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'THEY NEVER HAD A CHANCE': UNEQUAL OPPORTUNITIES AND FAIR REDISTRIBUTIONS*

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A meritocratic fairness ideal typically asserts that income inequality is justifiable if it arises from differences in performance rather than mere luck. In this study, we present experimental evidence that reveals how merit judgements are influenced by *the sources* of performance differentials, while holding fixed the underlying impact on incentives to perform. Drawing inspiration from real-world factors that create inequality, we investigate unequal opportunities in education and employment that impact performance. Contrary to some earlier findings suggesting that merit judgements are unaffected by unequal circumstances, our study demonstrates that individuals' redistributive behaviour is responsive to both the nature and extent of these unequal opportunities. This research thus provides fresh insights into the nuanced factors that motivate people to endorse income redistribution.

> The worker said to himself: 'Here I am, a workman. Why am I a workman? Am I fit for nothing else? Of course not. Had I had a proper chance I would have shown the world. A doctor? A brewer? A minister? I could have done anything. I never had a chance. And so I am a worker. But don't think that at bottom I am any worse than anyone else. I'm better.'
>
> (Michael Young, *The Rise of Meritocracy, 1870–2033*, 1958, p. 106)[1]

Inequality has attracted immense concern among both scholars (Piketty and Saez, 2014) and the general public. The top 1% of the world's population owns nearly half of all the world's wealth, while the bottom half of the population only accounts altogether for less than 1% of total wealth (Shorrocks *et al.*, 2021), a striking statistic that has led to widespread outrage. On a practical level, people are concerned about the underlying sources of inequality, that is, whether or not inequality is the result of fair origins (Starmans *et al.*, 2017). Although views on what is considered fair can differ among individuals, many ordinary citizens as well as political leaders

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[1] In his book *The Rise of the Meritocracy, 1870–2033*, Young (1958) coined the term 'meritocracy'. In this dystopian political fiction, he explored the potential pitfalls of a society that relies primarily on meritocracy.

endorse a meritocratic view of fairness.[2] In this view, instead of luck, heritage or other factors beyond their control, individuals should be rewarded based on their merit, that is, factors deemed as deserving such as individuals' own efforts or choices, ideally under an environment with a level playing field (Konow, 2000; Cappelen *et al.*, 2007; see also the review by Cappelen *et al.*, 2020).

In practice, however, the presence of unequal opportunities posits a challenge to making meritocratic judgements. Unequal opportunities often have the feature that some aspects of the situation faced by individuals are identical, while other aspects, potentially arising at different points in time, are unequal and determined by factors beyond an individual's own control. To the extent that unequal opportunities blur the boundary between luck and merit, what then constitutes a reasonable meritocratic judgement in situations with unequal opportunities? The objective of this paper is to uncover people's fairness views and redistribution preferences in such situations. In our study, inspired by real-world observations, we introduce a novel experimental design to investigate two distinct forms of unequal opportunity.

The first form of unequal opportunity we consider is motivated by inequality in educational opportunities, reflecting the *ex ante investment* that individuals receive in human capital accumulation and training. While most people believe that a good education is the key component to climbing the social ladder, educational quality, measured either by school features or effective parental investments, is often substantially unequal.[3,4] For example, children born into more uniformly affluent residential neighbourhoods receive the benefit of higher-quality local public schooling, while those in poorer neighbourhoods have to try their best to learn with limited classroom resources. Students from advantaged socio-economic backgrounds are also more able to seek their parents' advice or financial help in their educational pursuits, while students from less advantaged backgrounds may not have any household member who can provide such assistance. If merit is measured by exam performance or productivity at work, a key input into the performance result is largely unaccounted for, which is the opportunity an individual was provided with to actually generate that performance.

The second form of unequal opportunity examined in our study is reminiscent of inequality in employment opportunities. This represents the disparities present *at the time* of performance evaluation, when individuals may face differential opportunities to demonstrate their willingness to work hard and their ability to perform well. Examples of this source of inequality abound in labour market discrimination based on factors such as gender, race, ethnicity, age and sexual orientation (see the review by Bertrand and Duflo, 2017). Another example involves unequal and unexpected macroeconomic conditions or shocks. Perhaps through no fault of their own, a

[2] That meritocracy and equal opportunity are core American values is reflected in political discourse. For example, in President Barack Obama's inauguration speech, he asserted, 'We are true to our creed when a little girl born into the bleakest poverty knows that she has the same chance to succeed as anybody else . . . '. A similar idea was also reflected in the inauguration speech of President George W. Bush, in which he said, 'The ambitions of some Americans are limited by failing schools and hidden prejudice and the circumstances of their birth . . . I will work to build a single nation of justice and opportunity'.

[3] A global median of 60% rates education as 10, 'very important' for getting ahead in life, on a scale from 0 to 10; see Pew Research Center (2014).

[4] Inequalities in education and job opportunities can be the key drivers of unequal outcomes. In early childhood, parents invest much more money and time on childcare than less educated parents (Doepke and Zilibotti, 2017; Blanden *et al.*, 2023). Children from advantageous socio-economic backgrounds are healthier (Currie, 2009), score higher on IQ tests (Falk *et al.*, 2021) and are more likely to pursue schooling on an academic rather than vocational track (Falk *et al.*, 2020); they also have access to better information on college application and job opportunities (Hällsten and Thaning, 2018; Jackson, 2021). Chetty *et al.* (2020) found that children from families in the top 1% of the income spectrum are 77 times more likely to attend an Ivy-Plus college compared to children from families in the bottom income quintile.

worker has built up their human capital in a particular industry, only to find that due to unforeseen macro-level factors, that industry is no longer growing, while other workers are well prepared to work in the current high-growth industries. Alternatively, a worker may be constrained to living and working in specific geographic areas, where opportunities for employment and job growth may differ vastly as compared to other geographic areas.

In this paper, we conduct two online experiments with nearly 4,000 participants to test individuals' redistributive preferences under these two types of unequal opportunity. We are interested in individuals' redistributive preferences when they encounter a pair of workers who have the same incentives to perform well, but experienced unequal opportunities. Specifically, the two workers first study some learning materials and then work on a knowledge evaluation task. The default initial allocation is that the worker who answers more correct answers in the knowledge evaluation is assigned \$6, while the other worker is assigned \$0. Then a third-party spectator is offered the opportunity to redistribute earnings from the higher earner to the lower earner after being well informed about the situation of the unequal opportunities (Almås *et al.*, 2020).

In the main experiment, we implement four main between-subject treatments. The first treatment is called *Random-Education*; it aims to reflect unequal opportunities in gaining new knowledge prior to the performance evaluation, as exemplified by different quality levels of education that individuals may receive. In this treatment, different learning materials were randomly assigned within each pair of workers. While workers' motivations to learn and perform well in the same subsequent evaluation task were identical, one worker's learning materials were highly relevant to the knowledge evaluation, while the other worker's materials were of similar topic and length, but lacked critically relevant information with respect to the evaluation. The second treatment is called *Random-Employment*; it intends to reflect unequal opportunities at the time of the performance evaluation, representing the different career opportunities individuals may have. In this treatment, the two workers read fully identical learning materials. However, in the knowledge evaluation that followed, one worker was asked to complete the full set of knowledge questions, while the other worker only had access to a truncated subset of the questions.

The third and fourth treatments are called *Luck* and *Merit*, respectively; they provide a joint benchmark with equal opportunity for learning and performance, and differ in terms of whether the inequality in initial rewards can be fully attributed to luck or effort. Under each of the two unequal opportunity treatments, there are two competing hypotheses on what a meritocrat would do. On the one hand, since unequal outcomes are driven by differences in opportunities, which were randomly assigned to workers and thus having origins in luck, they may fully equalise income between the two workers as though inequality in initial rewards is due to pure luck. In other words, their behaviour would be similar to that in the benchmark Luck treatment. On the other hand, they could judge the workers only by their productivity result regardless of the opportunity condition that workers were randomly assigned to, and therefore decide not to redistribute the income, as though the inequality in income is purely due to effort. In other words, their behaviour would be similar to that in the benchmark Merit treatment.

Our experimental results show that, compared to the Merit treatment, spectators made more equalising redistributions when opportunities were unequal. However, the redistributed amount is not as large as in the Luck treatment. Thus, inequality stemming from unequal opportunities is considered mostly unfair, but is not functionally equivalent to pure luck in terms of redistributive preferences. We also find that the impact of unequal opportunities varies across the different opportunity scenarios: the redistributed amount is higher under unequal educational opportunities

than under unequal employment opportunities, implying that the former is perceived as closer to pure luck than the latter.

In the second follow-up experiment, we implement three between-subject treatments to study the effects of *varying degrees* of unequal opportunities on spectators' redistributive preferences. In the first treatment, named *Vary-Education*, we manipulate the amount of relevant learning materials (from none to the maximum possible) given to the disadvantaged worker for the subsequent knowledge evaluation in different scenarios. By contrast, the advantaged worker always receives the most relevant learning materials. In the second treatment, *Vary-Employment*, we vary the number of questions (from zero to the maximum possible) available to the disadvantaged worker during the knowledge evaluation in different scenarios, while the advantaged worker always has access to the complete set of knowledge evaluation questions. Spectators are explicitly informed about the degrees of unequal opportunities before making their redistribution decisions. In the third treatment, *Vary-Probability*, we merge the original Luck and Merit treatments by having the inequality in initial rewards determined probabilistically by either luck or performance, and vary this probability in different scenarios (from 0% to 100%; Cappelen *et al.*, 2022b). Additionally, we test the robustness of our first experiment's findings by including a scenario in each unequal opportunity treatment that replicates the original degree of unequal opportunity from the first experiment.

