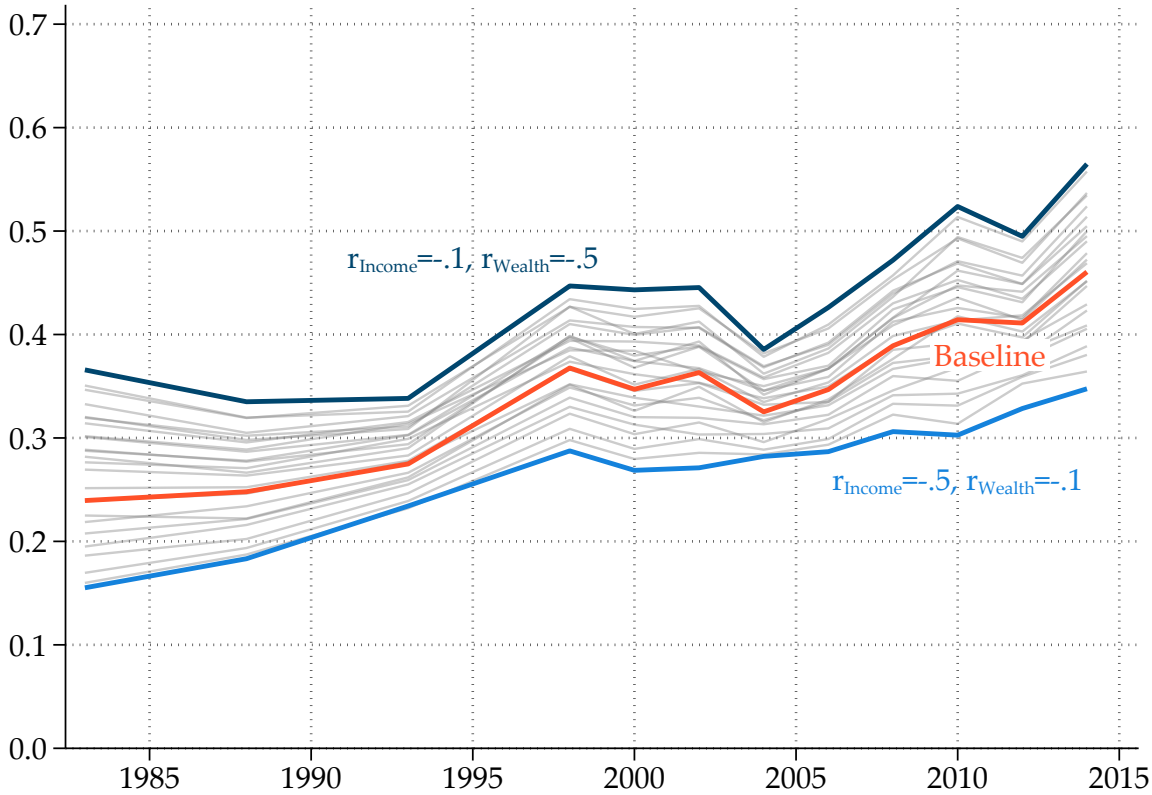
(B) Child Age 30-55

(C) Child Age 35-50

(D) Child Age 40-45

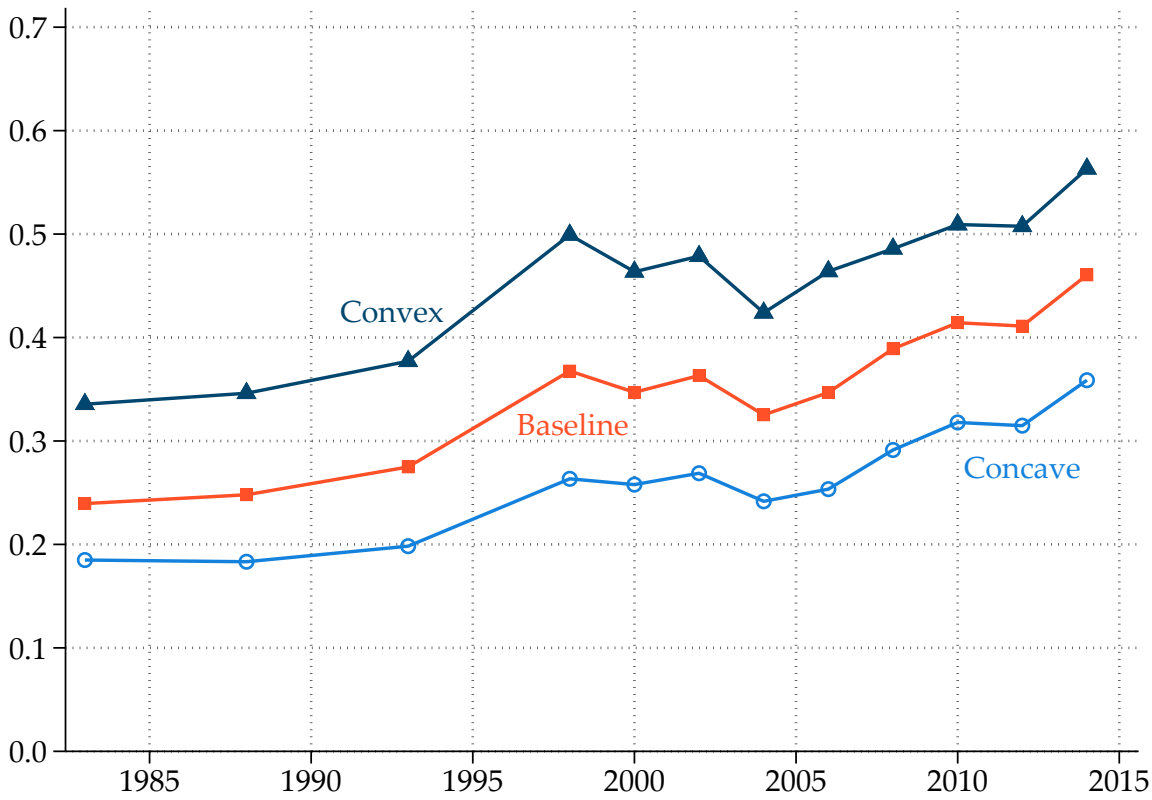
Data: PSID.
Note: This figure shows the sensitivity of inequality of opportunity in the US to different sample restrictions regarding the age of children. Panel (A) replicates our baseline estimates from Figure 2. In Panels (B)-(D) we sequentially narrow the age restriction to 30-55, 35-50, and 40-45. All estimates are computed based on equation 3 with dimension weights $r_{Income} = r_{Wealth} = -0.2$.

FIGURE S.2. Equality of Opportunity in the US, 1983–2014
Varying Degree of Inequality Aversion



Data: PSID.
Note: This figure shows the sensitivity of inequality of opportunity in the US to alternations in r_q. We display are all pairwise combinations of $r_{Income} \in (-0.1, -0.2, -0.3, -0.4, -0.5)$ and $r_{Wealth} \in (-0.1, -0.2, -0.3, -0.4, -0.5)$. In orange we replicate our baseline estimates from Figure 3. Highest estimates of inequality of opportunity are obtained for $r_{Income} = -0.1$ and $r_{Wealth} = -0.5$, where we place much weight on the less equally distributed wealth dimension, and little weight on the income distribution (dark blue line). Conversely, lowest estimates of inequality of opportunity are obtained for $r_{Income} = -0.5$ and $r_{Wealth} = -0.1$, where we place little weight on the less equally distributed wealth dimension, and much weight on the income dimension (light blue line).

