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# Polarization of opportunity

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Keywords: Inequality Opportunity Polarization United States	We introduce the concept of polarization of opportunities (POp) to explore how various circumstances shape unfair inequalities. While conventional measures of inequality of opportunity (IOp) focus on outcome disparities linked to factors such as race or gender, they do not account for how these circumstances group individuals into relatively uniform clusters. POp fills this gap by examining both the influence of circumstances and their role in clustering individuals into distinct poles. Using U.S. data, our analysis shows that while income polarization and IOp have risen over time, POp has decreased.

## 1. Introduction

Imagine two similar worlds where individuals' achievements are partly determined by ascriptive characteristics and partly by individual choices. In the first world, there is one primary ascriptive factor - gender - that largely determines success or failure in life. In the second world, gender is just one of many factors - including ethnicity or parental background - that interact in complex ways to shape life opportunities. Assuming that the contribution of exogenous factors is the same in both worlds, determining which is preferable is not straightforward, because each presents unique challenges and distinct policy implications. In the first world, gender polarizes the distribution of income creating two well-defined groups, one for men and another for women. Here, knowing gender suffices to predict individuals' outcomes accurately. In the second world, the interconnection among different characteristics prevents individuals from segregating into clearly identified groups. This has significant social implications: while compensation policies for disadvantaged groups are easier to implement in the first world, a heightened awareness of unfair inequalities could lead to social unrest.

In this paper, we introduce the concept of *polarization of opportunities* (POp) to address the differences between these two worlds. We begin with the concept of *ex-ante inequality of opportunity* (IOp), according to which unfair inequality is inequality in the expected outcomes of

individuals who share the same set of circumstances, such as race, gender, and socioeconomic background (Roemer and Trannoy, 2016). We argue that these measures are not able to distinguish between the two scenarios presented above. POp, instead, analyzes not only the contribution of circumstances to individuals' outcomes, but also the extent to which these exogenous factors cluster individuals into homogeneous groups.

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In a more opportunity-polarized society, groups with different access to opportunity sets are easily identified, potentially creating a sense of injustice and leading to social tension and conflict. Conversely, lower polarization levels can obscure the mechanisms causing unfair inequalities, making it harder for policymakers to target less advantaged individuals. We acknowledge this tension, but in this paper we do not favor any particular normative interpretation of opportunity polarization.<sup>1</sup>

## 2. Inequality of opportunity and polarization of opportunity

Following van de Gaer (1993) consider a variable of individual success (e.g. income),  $y \in \mathbb{R}$ , as a function of two kinds of variables *only*: circumstance variables and effort variables:

$$\mathbf{y} = \mathbf{g}(C, \ \mathbf{e}) \tag{1}$$

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<sup>&</sup>lt;sup>1</sup> Moreover, we recognize that measuring polarization opportunity and social stratification solely by examining the extent to which observable ascriptive characteristics predict future income is inherently limited, as social inequalities and the boundaries between social classes are shaped by complex interactions among many factors that go beyond expected income (Bourdieu, 1984).

where circumstances  $C \in \Gamma$ , effort  $e \in E$  and  $g : \Gamma \times E \rightarrow \mathbb{R}$ .  $C \in \Gamma$  are factors the society do not hold individuals responsible, like gender, ethnicity or parental occupation. Effort variables are instead variables considered to be within individuals' sphere of responsibility. The exante principle of equality of opportunity argues that inequalities due to different circumstances should be eliminated (conceptually) prior to the realization of effort, by equalizing the value of the opportunity sets. This value is generally assumed to be the expected outcome (Roemer and Trannoy, 2016). Thus, the ex-ante approach associates perfect equality of opportunity with the condition:

$$E(\mathbf{y}|C_i) = E(\mathbf{y}|C_k), \ \forall \ C_i, \ C_k \in \Gamma$$
(2)

This condition can be analysed following the framework introduced by John Roemer, which divides the population into distinct, nonoverlapping groups or "types". In this context, IOp is between-type inequality and POp could be measured using a discrete polarization measure, such as the Esteban-Ray (ER, Esteban and Ray, 1994) index, aligning with the idea of social stratification, where society is seen as divided into meaningful social groups. Alternatively, a second approach, common in the IOp literature, rejects fixed group divisions and treats Roemerian types as theoretical constructs difficult to define and identify empirically. This approach focuses on predicting outcomes based on observable circumstances outside individual's control, using regression models or more advanced methods like random forests. Under this approach, POp can only be estimated applying a continuous polarization measure to the distribution of predicted outcomes such as the Duclos-Esteban-Ray index (DER, Duclos et al., 2004).