The results from the second experiment yield further insights into our research question. Firstly, we successfully replicate the first experiment's findings, demonstrating that spectators do consider the effects of unequal opportunities when making redistributive choices. Inequality resulting from unequal educational opportunities is perceived as closer to pure luck, while inequality due to unequal employment opportunities leans more towards merit. Secondly, we discover that even minor uncertainty or ambiguity in attributing inequality to luck or effort tends to influence the redistributive behaviour of meritocratic spectators towards equality. This pattern is, not only consistent with the probabilistic luck and merit scenarios previously studied by Cappelen *et al.* (2022b), but is also corroborated in our novel scenarios of unequal opportunities. Finally, by extending the theoretical model of Cappelen *et al.* (2022b) to our unequal opportunity scenarios and utilising structural estimation, we provide evidence that the egalitarian pull on redistributive behaviour that is commonly observed across all treatments can be rationalised by the spectators' attempts to minimise a convex loss function representing deviations from the perceived fair redistributed amount in the scenario of a level playing field.

Our study contributes to the broad literature that seeks to understand people's preferences for redistribution. A number of survey experiments explore the general pattern and structure of distributional preferences without varying the source of inequality (Kuziemko *et al.*, 2015; Karadja *et al.*, 2017; Fisman *et al.*, 2021; Hvidberg *et al.*, 2023). Also using survey methods, Alesina and La Ferrara (2005) and Alesina *et al.* (2018) documented that people's beliefs about the sources of inequality such as effort, luck, heritage or other factors related to equality of opportunities are critical determinants of their preferences for redistribution.[5] In contrast to survey methods, a growing literature aims to reveal preferences in redistributive decisions that have real payoff consequences (Konow, 2000; Cappelen *et al.*, 2010; 2013; 2022b; Mollerstrom

[5] There is also a large theoretical literature that investigates different channels through which beliefs about inequality affect the demand for redistribution, such as beliefs formed on the basis of personal experiences (Piketty, 1995), beliefs about the social desire to implement fair outcomes (Alesina and Angeletos, 2005) and beliefs that are optimally biased to conform to individuals' own world views of justice (Benabou and Tirole, 2006). In these models, since beliefs are typically heterogeneous, multiple redistributive equilibria consequently arise.

et al., 2015; Deffains *et al.*, 2016; Akbaş *et al.*, 2019; Almås *et al.*, 2020; Valero, 2022). Typically, the decision-making environment involves a production phase in which a pair of workers independently complete some tasks, and a redistribution phase in which an impartial spectator is asked to redistribute money between the workers. Experiments generally reveal that people hold different fairness ideals and these fairness ideals interact with the source of inequality to significantly impact their redistributive decisions.

Within this broad literature, our study aligns closely with that of Almås *et al.* (2020), who examined how the source of inequality influences redistributive decisions. In our main experiment, we replicate two of their principal treatments as control treatments, in which either luck or merit determines the initial assignment of earnings to a pair of workers. They found that spectators are more inclined to equalise the total income when luck, rather than merit, determines the initial earning allocation. This observation is further substantiated by Cappelen *et al.* (2022a), who demonstrated that even when luck has a marginal influence on performance (as minute as 1%), people tend to equalise total income more than when luck is totally absent—a finding we also replicate in our follow-up experiment. In these studies, luck is a direct cause of inequality. Conversely, in most real-world scenarios, luck assumes a more indirect and nuanced role, taking shape as various forms of unequal opportunities. This indirect influence is arguably more foundational, and if misconstrued as merit or overlooked altogether, can generate as much socio-economic inequality as when luck has no bearing at all. Our study is among the first to explore how this subtle manifestation of luck shapes people's redistributive preferences in comparison to situations devoid of unequal opportunities.

At least three studies that are contemporaneous to ours similarly investigate how redistributive preferences are influenced by unequal circumstances. The distinctive feature of our research is the introduction of an experimental design that enables the examination of the impact of varying forms and degrees of unequal opportunities (reminiscent of unequal educational or employment opportunities encountered in real life) on redistributive preferences. Within our design, we confront the complex attribution problem of income inequality to either effort or luck, introducing ambiguity regarding whether a disadvantaged worker might have excelled on a level playing field. Unlike our approach, both Preuss *et al.* (2022) and Andre (2024) represented unequal conditions through exogenously defined and varied piece rates for completing an identical task. This manipulation of piece rates allows the uncertainty in attributing results to effort or luck to be precisely quantified ex post. Our framework, in contrast, resonates with a broader spectrum of real-world instances in which unequal opportunities are not easily measured, leaving the attribution of inequality ambiguous. Moreover, the insights derived from these two designs differ. In particular, Andre (2024) observed that most spectators regard workers' final performance levels as unaffected by luck, even when recognising that the disadvantaged worker's effort was hampered, and given that the workers' piece rates are revealed only after the task completion, thus preserving identical work incentives. However, we find that spectators do at least partly consider the effect of unequal opportunities, and their redistributed share reflects both the underlying nature and extent of these inequalities. This indicates that meritocracy may not be that 'shallow' after all.

Bhattacharya and Mollerstrom (2022) explored an interesting unequal opportunity scenario that aligns closely with our examination of unequal employment opportunities. In their design, one worker is randomly designated to work on an encoding task for one minute, while the other worker must wait for the same duration, without the option to leave early. We adopt a conceptually similar situation in the Vary-Employment treatment of our second experiment.

Both our investigation and theirs yield a similar conclusion that may sound counterintuitive at first: when the degree of unequal opportunities is at its maximum, the modal behaviour is not to redistribute at all. This outcome underlines that the decision to reward based on the difference in effort exerted during the task overwhelmingly supersedes considerations regarding unequal opportunities.[6]

In terms of the relationship between the context of our study and these concurrent studies, the nature of unequal opportunities investigated by Preuss *et al.* (2022) and Andre (2024) resonates with our study of unequal educational opportunities. Both these studies and ours emphasise ex ante unequal opportunities before starting the identical performance task. Conversely, the approach of Bhattacharya and Mollerstrom (2022) is akin to our focus on unequal employment opportunities at the time of performance. From this vantage point, our paper crafts a unified framework to analyse these different facets of unequal opportunities on redistributive behaviour, which other individual studies do not allow for.

1. Main Experiment

1.1. *Design Overview*

We use the paradigmatic spectator-worker design (ex. Almås *et al.*, 2020) to create experimentally controlled situations of inequality between two workers. In our pre-registered design, each worker's task was to study a brief reading material passage for up to 5 minutes, then answer multiple-choice questions in a knowledge evaluation within another 5 minutes.[7] Workers were then randomly paired ex post and assigned initial rewards in addition to a fixed base payment of $2. Across all treatments, the initial reward allocation is the same: one of the workers received $6, while the other worker received $0. The treatments differ in terms of the underlying source of the workers' reward and/or performance differential.

Another set of participants playing the role of the impartial third parties, which we refer to as spectators, was informed about the workers' scenario and initial reward allocation, and then given an opportunity to reallocate the rewards from the higher-earning worker to the lower-earning worker. One-third of spectators' decisions were randomly chosen to be implemented on the participants playing the role of workers. The primary variable of interest is the spectator's redistributive decision, which is interpreted as reflecting decision-makers' views about fairness concepts and preferences over redistribution.

1.2. *Treatments*

We implement four between-subject treatments, which vary in terms of the source of inequality and/or performance differential between workers. We discuss the treatments in the following sections, organised by whether there was an opportunity differential imposed between workers.

[6] In a related design, Cappelen *et al.* (2023) studied how spectators decide whether to compensate a worker who has not been offered work. Their main concern is to understand how this compensation decision varies with the probability of the worker's false claim for compensation. The key difference from the spectator-worker paradigm employed in the present study is that in their study, the spectator's decision is not to transfer earnings from a higher earning worker to a lower earning worker, but rather to pay some additional compensation to an unemployed worker.

[7] Prior worker tasks considered in the literature include word unscrambling (Almås *et al.*, 2020) and other tasks of a routine manual nature (Konow, 2000). For our research question of interest, it is essential that our worker task is knowledge or training based, so that the concepts of opportunity we are interested in can be accurately represented to spectators.

We also implement two additional treatments addressing spectators' desire to seek information about inequality, but we defer discussion of them until Section 4.1.

1.2.1. *(Benchmark) Treatments with equal opportunities*

In the two treatments, *Luck* and *Merit*, both workers in a pair first studied identical reading materials, then completed the same set of multiple-choice knowledge questions pertaining to the topic addressed in the reading materials. In the Luck treatment, the initial assignment of rewards between the two workers was fully determined by a lottery (i.e., one of them was randomly selected to receive the entire initial reward, \$6), independently of workers' performance levels on the knowledge questions. In the Merit treatment, the initial assignment was determined by the workers' performance levels on the knowledge questions (i.e., the worker who answered more questions correctly received the entire initial reward, \$6).

To avoid spectators' decisions being affected by workers' expectations, workers were not told the lottery result (in the Luck treatment) or the result about their relative performance (in the Merit treatment).[8] Spectators were informed of the exact procedure of the assignment of initial rewards to workers. These two treatments have been previously implemented by Almås *et al.* (2020), and we replicate them here in the context of our worker task for the purpose of straightforward comparability with our novel unequal opportunity treatments.

1.2.2. *Treatments with unequal opportunities*

The Luck and Merit treatments, which serve as benchmarks for comparison to our other treatments, do not involve any unequal opportunities. However, in our main treatments, *Random-Education* and *Random-Employment*, we introduce the potential for unequal opportunities to affect workers' performance outcomes.

The Random-Education treatment differs from the Merit treatment in that workers randomly received different reading materials: one set of reading materials was highly relevant to the subsequent knowledge questions, containing all the information needed for the worker to answer all the knowledge questions correctly. By contrast, the other set of reading materials, about the exact same topic and of similar length, lacked several pieces (exactly eleven out of fifteen pieces) of vital information for successfully completing the knowledge questions. Workers were not explicitly informed that there were two different versions of reading materials. The spectators, however, were informed about which of the two workers received the highly relevant reading materials, and that the worker with the higher number of correct answers in the evaluation received the entire initial reward, \$6, while the other worker received \$0. Since the answers to the knowledge evaluation were embedded in the relevant reading materials, and we informed workers that answers should be based on these materials, the worker who received the highly relevant reading materials was substantially advantaged. Therefore, we expect that workers who performed better on the evaluation should most likely be the one who received the highly relevant materials. We ex post match each pair of workers, such that one worker who received the highly relevant materials and performed better is paired with a worker who received the less relevant materials and performed worse.[9] In practice, our reading materials successfully

[8] However, as tested in a robustness study by Almås *et al.* (2020), spectators' behaviour in these two treatments is not affected even when spectators are told that the workers have been informed about their initial earnings.