FIGURE S.3. Equality of Opportunity in the US, 1983–2014
Varying Type Weights



Data: PSID.
Note: This figure shows the sensitivity of inequality of opportunity in the US to alternations in a_t. The central line replicates our baseline estimates from Figure 3 where we use linear a_t. We construct convex (concave) weights as a_t^2 ($a_t^{0.5}$). Convex (concave) weights place relatively more (less) weight on low types, and we therefore detect higher (lower) levels of inequality of opportunity. All estimates are computed based on equation 3 with dimension weights $r_{Income} = r_{Wealth} = -0.2$.

TABLE S.1. Predicting the Parental Income Rank

	Parental Income Rank
Parental Education	8.625
	(0.468)
Parental Occupation	7.363
	(0.458)
Race	6.009
	(0.589)
Region of Upbringing	-1.884
	(0.451)
N	3729
R^2	0.257

Data: PSID.
Note: This table reports coefficient estimates with standard errors in parentheses from a regression of parental income rank on the standardized family background characteristics parental education (3 categories), parental occupation (3 categories), race (2 categories) and region of upbringing (2 categories). Due to the standardization of the right hand side variables, each coefficient gives the absolute change in parental income rank for a one standard deviation increase in the right hand side variable and the coefficient magnitudes can be directly compared.