Although both approaches are possible, we lean towards the second one because we believe that comparing polarization across different group structures can yield misleading results. Discrete polarization measures, such as the ER index, are very sensitive to the number and relative sizes of groups.<sup>2</sup>

To formalize the empirical implementation of the second approach we follow Ferreira and Guignoux (2011) and run a parametric regression model of the outcome against the vector of circumstances, such that  $y_i = \alpha + \beta C_i + \varepsilon_i$ . After assigning each observation with the average realization of the outcome ( $\hat{y}_i = \hat{\alpha} + \hat{\beta} C_i$ ), POp is estimated by applying a suitable polarization measure to the vector of predicted incomes,  $P(\hat{y})$ . We propose using the DER measure which, for a continuous non-negative variable *Y* with distribution f(y), as:

$$P_{\alpha}(f) = \int \int f(\mathbf{y})^{1+\alpha} f(\mathbf{x}) |\mathbf{y} - \mathbf{x}| d\mathbf{y} d\mathbf{x}$$
(3)

where  $\alpha \in [0.25, 1]$ . While Eq. (3) quantifies absolute polarization, it can be transformed into a relative measure by multiplying it by  $\mu^{\alpha-1}$ , where  $\mu$  represents the outcome per capita.

This measure is grounded on the alienation–identification framework. Alienation arises when individuals feel disconnected or excluded from those in different income strata. This is represented by the term |y - x|, which measures the absolute distance between two incomes. Larger distances contribute more significantly to the polarization measure, reflecting greater alienation between groups. On the other hand, identification intensifies as individuals within a group become more similar in their predicted outcomes. This effect is represented by the term f $(y)^{1+\alpha}$ . The power  $1+\alpha$  emphasizes clustering in regions of higher density, with  $\alpha$  acting as a polarization aversion parameter. As this parameter increases, the measure weights more high-density regions, strengthening the identification effect and further distinguishing polarization from inequality. When  $\alpha = 0$ , there is no additional weight on clustering and the measure reduces to the absolute Gini index. As discussed by Ferreira and Gignoux (2011), inequality of opportunity (IOp) mechanically weakly increases when the model specification is enriched with additional regressors. This is not the case for POp where the relative importance of the clustering component can counterbalance the tendency of the index to inflate as the model becomes more saturated in-sample and inequality in the distribution of predicted incomes rises.

### 3. Application to the USA

We now turn to illustrate how POp captures a concept distinct from both IOp and income polarization. We use the Panel Study of Income Dynamics (PSID) as repeated cross-sectional data to measure IOp and POp in the US between 1970 and 2014.<sup>3</sup> As the outcome variable, we use household disposable income. As circumstances, we consider ethnicity (6 categories), parental education (9 categories), parental occupation (3 categories), birth area (6 categories) and sex at birth (2 categories).<sup>4</sup> For each wave, we measure ex-ante IOp and POp using the OLS-based parametric approach described in Section 2.

Fig. 1 shows the evolution of IOp, polarization and POp in the US over a 35-year period.<sup>5</sup> IOp is obtained by applying the Gini index to individuals' predicted incomes (purple line).<sup>6</sup> We measure the evolution of polarization and POp by applying the DER index, setting  $\alpha = 1$ , applied to disposable household income (green line) and to income predictions (red line). To simplify the exposition of results, all estimates are normalized according to their value in 1970. These three trends do not move in parallel. IOp declined during the 1970s but then increased steadily until 2006. Polarization shows a notable rise over the period analized, peaking around mid-2000s before starting to decline. On the contrary, POp declined over time, particularly after 1982, and stabilized around the 2000s. As a result, while both IOp and polarization increased by about 20 % from 1970 to 2014, POp decreased by approximately 10 %.