[9] In this study, we applied ex post matching to ensure that, within each pair, workers with disadvantaged conditions were always the lower performers. This approach, while precluding the chance for disadvantaged workers to outperform their advantaged counterparts, was not designed to deceive or mislead participants. All workers were informed about the

generated the higher expected performance among workers who received the highly relevant materials (average score of 12.5 out of 15), while workers receiving the less relevant materials performed worse (average score of 7.9 out of 15). The Random-Education treatment is designed to partially represent unequal opportunities originating in access to varying qualities of education for individuals, which often arise from circumstances beyond an individual's personal control.[10]

The Random-Employment treatment represents another type of unequal opportunity. In this treatment, a pair of workers received the identical highly relevant reading materials. One randomly determined worker had access to the full set of fifteen knowledge questions, while the other worker only had access to a truncated set of the knowledge questions, specifically a subset of four questions from the full set. Workers were not informed that there were two different versions of knowledge questions. The spectators, however, were informed about which worker had received the full set of questions, and that the worker with the higher number of correct answers received the entire initial reward of $6 (we expect that this worker should almost always be the one who received the full set of questions), while the other worker received $0. Again, we ex post match each pair to include one worker who received the full set of questions and performed better, and a worker who received the truncated set of questions and performed worse. The Random-Employment treatment is intended to partially emulate circumstances in the labour market that might be unevenly imposed upon different workers.[11]

In both of the treatments with unequal opportunities, spectators were told that the worker who scored higher in the knowledge evaluation was assigned $6, while the other worker was assigned $0. We highlighted to the spectator that the worker who studied the highly relevant reading materials also scored higher in the evaluation in the Random-Education treatment and that the worker who had access to the full set of the evaluation questions scored higher in the Random-Employment treatment. Spectators are only informed about the nature of the unequal

pairing and the potential for earning bonuses only after they completed their task. Furthermore, our spectator instructions described a specific example of a scenario between two unnamed, but specific workers (in which a disadvantaged worker performed worse and earned less initial payment than an advantaged counterpart), but made no broader statements about how prevalent or absolute this scenario was in our experiment or beyond. This matching method is to maximise the efficiency of the observations. It is, however, possible that spectators may behave differently if they knew the empirical impossibility for the lower-opportunity workers to win under this implementation. We leave this as a topic for future research.

[10] Unequal educational access is prevalent and near universal in most societies around the world. For example, in the United States, two equally able and hard-working children could receive vastly different education qualities due to differences in the quality of local public education in the school districts they reside in. In addition, gaps in educational experiences vary widely based on parental investments made towards children's education. While families with economic means can enhance their children's education through supplementary courses outside of the formal required schooling, families with lesser economic means usually cannot afford to do so. At an even more fundamental level, students vary in terms of the family background endowments such as family-specific values and norms, which could affect parental support and prioritisation of educational pursuits. Our Random-Education treatment can be interpreted as implementing this inequality in educational opportunity, but isolated from the other potentially confounding factors mentioned, so that spectators' attitudes towards educational opportunity can be observed while isolated from any preconceived notions they may have about geographic and socio-economic differences between workers.

[11] For example, in the United States, due to circumstances beyond individual workers' personal control, some geographic regions have accelerated economically, providing local residents with ample job opportunities. On the other hand, some regions have stagnated economically, leaving residents with very limited opportunities for gainful employment. For personal or economic reasons, some residents may not be able to migrate to other regions, and may then be limited to the local labour market conditions. Another potential domain for interpreting the Random-Employment treatment is in terms of workers' established professions of employment. Workers may have trained or studied in their profession, and sudden economic shocks may alter the employment opportunities available to different professions in the economy. For workers whose professions are suddenly in low demand, the overall work opportunities are fewer than for other professions, which tends to result in lower income earned. While removing real-world contexts and potential other confounding factors that could affect spectators' attitudes, our Random-Employment treatment aims to gauge third-party attitudes on deservingness based on the differing exogenous work opportunity levels available to individuals.

Table 1. *Main Treatments in the Main Experiment.*

Treatment	Reading materials	Performance evaluation	Initial assignment
Luck	Same	Same	Random worker gets 6 USD
Merit	Same	Same	Better performer gets 6 USD
Random-Education	Different	Same	Better performer gets 6 USD
Random-Employment	Same	Different	Better performer gets 6 USD

opportunities, but not their degree. (How varying degrees of unequal opportunities impact redistributive decisions will be our subject of study in the follow-up experiment introduced in Section 3 below.) Spectators were also not informed of the absolute performance difference between the paired workers. Importantly, spectators were informed that the workers were not aware of their own performance result as compared to that of their paired worker, and furthermore that workers were not aware of any potential differences between the reading materials or number of knowledge evaluation questions provided, between the paired workers. This specific set of information provided to spectators and workers serves to help isolate the effects of unequal opportunity on spectators' redistributive decisions from potential influences of perceptions of workers' expectations, and further helps mitigate the possibility that spectators would attribute performance differences between workers as driven by differing effort levels due to knowledge of their unequal opportunities.

In summary, across these four treatments, the spectators faced the same redistributive decisions with identical levels of initial income inequality, and a pair of workers with identical incentives to learn and perform. The only difference is the source of inequality in initial rewards, by treatment. By comparing spectators' redistributive decisions in the Random-Education treatment to the joint benchmark provided by the Luck and Merit treatments, we are able to causally identify the effect of the unequal learning opportunities on the level of redistribution preferred by spectators. Similarly, by comparing spectators' redistributive decisions in the Random-Employment treatment to the same joint benchmark, we are able to causally identify the effect of the unequal employment opportunities on the spectators' choices of redistribution. Table 1 summarises the main features of these treatments.

1.3. *Conceptual Framework*

In this section, we provide a simple framework for understanding our experiment and its results. The framework closely follows the model proposed by Almås *et al.* (2020) and Cappelen *et al.* (2022b).

In each of our treatments j, which presents a predicament between two workers, the spectator is tasked with choosing the income distribution between the two workers, $(y, 1-y)$, where y denotes the share of total earnings redistributed to the worker who received no earnings in the initial allocation. We assume that the spectator cares about a 'fair' allocation between the two workers according to the loss utility function, $U(y) = -(|y - m(j)|)^{\alpha}$, where $m(j)$ denotes the spectator's perceived *fair* share allocated to the worker who did not receive any initial earnings, and α indicates the curvature of the loss function. Thus, the optimal interior solution has the spectator simply selecting their perceived fair distribution, $y(j) = m(j)$. It follows immediately that any differences in y across treatments arises from differences in spectators' fairness views regarding workers' predicaments across the different treatments.

Following the literature (Almås *et al.*, 2020; Cappelen *et al.*, 2022b), we can conceptualise spectators' attitudes towards the Luck and Merit treatments as endpoints on a spectrum of possible fairness attitudes that spectators could hold. An intuitive way of conceptualising unequal opportunities is as an initial round of (random) luck being imposed on workers prior to their performance evaluations. This luck, combined with the subsequent effort, results in income inequality and creates ambiguity in attributing outcomes to merit or luck. Consequently, unequal opportunities might matter differently to people's fairness views, depending on to what degree they attribute income inequality to merit as compared to luck. On the one hand, unequal opportunities might be viewed as purely a matter of luck, since these opportunities are completely out of workers' own control in our experiment. On the other hand, the difference in initial rewards is directly a product of workers' different performance levels in the evaluation task, making it reasonable to discount the impact of unequal opportunities and attribute workers' final performance largely to merit. Hence, the Luck and Merit treatments serve as benchmarks that enable us to assess the degree to which the spectators attribute performance differentials arising from unequal opportunities to pure luck and/or pure effort. Under this conceptualisation, we would expect that the level of redistribution in scenarios with unequal opportunities lies between the redistributions observed in the Luck and Merit treatments.

The literature on fairness perceptions has typically categorised people as holding one of the three types of fairness view: egalitarian, libertarian and meritocratic (Cappelen *et al.*, 2007; see Cappelen *et al.*, 2020 for a review). Spectators with an egalitarian fairness view will always fully equalise the total income between workers, while those with a libertarian fairness view will never redistribute income at all. Only the meritocratic fairness view distinguishes between the source of income inequality; inequality due to luck is considered unfair, while inequality due to merit is regarded as fair. Specifically, the perceived fair share $m(Merit) < 1/2$ and $m(Luck) = 1/2$. Therefore, any difference in redistribution decisions between the Luck and Merit treatments must be driven by spectators holding meritocratic fairness views.

It also follows that only meritocratic spectators would be sensitive to the potential effects of unequal opportunities or types of unequal opportunities. Although it is clear that in the presence of unequal opportunities the superficial source of inequality is due to performance differentials, the degree to which performance is attributable to merit in the eyes of spectators is ambiguous. Whether a meritocratic spectator attributes performance differentials under unequal opportunities largely to luck or largely to merit depends on their perception of the underlying unequal opportunity. Our experiment aims to shed light on this inherently empirical question.

This perception could also differ across different types of unequal opportunity, such as the educational and employment opportunities we consider in our treatments. While our unequal educational opportunity treatment represents an early inequality in opportunity in a worker's performance production process, our unequal employment opportunity treatment represents an inequality in opportunity that is concurrent with the performance evaluation. An additional empirical question is how spectators differentially weigh the influences of luck and merit in these two unequal opportunity settings.

1.4. *Implementation*

Each worker earned a base fixed payment of $2 for completing the task. Depending on the treatment, they were informed that their task performance or luck would determine their reward temporarily, but that another participant in our study would be tasked with making the

Table 2. *Descriptive Statistics about Spectators' Characteristics.*

	Treatment				
	Luck	Merit	Random-Education	Random-Employment	US population (ACS, 2020)
Female (%)	55.2	56.7	50.2	55.2	50.8
Age (years)	44.7	45.2	44.1	43.9	38.2
High education (%)	48.3	57.2	53.2	57.6	32.9
Individual yearly income (USD)	58,833	59,214	57,487	58,405	68,764
Conservative (%)	22.9	25.9	27.4	19.2	27.0
Observations	201	201	201	203	

Note: This table reports descriptive statistics for spectators' characteristics in the main experiment, as well as the population data (from the American Community Survey (ACS) 2020 for sex, age, education and income, and Gallup for the party affiliation since 2021). A subject is categorised as 'high education' if he or she has completed at least four-year college education. Conservative is defined as having selected Republican as their political party/stance most typically supported. Individual yearly income indicates subjects' self-reported pre-tax income, while in the population data it refers to mean earnings for full-time, year-round workers in the past twelve months.

redistribution decision between them and their paired worker. Note that workers only knew the rule determining the initial allocation of reward, but they were not told whether or not they were actually assigned the initial \$6, and spectators were informed of this fact.

Spectators were randomly assigned to one of the six treatments (the four main treatments discussed earlier and two additional treatments on information search to be discussed in Section 4.1 below) and earned a flat payment of \$3 for completing their task. They were provided with instructions describing the situation faced by the workers and the initial reward result between 'Worker A' and 'Worker B'. After reading the instructions, they must pass a comprehension quiz in order to proceed. This helps ensure that spectators comprehended the situation of the workers correctly, and that they understood the reality of their own role in workers' outcomes. Spectators had to determine whether and how much to redistribute the earnings from the worker initially awarded \$6 to the worker initially awarded \$0. They could choose to redistribute the workers' earnings in increments of \$1 or alternatively, decline to redistribute.[12] They were informed that one-third of all spectator participants doing this task would have their choice implemented on real workers in our study and, therefore, that they should make their redistribution decision carefully as though it would be actually implemented. Experimental instructions and procedures for both the spectators and workers are provided in Online Appendix E.

A total of 2,034 participants were recruited for our study via the CloudResearch Panel of Amazon Mechanical Turk.[13] For each treatment, we recruited approximately 201 spectators and 134 workers (67 pairs) to implement the above-described procedure. The sample was targeted to be approximately representative of the general population in the United States with respect to gender, age and income. In Table 2 we show an overview of spectators' characteristics across all treatments. We observe that characteristics are nearly balanced across all treatments and are close to the general US population data, except that the share of highly educated spectators is overrepresented in our data. To provide a balance test for all characteristics, we first run

[12] Note that the presence of extreme inequality as the default option prior to redistribution might serve as a reference point influencing redistributive decisions. A related study by Bhattacharya and Mollerstrom (2022) found that spectators making distributive, rather than redistributive, decisions tend to opt for more equal outcomes. Although this design element is unlikely to affect the relative comparisons among different treatments in our study, it does suggest that the quantitative measures of redistribution we have found (as well as other studies using this default setting) should be approached with some caution.

[13] In Online Appendix D we discuss the sample restriction and data quality for each experiment.

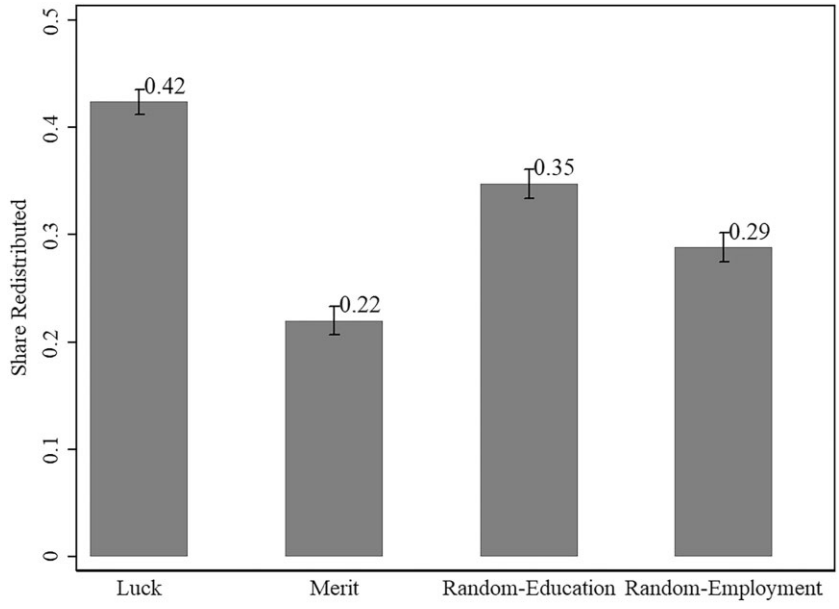

Fig. 1. *Share Redistributed by Spectators.*
Note: SEs are indicated by the bars.

a multinomial logit regression of treatments on all characteristics and then conduct a joint orthogonality test (chi-squared test). The *p*-value for this joint significance test is .375, indicating that an overall balance is achieved.

2. Results

2.1. *Spectators' Decisions*

Our main outcome variable of interest is the share of the better-performing worker's initial reward that is redistributed by spectators to the other worker. Figure 1 shows this average share redistributed in each of the treatments. Comparing the Luck and Merit treatments, we replicate the stylised finding in the literature that people are significantly more willing to redistribute when the source of inequality in earnings is due to luck rather than performance ($p < .001$, Wilcoxon rank-sum test). Online Appendix Figure A1 further shows the distribution of spectators' decisions across all treatments. Complete equalisation is the modal behaviour when luck is the source of inequality: in the Luck treatment 71.1% of the spectators equalise completely between the two workers, whereas only 9.5% do not redistribute at all. By contrast, in the Merit treatment where performance is the source of inequality, only 10.0% completely equalise the total income, while 33.3% do not redistribute at all.

Turning to the two treatments with unequal opportunities, we find that opportunities matter differently for spectators' fairness considerations, depending on the source of the performance differential. First, we observe that the average share redistributed in the Random-Education treatment (34.7%) is relatively closer to that in the Luck treatment (42.4%) than the Merit treatment (22.0%), although the difference is significant ($p < .001$) for comparisons with both

benchmark treatments. As shown in Online Appendix Figure A1, complete equalisation, albeit to a lesser extent, is also the modal behaviour in the Random-Education treatment (47.8%). On the other hand, 16.9% do not redistribute at all. This pattern is more similar to the Luck treatment than the Merit treatment. Thus, when the source of the performance differential is due to random assignment of learning materials, spectators tend to attribute the performance differential more to luck than to merit.

Second, the average share redistributed in the Random-Employment treatment (28.8%) tends to be closer to that in the Merit treatment than the Luck treatment, and again in both comparisons with the two benchmark treatments the difference is significant ($p < .001$). As shown in Online Appendix Figure A1, complete equalisation is no longer the modal behaviour in the Random-Employment treatment (29.1%). On the other hand, 23.7% do not redistribute at all and 36.0% redistribute 40% of the total income. This pattern is more similar to the Merit treatment than the Luck treatment. Thus, when the source of the performance differential is due to the random assignment of workloads, spectators tend to attribute pay inequalities to merit more so than to luck.

Third, we verify that spectators redistribute significantly more in the Random-Education treatment than in the Random-Employment treatment ($p < .001$). In Online Appendix Table A1, we report the corresponding regression analyses of the average share redistributed on the treatment indicators and on individual characteristic variables collected from the post-experimental questionnaire. In Online Appendix Table A2, we show that these results are robust to multiple hypothesis testing adjustments.

Summarising the overall pattern across the two benchmark treatments and the two treatments with unequal opportunities, we find that while spectators did at least partly attribute unequal opportunities to luck, this tendency is stronger when unequal opportunities are about learning prior to the performance evaluation than when they are about workload in the performance evaluation. Intuitively, the treatment difference may arise because in the situation of unequal educational opportunities, despite having exerted a similar amount of effort in studying their learning materials and finishing the knowledge evaluation, some workers simply arrived at the evaluation ill prepared to complete it successfully, through no fault of their own. However, in the situation with unequal employment opportunities, some workers exerted less effort in the knowledge evaluation based solely on the number of questions available to them, even though in the counterfactual situation they might have exerted a similar amount of effort as the other workers. Spectators seemed to hold these workers personally responsible for completing less work, even though it was also through no fault of their own. Hence, our finding suggests that spectators assign more weight to the actual effort exerted in the knowledge evaluation than the mere willingness to work hard, which is ex ante similar for both workers.

2.2. *Heterogeneity Analysis*

As specified in our pre-analysis plan, we conduct an analysis of the redistributive choices of different subgroups of spectators along the following demographic dimensions: gender, education, income and political identity.

We first discuss the correlation between individual spectators' characteristics and the average share they redistributed. Column (2) of Online Appendix Table A1 shows that conservatives (self-identified Republicans) tend to redistribute significantly less than non-conservatives (29.3%

versus 32.9%, $p = .022$, Wilcoxon rank-sum test). Online Appendix Figure A2 shows that the political party difference is noticeable in all treatments, except for the Luck treatment. By contrast, we find no evidence of an association between gender and the share redistributed. Neither income nor education level seem to matter in redistributive decisions. In Online Appendix Table A3, we show that these results are largely robust to multiple hypothesis testing adjustments, with the exception that the small difference in behaviour associated with income level is no longer statistically significant.

Next, we test subgroup differences across all treatments based on gender, education, income and political affiliation. Online Appendix Table A4, which incorporates dummy variables for subgroups based on these factors, shows that the treatment effects are generally consistent across subgroups. In almost all subgroups, merit as the source of inequality, whether it is in its purest form (in the Merit treatment) or partly compromised by unequal opportunities, results in a significantly lower redistributed share than Luck.[14]

3. Varying the Degree of Unequal Opportunity

In this section, we present the results from a follow-up experiment, which extends our main experiment in two significant ways. First, whereas in the main experiment's unequal opportunity treatments, spectators were aware of workers having unequal opportunities ex ante (in the Random-Education treatment) or ex post (in the Random-Employment treatment) without knowing the degree of inequality, our follow-up experiment provides explicit information about the degree of unequal opportunity. This enables us to test the robustness of our findings from the main experiment.