What does explain the decline of POp despite the rising of IOp and the polarization of income? Fig. 2 presents the predicted income distribution in the US for 1970 and 2014.<sup>7</sup> This figure illustrates a rising dispersion of the predicted income distribution conditional on the set of circumstances. This aligns with the observed rise in IOp and polarization levels. However, the two poles observed in 1970 became less prominent in 2014, offsetting the impact of the increased dispersion and ultimately leading to a decrease in overall polarization.

In the 1970s, the level of inequality of opportunity (IOp) was lower, but fewer combinations of circumstances strongly predicted individual incomes. Nearly all individuals at the first pole, centered around \$17,000, were black women born in the southern United States. The second pole, though slightly more diverse in terms of circumstances, primarily consisted of white individuals (both men and women) whose parents had at least a secondary education. In 2014, the only clear pattern we identified is centered around the third pole, observed at approximately \$45,000, which predominantly includes white individuals with highly educated fathers. In recent years, circumstances

 $<sup>^2</sup>$  We demonstrate this sensitivity in our empirical application and provide detailed information in Online Appendix B.

<sup>&</sup>lt;sup>3</sup> Panel Study of Income Dynamics is a public use dataset produced and distributed by the Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI (2024).

<sup>&</sup>lt;sup>4</sup> Main descriptives are available upon request. The original data comes from the Global Estimates of Opportunity and Mobility Database (GEOM, 2024), Version 1 (https://geom.ecineq.org).

<sup>&</sup>lt;sup>5</sup> These estimates are based on 100 bagged subsamples constructed to account for sample size differences (we set the minimum sample size across all waves, in 1970 with 4,112 observations) and circumstance composition in each wave. We have repeated the exercise seven times, eliminating one circumstance each time, and our main results remain consistent. Results from this exercise are available upon request.

<sup>&</sup>lt;sup>6</sup> Results based on the mean logarithmic deviation are available in Table 1 in Appendix.

<sup>&</sup>lt;sup>7</sup> The densities have been estimated using a gaussian kernel estimator with the optimal bandwidth defined by Silverman (1986).



**Fig. 1.** Evolution of inequality and polarization of opportunity in the US. 1970 - 2014. Note: Own elaboration using PSID data (1970–2014). All values normalized to 1970 = 1. Pol.(1) is the polarization index DER estimated on incomes described in Eq. (3). POp(1) is the same polarization index applied to the distribution of predicted income. IOp is the level of inequality of opportunity obtained as described in Section 2 and measured in Gini points. Specific values are available in Table A1 in the Appendix B.



Fig. 2. Conditional income distribution in the US. Note: Own elaboration using PSID data (1970, 2014). Monetary values in USD 2017. Predictions are obtained by estimating an OLS regression as detailed in Section 2.

beyond an individual's control interact in more complex ways, making IOp less visible and potentially more difficult to address. This was to a large extent due to changes in the marginal distribution of circumstances. For instance, in 1970 around 13 % of black individuals had a father with secondary or tertiary education, a share that ascended to 55 % from 2010 onwards.

Interestingly, today's adults' circumstances are largely shaped by their parents' past outcomes, reflecting a reduction in polarization across generations. Specifically, this highlights the transition from the parents of adults in the 1970s (mostly born before WWII) to the parents of adults in the 2000s (born between the 1950s and 1960s)—a period when inequality in the U.S. was at its lowest.

### 4. Conclusion

A society can exhibit polarization even when inequality is relatively low, particularly if individual incomes cluster around a few distinct and densely populated poles. Traditional measures of inequality of opportunity (IOp), however, fail to capture how circumstances group individuals into relatively homogeneous clusters based on their opportunity sets. This limitation can be addressed through the concept of polarization of opportunity (POp), which we introduce in this paper. Using U.S. data, our analysis reveals that POp can decline even as income polarization and IOp rise. In 1970, a few key characteristics - such as sex at birth, ethnicity, and birthplace - interacted in ways that strongly predicted more or less favorable outcomes, resulting in a distribution with two well-defined poles. In more recent years, however, a combination of changes in the distribution of circumstances - such as a higher share of educated parents employed in higher occupations - and more complex interactions among these circumstances have reduced polarization of opportunity, making the identification of distinct poles less apparent.

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### Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.econlet.2025.112386.