Second, in the main experiment, spectators made redistributive decisions under a single unequal opportunity scenario. The follow-up experiment, however, requests each spectator to redistribute rewards among seven different pairs of workers, each under a distinct scenario with varying degrees of unequal opportunity, with the spectators informed of the exact degrees. To provide an equal opportunity benchmark, we create seven corresponding scenarios in which the initial reward is probabilistically determined by workers' performance and luck, and these exact probabilities are disclosed to spectators (Cappelen *et al.*, 2022b). This new experimental design allows us to examine how spectators' redistributive preferences react to their perceptions of varying degrees of unequal opportunity and how these reactions contrast with the patterns observed in the equal opportunity benchmark.

3.1. *Treatments*

We implement three between-subject treatments: (1) varying degrees of unequal educational opportunity (the *Vary-Education* treatment); (2) varying degrees of unequal employment opportunity (the *Vary-Employment* treatment); (3) varying combinations of probabilistic weighting of performance and luck (the *Vary-Probability* treatment).

[14] In Online Appendix Table A5, we show that these results are largely robust to multiple hypothesis testing adjustments, but with important exceptions. For all subgroups, except for non-conservatives, the difference between the Random-Education and Random-Employment treatments is not statistically significant. The difference between the Random-Education and Luck treatments and the difference between the Random-Employment and Merit treatments are also not significant for some subgroups such as males.

3.1.1. *The Vary-Education and Vary-Employment treatments*

Each unequal opportunity treatment includes seven scenarios with varying degrees of unequal opportunity, characterised by the values 15 versus 0, 15 versus 1, 15 versus 4, 15 versus 7, 15 versus 11, 15 versus 14 and 15 versus 15. In the Vary-Education treatment, the first number indicates that one worker in the pair has access to all fifteen relevant pieces of information necessary for correct answers in their reading materials, while the second number indicates the amount of relevant information received by the other worker.[15] For instance, in the 15-versus-4 scenario, the disadvantaged worker has access to only four specific information pieces for the knowledge questions, while the other eleven pieces are transformed into vague phrases without information content. Likewise, in the Vary-Employment treatment, the first number represents one worker's access to all fifteen knowledge questions, and the second number indicates the number of questions accessible to the other worker. Both workers study the same fully relevant reading materials before attempting the knowledge questions.

Spectators were explicitly aware of the exact degree of unequal opportunity under each scenario, a detail not provided in the main experiment. Other features, however, were maintained to be consistent with the main experiment. Specifically, the workers were not informed that different versions of reading materials or knowledge questions were being used, although spectators were made aware of this. The spectators were also informed about which worker in each pair received the fully relevant reading materials, or had access to the complete set of fifteen knowledge questions, and that the worker with the higher number of correct answers would receive the entire initial reward of $6. After the evaluation, workers were paired ex post under each scenario. A worker receiving the fully relevant materials or the complete set of questions and performing better was matched with another worker who had access to less relevant materials or a reduced number of questions and performed worse.[16]

3.1.2. *The Vary-Probability treatment*

The Vary-Probability treatment incorporates seven scenarios, each with distinct probabilistic combinations of luck and performance determining the initial assignment of rewards. In this treatment, both workers have equal opportunities, accessing the same fully relevant reading materials and answering the same full set of knowledge questions. Designed to align with the experiment reported in Cappelen *et al.* (2022b), this treatment allows us to use the same structural model to estimate and compare how different combinations of probabilistic weighting between luck and performance, as well as perceptions of varying degrees of unequal opportunity, affect spectators' redistributive preferences.

In each scenario, the probability assigned to luck takes on the values of 0%, 1%, 10%, 50%, 90%, 99% and 100%. For example, in the 10% luck scenario, spectators were informed that the initial reward was determined by luck with a 10% probability and by performance with a 90% probability. In the luck scenario, the worker in the pair who was fortunate based on

[15] To implement this design, we create seven different versions of reading materials in which the number of pieces of information relevant to the knowledge questions is 0, 1, 4, 7, 11, 14 and 15, respectively. In particular, the version with four pieces of relevant information is the same one used in the Random-Education treatment of the main experiment. We also create seven different versions of knowledge questions in which the total number of questions is 0, 1, 4, 7, 11, 14 and 15, respectively. In particular, the version with four questions is the same one used in the Random-Employment treatment of the main experiment.

[16] Similar to the main experiment, this ex post matching procedure precludes the chance for disadvantaged workers to outperform their advantaged counterparts. Therefore, the experiment specifically varies spectators' perceptions of the degree of unequal opportunity and examines their reactions to these perceptions.

a computerised fair coin toss earned \$6, while in the performance scenario, the worker with more correct answers earned \$6 (with ties resolved randomly by the computer). Spectators were provided with the exact probability under each scenario. However, the workers were not given specific details, being informed only that their initial reward would be determined by either luck or performance, with some undefined probability.

3.1.3. *Structural model*

As discussed in Section 1.3, we conceptualise unequal opportunity as a luck component imposed on workers before they have a chance to demonstrate their performance. Under this interpretation, we can organise the data across all three treatments using the structural model proposed by Cappenlen *et al.* (2022a), originally used to organise data in probabilistic situations analogous to our Vary-Probability treatment.

We focus on meritocratic spectators, whose behaviour is sensitive to the source of inequality. The key new parameter introduced is the probability of the higher earner being the higher performer, denoted p. From the discussion in Section 1.3, it is clear that, under no uncertainty ($p = 1$), a meritocrat aligns her redistribution with her perceived fair share, $y(j) = m(j) \leq 1/2$ for treatment j. However, when $p < 1$, the meritocratic spectator aims to minimise the expected deviation from the perceived fair share according to the expected loss function:

$$EU(y) = -p[|y - m(j)|]^{\alpha} - (1 - p)\{|y - [1 - m(j)]|\}^{\alpha}.$$

For the Vary-Probability treatment, we can directly calculate the probability: 100%, 99%, 90%, 50%, 10%, 1% and 0% luck scenarios correspond to p being 0.5, 0.505, 0.55, 0.75, 0.95, 0.995 and 1, respectively. The Vary-Education and Vary-Employment treatments lack an immediately equivalent notion of p, as the higher earner must always be the higher performer in scenarios involving unequal opportunities. Thus, we must develop an alternative measure about the role of luck in these scenarios.

We first note that scenarios with unequal opportunities introduce different ambiguity levels about whether the advantaged worker is also the best performer *in a counterfactual scenario with equal opportunity*. In particular, there is no ambiguity in the 15-versus-15 scenario (equivalent to 0% luck), but ambiguity reaches a maximum in the 15-versus-0 scenario (similar, but not identical to the 100% luck scenario, considering the possibility of ties). Any other scenario's ambiguity level falls between these two extremes.

In this situation, how can we estimate the ambiguity level perceived by an average spectator? Consider a pair of workers, for whom, under the 15-versus-4 scenario, the disadvantaged worker is believed to win with a 25% probability. In comparison, under the equal opportunity scenario (15-versus-15 scenario), the probability increases to 50%. This 25% increase in probability signifies that one-quarter of a disadvantaged worker's realised defeats in the 15-versus-4 scenario may be attributed to luck since they would have won in the 15-versus-15 scenario. Following this logic, the perceived level of ambiguity (i.e., $1 - p$) for a particular scenario with unequal opportunity can be estimated by taking the absolute difference between an individual's belief regarding the disadvantaged worker's probability of winning in that scenario (denoted $B(unequal)$), and the same belief measure under the equal opportunity scenario (denoted $B(equal)$). In this manner, the key parameter p can be recovered for each scenario of each treatment. For this reason, in each of the seven scenarios we also ask for spectators' beliefs regarding the disadvantaged worker's chance of winning.

3.1.4. *Implementation*

The experimental protocol for the follow-up experiment was designed to align closely with that in the main experiment. Each worker received a base fixed payment of $2 for completing their task. Depending on the treatment and scenario, workers were assigned to read one of the seven versions of reading materials and then engage with one of the seven variations of knowledge evaluation tasks. Spectators, who were randomly assigned to one of the three treatments, received a flat payment of $3 for completing their task. Instructions were given to the spectators, detailing the situation faced by the workers, and the initial reward distribution between 'Worker A' and 'Worker B'. They were required to pass a comprehension quiz to proceed, and then determine if and how much to redistribute the earnings from the worker initially awarded $6 to the one initially awarded $0 in each of the seven scenarios. The spectators were informed that one of their decisions would be randomly chosen and applied to the corresponding matched pair of workers.

In the Vary-Education and Vary-Employment treatments, spectators first encountered the 15-versus-4 scenario to make their redistributive decisions, allowing this scenario to serve as a straightforward robustness check of the main experiment. The only difference was that spectators were explicitly informed of the degree of unequal opportunity. Subsequently, the other six scenarios followed on the same page, arranged monotonically to promote thoughtful decisions, with opportunities to revise previous answers. Spectators could redistribute any amount in increments of $1 under each scenario. On the same page, they were also asked to express their beliefs about the lower earner's probability of winning. The Vary-Probability treatment was implemented analogously, with spectators first seeing the 10% luck scenario, followed by the other six scenarios on the same webpage, also arranged monotonically.

A total of 1,938 participants were recruited via Connect by CloudResearch, a crowdsourcing platform designed for online research. For each treatment, approximately 210 spectators and 420 workers (210 pairs) were involved in the procedure described above. The sample aimed to reflect the general population of the United States concerning gender, age and income.[17] The complete experimental instructions and procedures for both spectators and workers are provided in Online Appendix E.

3.2. *Results*

3.2.1. *Spectators' aggregate decisions*

Figure 2 shows the average share redistributed in each treatment under various scenarios, including the average belief about the disadvantaged worker's probability of winning in unequal opportunity treatments. In the Vary-Probability treatment, we confirm our findings from the main experiment: spectators are notably more willing to redistribute when inequality is completely attributed to luck (100% luck scenario) as opposed to performance (0% luck scenario) ($p < .001$, Wilcoxon signed-rank test). Interestingly, the pattern across different combinations of luck and performance replicates the result of Cappelen *et al.* (2022b). In particular, small changes in probability at the extremes scarcely affect redistribution, and the redistributed share in the intermediate 50% luck scenario mirrors that of the 100% luck scenario. This implies that the average spectator may exhibit a convex loss function with $\alpha > 2$.[18]

[17] Online Appendix Table A6 shows an overview of spectators' characteristics across all treatments in the follow-up experiment. The balance test produces a p-value of .142, indicating that an overall balance is achieved.