## Appendix A: Table A1 results

	Юр		POp				Polarization			
Year	Gini	MLD	a=0.25	<i>α</i> =0.50	a =0.75	$\alpha = 1$	a =0.25	<i>α</i> =0.50	<i>α</i> =0.75	$\alpha = 1$
1970	0.1557	0.0397	0.125	0.137	0.154	0.175	0.263	0.232	0.210	0.192
1972	0.1541	0.0393	0.124	0.137	0.154	0.177	0.265	0.234	0.210	0.192
1974	0.1362	0.0295	0.116	0.128	0.145	0.165	0.263	0.234	0.212	0.195
1976	0.1374	0.0302	0.115	0.129	0.147	0.170	0.256	0.227	0.205	0.188
1978	0.1335	0.0288	0.112	0.126	0.145	0.168	0.257	0.229	0.209	0.192
1980	0.1377	0.0306	0.115	0.129	0.147	0.171	0.290	0.259	0.236	0.219
1982	0.1507	0.0375	0.121	0.136	0.155	0.181	0.275	0.242	0.217	0.198
1984	0.1645	0.0441	0.132	0.143	0.157	0.176	0.299	0.264	0.238	0.217
1986	0.1684	0.0465	0.136	0.146	0.159	0.177	0.296	0.260	0.233	0.212
1988	0.1734	0.0485	0.141	0.148	0.158	0.170	0.337	0.300	0.273	0.252
1990	0.1793	0.0526	0.144	0.149	0.158	0.170	0.314	0.276	0.248	0.226
1992	0.1787	0.0520	0.145	0.149	0.156	0.164	0.322	0.283	0.253	0.231
1994	0.1836	0.0552	0.148	0.152	0.159	0.169	0.323	0.282	0.252	0.228
1996	0.1782	0.0542	0.153	0.155	0.159	0.166	0.315	0.276	0.250	0.236
1998	0.1902	0.0612	0.163	0.161	0.160	0.161	0.335	0.293	0.262	0.239
2000	0.1709	0.0475	0.154	0.155	0.157	0.161	0.327	0.286	0.256	0.233
2002	0.1778	0.0520	0.158	0.157	0.159	0.161	0.338	0.297	0.267	0.243
2004	0.1871	0.0555	0.162	0.159	0.159	0.159	0.345	0.301	0.268	0.242
2006	0.2087	0.0702	0.172	0.166	0.162	0.159	0.365	0.318	0.286	0.262
2008	0.1814	0.0520	0.154	0.154	0.156	0.160	0.340	0.296	0.263	0.236
2010	0.1917	0.0581	0.163	0.160	0.159	0.160	0.338	0.293	0.259	0.233
2012	0.1876	0.0550	0.163	0.161	0.161	0.162	0.339	0.293	0.259	0.234
2014	0.1871	0.0548	0.161	0.159	0.159	0.160	0.333	0.286	0.252	0.225

Note: IOp is inequality of opportunity estimated ad described in Section 2. POp and Polarization are obtained applying the DER index in Eq. (3) to the distribution of predicted incomes and income respectively.  $\alpha$  is the relative weight given to the clustering component of DER. Own elaboration using PSID data (1970–2014).

#### Data availability

The authors do not have permission to share data.

### References

- Bourdieu, P., 1984. Distinction: A Social Critique of the Judgement of Taste. Harvard University Press, Cambridge, MA.
- Duclos, J.Y., Esteban, J., Ray, D., 2004. Polarization: concepts, measurement, estimation. Econometrica 72, 1737–1772.

Esteban, J.M., Ray, D., 1994. On the measurement of polarization. Econometrica 62, 819–851.

- Ferreira, F., Gignoux, J., 2011. The measurement of inequality of opportunity: theory and an application to Latin America. Rev. Income Wealth 57, 622–657.
- GEOM (2024) "Global estimates of opportunity and mobility", London School of Economics and Political Science and University of Bari, Version 1, released on June 6th 2024.
- Roemer, J., Trannoy, A., 2016. Equality of opportunity: theory and measurement. J. Econ. Lit. 54 (4), 1288–1332.
- Silverman, B.W., 1986. Density Estimation. Chapman and Hall, London.
- van de Gaer, D., 1993. Equality of opportunity and investment in Human capital. Katholieke Universiteit Leuven: Belgium. Ph.D. diss.