[18] In Online Appendix Table A7, we provide the corresponding regression analysis of the average redistributed share for each treatment.

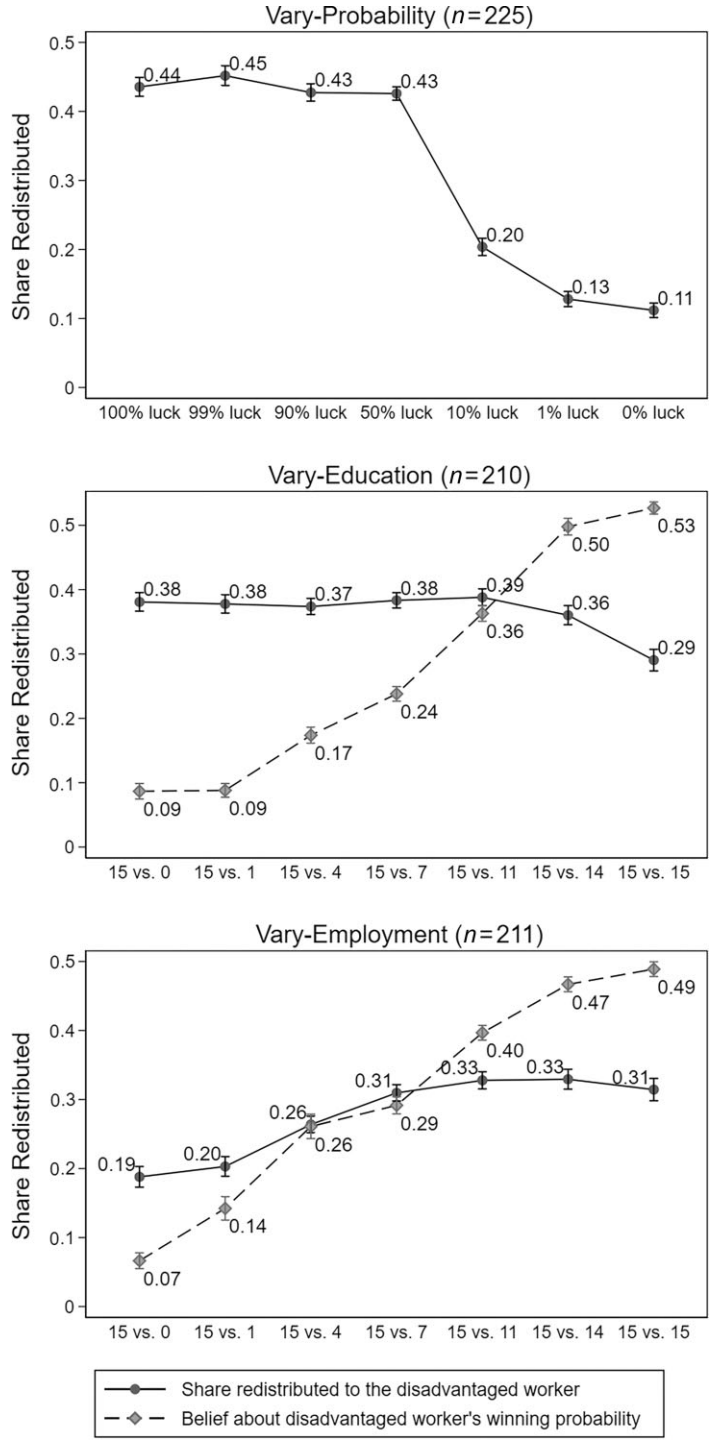

Fig. 2. *Share Redistributed by and Elicited Beliefs of All Spectators.*
Note: SEs are indicated by the bars.

Turning to the Vary-Education and Vary-Employment treatments, we first replicate our findings from the main experiment regarding the 15-versus-4 scenario. Specifically, the redistributed share in the unequal educational opportunity setting (37.4%) is more aligned with the 100% luck scenario (45.2%) than the 0% luck scenario (11.2%), whereas the unequal employment opportunity (26.4%) is closer to the 0% luck scenario. All pairwise comparisons are significant ($p < .001$).

Secondly, in the Vary-Education treatment, spectators' responses are mainly invariant to the degree of unequal opportunity except at the extreme 15-versus-15 scenario where unequal opportunity is eliminated. Still, redistribution in this extreme case is notably higher than in the 0% luck scenario (29.0% versus 11.2%, $p < .001$, Wilcoxon rank-sum test). The finding suggests that the salience of unequal opportunities exerts an egalitarian pull even in the scenario with no ambiguity about whether the higher earner is also the higher performer.

Thirdly, a non-decreasing curve is observed in the Vary-Employment treatment. As the degree of unequal opportunity decreases, the share of redistribution initially increases, but eventually decreases when unequal opportunity is eradicated, stabilising at a relatively high level (31.4%). This can be interpreted as follows: when the inequality in the knowledge evaluation task is substantial, spectators might justify income inequality by attributing it to potential variations in effort across tasks, thereby neglecting the core unequal opportunity. The more pronounced the difference, the more inequality is accepted. In contrast, when the inequality in the knowledge evaluation task is minimal, spectators become more sensitive to the root of the inequality, which leads to a resurgence in inequality tolerance for a different reason—merit assumes greater importance with reduced disparities in tasks. Essentially, spectators appear to try to balance the desire to base their redistributive decisions on differential workload (i.e., compensating the advantaged worker for exerting more effort) and the desire to base their decisions on the source of inequality (i.e., compensating the disadvantaged worker for being unlucky). It is worth noting that the former desire does not apply to the Vary-Probability or Vary-Education treatment, and its significance was previously highlighted in the Random-Employment treatment of the main experiment.

The somewhat puzzling observation that spectators continue to redistribute a significant share to the lower earner, even at the extreme where unequal opportunity should be absent and merit should predominate, indicates that many spectators are not behaving as meritocrats. In Online Appendix Figure A3, which displays the distribution of spectators' decisions across all treatments and scenarios, the modal choice under the 15-versus-15 scenario in both the Vary-Education and Vary-Employment treatments is to completely equalise the reward. It seems that spectators, who would have been classified as meritocrats in the Vary-Probability treatment, behave like egalitarians in the Vary-Education and Vary-Employment treatments, due to the strong egalitarian pull created by the salience of unequal opportunity. This effect is not predicted by the theoretical model. Therefore, to assess whether spectators' behaviour is at least partially consistent with the theory, the following analysis will focus on those who could be described as 'marginal' meritocrats. A 'marginal' meritocrat is defined as one who allocates more than half of the total income to the higher earner when there is no uncertainty or ambiguity (i.e., under the 0% luck scenario or the 15-versus-15 scenario) and allocates at least one dollar to the lower earner when uncertainty or ambiguity reaches its zenith (i.e., under the 100% luck scenario or the 15-versus-0 scenario).[19]

[19] The 'marginal' meritocratic fairness view is a weaker notion than the 'standard' meritocratic fairness view defined in Section 1.3. A 'standard' meritocrat is defined as one who allocates more than half of the total income to the higher

Figure 3 illustrates the average share redistributed by meritocratic spectators across all three treatments. This reveals a more coherent pattern than Figure 2, demonstrating that, as the degree of unequal opportunity diminishes, the share redistributed remains relatively unresponsive at first, but sharply falls as ambiguity levels become very small.[20] This common pattern further supports the notion that the average meritocratic spectator may have a convex loss function with $\alpha > 2$. We explore the curvature parameter in more detail through structural model estimation in the subsequent subsection.

To summarise, three broad new lessons are drawn from the follow-up experiment. First, the idea that uncertainty or ambiguity in attributing higher reward to higher performance brings about an egalitarian pull is, not only replicated in the probabilistic scenarios, but also affirmed in the scenarios with unequal opportunities. We provide further evidence from structural estimation in the next subsection. Second, the salience of unequal opportunities itself exerts an additional egalitarian pull, even in the scenario with no ambiguity in attribution (i.e., the 15-versus-15 scenario). Third, different kinds of unequal opportunity have distinct effects on redistributive preferences. Spectators take into account, not only the exogenous source of inequality, but also the endogenous choices (i.e., effort) prompted by that exogenous unequal opportunity. Specifically, in the Vary-Employment treatment, they seem to attempt to balance the desire to base their redistributive decisions on differing workload (i.e., compensating the advantaged worker for exerting more effort) with the desire to base their decisions on the source of inequality (i.e., compensating the disadvantaged worker for being unlucky).

3.2.2. *Structural estimation*

Our follow-up experiments elicited spectators' redistribution decisions under varying unequal opportunity levels (rather than a single possible unequal opportunity level), thus providing a fertile setting for structural estimation of the curvature parameter on the loss function, described in Section 3.1.3. An estimation of the curvature parameter can be interpreted as expressing how averse spectators are to distribution outcomes that deviate from their notion of a fair share.

We estimate the curvature parameter α based on (1), from which we derive a closed-form solution for the optimal redistributed share: $y = 1 - m(j) + (2m(j) - 1)/[1 + (1/p - 1)^{1/(\alpha-1)}]$. For this exercise, we focus on meritocratic spectators as defined in the previous subsection. We allow the perceived fair share under equal opportunity $m(j)$ (i.e., the redistributed share under the 0% luck scenario or the 15-versus-15 scenario) to vary across treatments and spectators. As we explained in Section 3.1.3, we can straightforwardly calculate probability p in the Vary-Probability treatment: 100%, 99%, 90%, 50%, 10%, 1% and 0% luck scenarios correspond to p being 0.5, 0.505, 0.55, 0.75, 0.95, 0.995 and 1, respectively. In the Vary-Education treatment, using the data from average meritocratic spectators' beliefs about the disadvantaged worker's probability of winning (see Figure 3), the 15-versus-0, 15-versus-1, 15-versus-4, 15-versus-7, 15-versus-11, 15-versus-14 and 15-versus-15 scenarios correspond to p being 0.53, 0.54, 0.65,

earner in the completely merit case and implements an equal split in the completely luck case. Note that, by definition, the redistributed share under the 100% luck scenario and the 15-versus-0 scenario must be 50%. Our results remain robust if we instead focus on these 'standard' meritocrats.

[20] In Online Appendix Table A8, we provide the corresponding regression analysis of the average share redistributed by meritocratic spectators for each treatment.

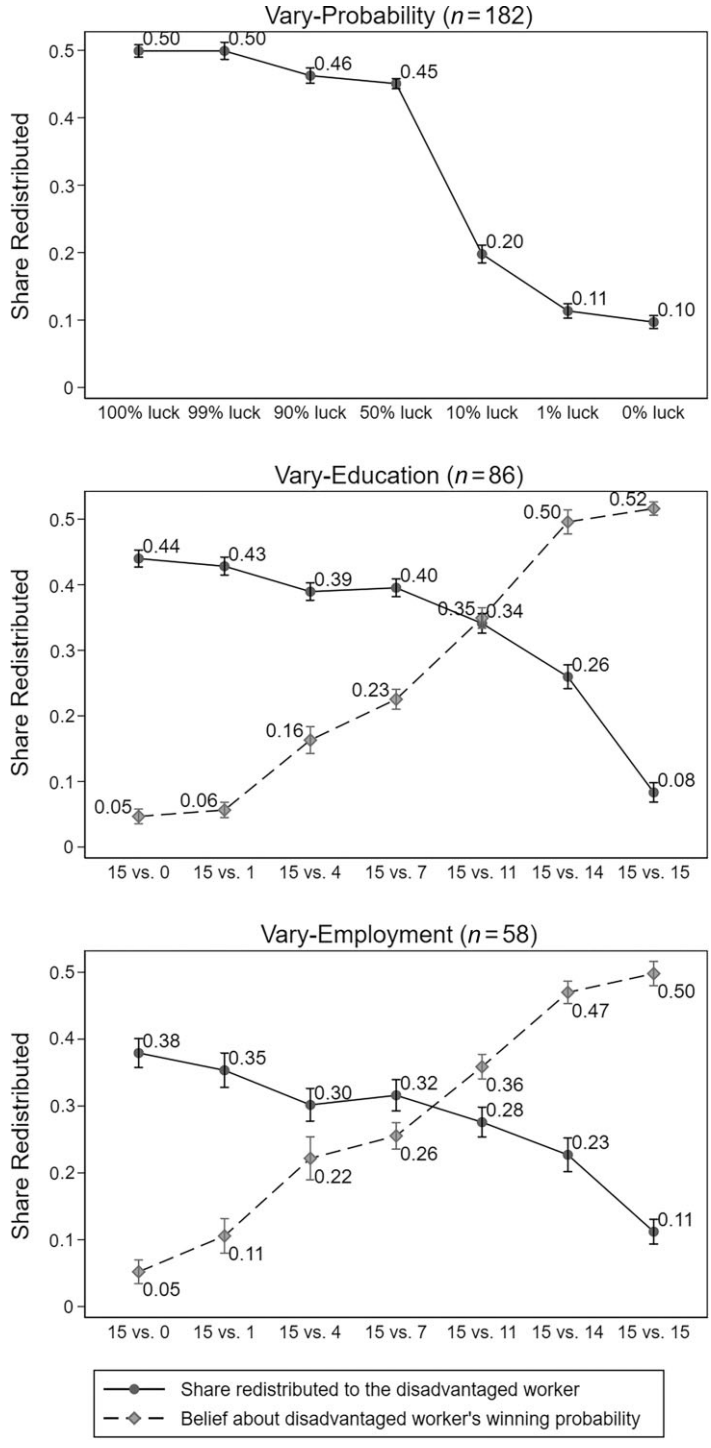

Fig. 3. *Share Redistributed by and Elicited Beliefs of Spectators Who Are Meritocrats.*
Note: SEs are indicated by the bars.

Table 3. *Structural Estimates.*

	Coefficient estimate (SE)		
	Vary-Probability	Vary-Education	Vary-Employment
α	2.532[a]	3.410[a]	2.182[b]
	(0.058)	(0.131)	(0.082)
var(ϵ_{it})	0.017	0.016	0.028
	(0.001)	(0.001)	(0.002)
Log likelihood	777.3	381.4	151.5
Observations	1,274	602	406
Subjects	182	86	58

[a]Coefficient is significantly different from 2 at the 1% level.
[b]Coefficient is significantly different from 2 at the 5% level.

0.71, 0.83, 0.98 and 1.[21] Similarly, in the Vary-Employment treatment, the corresponding p are 0.55, 0.61, 0.72, 0.76, 0.86, 0.97 and 1.

We use the following non-linear random effect model specification to estimate α for each treatment:

$$y_{is} = 1 - m_i + (2m_i - 1) \Big/ \left[1 + \left(\frac{1}{p_s} - 1\right)^{1/(\alpha-1)}\right] + \epsilon_{is}.$$

Here y_{is} is spectator i's redistributed share under scenario s, and ϵ_{is} denotes the residual with noise uncorrelated across spectators and scenarios.

Table 3 reports the estimate for each treatment. The estimated curvature parameter α is significantly greater than 2 in all treatments at least at the 5% level, consistent with the notion that a convex loss function can rationalise these meritocratic spectators' behaviour, that is, uncertainty or ambiguity regarding attribution of inequality to merit exerts an egalitarian pull among these spectators.

We observe that the curvature parameter in the Vary-Education treatment is the greatest, which reflects the fact that spectators were highly sensitive to redistributing the payments fairly in that scenario. The next highest curvature parameter was in the Vary-Probability treatment, and the lowest out of the three (while still of a high value greater than 2) was in the Vary-Employment treatment. This may be interpreted as reflecting spectators' relative willingness to tolerate deviations from fairness in the unequal employment opportunity settings, which may again stem from the differences in workloads completed between the two workers.

3.2.3. *Perceptions of worker effort*

In this section, we utilise spectators' answers to the post-experimental questionnaire of the follow-up experiment, to address potential concerns about the design in the main experiment regarding whether spectators' perceptions of worker effort across the different treatments were responsible for the redistribution results.

In the Random-Education treatment, our design aims to minimise the likelihood that the performance differential in the knowledge evaluation can be attributed to differences in effort. From an ex ante standpoint, both workers are expected to exert a similar amount of effort both in terms of studying reading materials and completing the knowledge evaluation. Similarly, in the

[21] Let us take the calculation in the 15-versus-0 scenario as an example. The average belief is 0.05 in the 15-versus-0 scenario and 0.52 in the 15-versus-15 scenario. The probability p of the higher earner also being the higher performer in the counterfactual scenario with equal opportunity is calculated as $1 - (0.52 - 0.05) = 0.53$.

Table 4. *Spectators' Opinions about Workers' Efforts and Their Redistributed Shares.*

	15 vs. 4 Vary-Education	15 vs. 4 Vary-Employment
Similar effort in reading materials and similar effort in answering questions	$N = 102$ Mean (SD) = 0.43 (0.14)	$N = 37$ Mean (SD) = 0.29 (0.19)
Having doubts about one of the effort domains	$N = 108$ Mean (SD) = 0.32 (0.20)	$N = 174$ Mean (SD) = 0.26 (0.17)
Having doubts about similar effort in reading materials	$N = 83$ Mean (SD) = 0.32 (0.21)	$N = 116$ Mean (SD) = 0.24 (0.17)
Having doubts about similar effort in answering questions	$N = 102$ Mean (SD) = 0.33 (0.21)	$N = 169$ Mean (SD) = 0.26 (0.17)

Random-Employment treatment, both workers are ex ante anticipated to exert a similar amount of effort in studying the reading materials. The unequal performance opportunity in the knowledge evaluation inherently leads to a difference in the effort *able to be exerted* across workers, but is not expected to alter the incentive to exert effort.

Despite our design efforts to maintain workers' incentives to study the materials and work as uniformly as possible, the key factor is spectators' perceptions of workers' efforts and how these perceptions influence their redistributive decisions.[22] Therefore, in our follow-up experiment, we asked spectators to express their opinions about whether the two paired workers subject to their redistribution decision exerted similar effort in reading materials and answering the knowledge questions. Table 4 illustrates the distribution of spectators' opinions and the share redistributed in the 15-versus-4 scenario (equivalent to the situation in the main experiment) for each category of opinions. In the presence of unequal educational opportunities, 48.6% of spectators believed that both workers exerted similar effort in both reading materials and answering questions. Their average redistributed share is 0.43, nearly identical to the 0.44 share in the 100% luck scenario. Thus, when spectators perceive that the different rewards are only due to unequal educational opportunities, their redistribution choices are equivalent to the scenario that the outcome is entirely due to luck. If spectators have doubts about the similarity of effort exerted across the two workers either in reading the materials or in answering the questions, their redistributed share falls to approximately 0.32, which is significantly lower than the share redistributed by those without doubt about workers' similar effort levels ($p < .001$, Wilcoxon rank-sum test). These findings offer suggestive evidence for how differential perceptions regarding worker effort under unequal circumstances influences when spectators will fully or only partially account for the impact of unequal opportunities in their redistribution decisions.

Somewhat different results emerge in the presence of unequal employment opportunities. Only 17.5% of spectators believe that both workers exert similar effort in both reading materials and answering questions, and doubts are mainly focused on unequal efforts in answering questions. However, even among these spectators, their average redistributed share of 0.29 is not significantly higher than that redistributed by others who harbour at least one type of doubt about the workers'

[22] We did not require workers to study the reading materials or work on the knowledge evaluation for the entire 5-minute period; they were permitted to proceed to the next page at any time within this time frame. Although we did not inform spectators of this detail, it is plausible that some may have had doubts about the claims of similar effort, particularly regarding knowledge questions in scenarios with unequal employment opportunities. Some might have even suspected cheating by copying the reading materials, a possibility we could not prevent in online experiments. To investigate this, we asked spectators to recall a specific scenario of unequal opportunity and envision a situation where the disadvantaged worker excels. They were then asked to select the most likely explanation from a multiple-choice question, with cheating as one of the options. Reassuringly, no spectator chose this response, allowing us to rule out perceptions of cheating as a factor in spectators' impressions about workers' efforts.

similar efforts. This indicates that the differences in evaluation tasks have a more potent impact on spectators' decisions than the facts about unequal opportunities.

In summary, the belief in workers' similar effort levels in the studying and work domains leads spectators to regard unequal educational opportunities as more consistent with pure luck, yet has almost no impact on their redistributive choices under unequal employment opportunity. It is also worth emphasising that even when some spectators expressed doubts about the claims of similar effort between the two workers, they do not entirely reject the influence of unequal opportunity, and thus at least partially compensate the disadvantaged worker.

4. Further Results on Information-Seeking Behaviour and External Validity

4.1. *Do Spectators Actively Seek Information about Unequal Opportunities?*

The treatments of the main experiment show that information about the origins of unequal opportunities is a key explanatory factor in redistribution choices. However, lack of information about unequal opportunities is precisely one of the greatest challenges when dealing with inequality in the real world. That is, it is often easy to overlook how a person's performance advantage is gained. For example, school admission officers might only see the scores of prospective students without knowing or paying much attention to students' family backgrounds that influence their pre-application educational opportunities; human resource administrators may only see the previous track records of two job candidates, while dismissing their prior career opportunities.

Therefore, the natural next question to ask is whether people would be willing to investigate the underlying source of performance inequality, even if it costs them personal effort and time. To this end, we designed two additional treatments to discern whether spectators, knowing about the *possibility* of unequal opportunities, proactively choose to search for information about the source of the performance differential. In both information treatments, before making redistributive decisions, spectators had the option to exert effort in a real-effort task in order to find out whether the pair of workers faced unequal opportunities. Online Appendix B presents a complete description of the treatment design and data analyses.

The main outcome variable of interest is whether spectators spend effort in the real-effort task to reveal information about unequal opportunities. We observe that across both treatments, almost 50% of spectators chose not to do so. Further regression analyses show that spectators' redistributive decisions do not depend on whether they learned about the presence of unequal opportunities or whether the information was actively or passively learned.

Despite the fact that only around 50% of the spectators were willing to expend personal effort to learn about whether unequal opportunities existed in the workers' scenario, when making redistribution choices, they behaved as if they knew about its presence. These results suggest both good and bad news regarding individuals' redistributive preferences. The good news is that people tend to assume the 'worse' of the scenarios and take the presence of unequal opportunities into account when making their redistributive decisions. However, we caution that this result might be due to the salience of the possibility of unequal opportunities in our experimental design. On the other hand, the bad news is that a substantial proportion of spectators did not seem to truly care about checking whether unequal opportunities existed. We view this finding as preliminary evidence in an extended line of research that seeks to determine whether fairness preferences elicited based on situations in which information on origins of inequality is available for free (as is true in almost all existing studies) are robust to situations in which an individual

making redistributive decisions must incur a personal cost to gain accurate information about sources of inequality.

4.2. *Supporting Evidence about External Validity*

Our experimental design presents a controlled environment to detect the causal impact of unequal opportunities on redistributive preferences. A natural concern is about the external validity of the results found in these relatively artificial scenarios. To shed light on this issue, we briefly discuss some findings from a vignette study with real-world scenarios that we administer in the worker survey in the main experiment. Online Appendix C presents a complete description of the study design and data analyses.

Before workers started to work on their main task, they were asked to answer a question about a brief hypothetical scenario. Workers were randomly assigned to one of the six hypothetical scenarios, independently of the treatment scenario they were assigned to as workers in the main experiment. The exact text of each scenario is presented in the experimental protocol for workers in Online Appendix E. We deliberately placed the hypothetical scenarios chronologically before the performance task for the main experiment, so that workers' answers to the hypothetical scenarios would not be potentially affected by their experiences in the knowledge evaluation task.

Each hypothetical scenario provides a description of how a manager should allocate a bonus to two employees within a corporate setting. For example, in a scenario designed to provide a more realistic real-world scenario mirroring the learning opportunities in the Random-Education treatment, the background story is about two employees being requested to take a certification test after participating in the same training program. But one employee is randomly selected to participate in a new and improved training program, while the other is still enrolled in the ordinary training program. Both of them pass the test, but the former employee obtains a higher score and is awarded a bonus of \$600 by his company. We then asked our participants to state their opinions about how a manager should redistribute this bonus. Other hypothetical scenarios are designed to mimic other treatments in the main experiment except for the Luck treatment.

Overall, the answers across the hypothetical scenarios, to some degree, help confirm the external validity of the findings in our main experiment. People do consider the impact of unequal opportunities when deciding upon the fair allocation of total earnings, and the allocation result lies in between that of merit and luck alone. In particular, compared to the actual decisions in the Merit and Random-Education treatments, we observe remarkably quantitatively similar results in corresponding hypothetical scenarios.

5. Discussion and Conclusion

Unequal opportunities permeate almost every aspect of society, and inspire intense intellectual debates regarding the morality of such situations and their often negative impact on our society. Some of them, such as inherited wealth, even have a direct impact on income inequality (Lekfuangfu *et al.*, 2023). Compared to more obvious disadvantages that individuals may face in society, unequal opportunities play a more subtle, but profound role in influencing their earnings prospects through, for example, early-life education (Falk *et al.*, 2021) and homophilic job-related networks (Jackson, 2021).

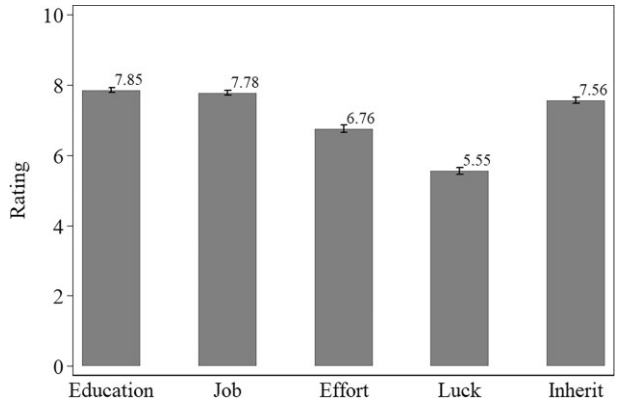

Fig. 4. *Rating of Factors Contributing to Socio-Economic Inequality.*
Note: The figure shows the average rating of the importance of each factor in causing socio-economic inequality. SEs are indicated by the bars.

To gauge the importance individuals assign to commonly discussed sources of inequality, we asked participants in our post-experimental survey for workers in the main experiment to indicate their beliefs about the significance of five specific factors in causing socio-economic inequality within the United States. These factors were education ('some people have better educational opportunities than others'), job opportunities ('some people have access to better job opportunities than others'), hard work ('some people work harder than others'), luck ('some people have better luck than others') and inheritance ('some people have inherited money from their family, giving them a head start compared to others'). For each factor, participants rated its perceived importance from 1 to 10, with 1 indicating 'not important at all' and 10 indicating 'extremely important'. Figure 4 shows the average rating for each factor. Interestingly, and consistently with the overall research question of our study, we observe that unequal educational and job opportunities are considered to be more important than either hard work or luck (for each pairwise comparison, $p < .001$, Wilcoxon signed-rank test). Meanwhile, inheritance is considered slightly less important than educational opportunities ($p = .009$), but more important than hard work ($p < .001$). This emphasis on education agrees with a global survey by Pew Research Center, in which people rated education as the most important factor for getting ahead in life (Pew Research Center, 2014).

Despite the perceived importance of unequal opportunities for our society at large, thus far there has been little scientific assessment of individuals' fairness perceptions and redistribution preferences towards circumstances involving unequal opportunities. Our study helps to fill this gap. Conceptually, unequal opportunity can be understood as a form of underlying luck, which occurs prior to the actual performance evaluation. We introduce a novel experimental approach to study two different forms of unequal opportunities with a design inspired by real-world observations about unequal educational and employment opportunities.

In our first experiment, which utilises participants representative of the US population, we exogenously manipulate the educational or employment opportunities presented to one of the paired workers. We find that both unequal educational and employment opportunities lead spectators to choose more equalising outcomes compared to the benchmark Merit treatment (equal

opportunity). However, the amount redistributed is not as large as in the benchmark Luck treatment, in which pure luck determines the initial income inequality. Thus, inequality stemming from unequal opportunities is considered unfair, but not fully equivalent to pure luck. In fact, we find that unequal educational opportunities are perceived as closer to pure luck in terms of deservingness of redistribution than unequal employment opportunities.

In our follow-up experiment, which is similarly targeted at the US population, we further investigate the impact of varying degrees of unequal opportunities on redistributive preferences. We first successfully replicate the findings from the main experiment and then show that small uncertainty or ambiguity exerts an egalitarian pull on the redistributive behaviour of meritocratic spectators. This pattern is commonly observed regardless of whether inequality is probabilistically determined by either luck or performance, or influenced by varying degrees of unequal opportunities. A structural estimation exercise further indicates that this pattern is consistent with a meritocrat's attempt to minimise a convex loss function that represents deviations from the perceived fair redistribution in the scenario with a level playing field.

In real life, the presence of unequal opportunities is often not immediately observable due to either their indirect role in influencing income as mentioned earlier or perhaps their socially uncomfortable nature that often makes advantaged people purposefully hide this fact from outsiders. In our additional treatments from the main experiment where spectators needed to expend effort to reveal information about the presence of unequal opportunities, we find that a substantial proportion of them do not appear to sufficiently care about the source of performance differential and thus decline to reveal such information. Even though their redistribution decision does not appear to be affected by the information, it still raises concerns about whether people truly care about equalising outcomes based on the actual sources of inequality in society.[23] More broadly, these findings raise a potentially important methodological question: to what extent do redistributive preferences measured in existing studies, where information is freely available, accurately represent individual attitudes in real-world policy-making scenarios? More research is needed to gain a better understanding of the effect of information on people's redistribution preferences beyond our relatively low-stake environments.

One of the practical implications of the findings in this paper concerns the use of technology and automation in making business decisions, such as hiring workers. Understanding that worker performance is influenced by past advantages, such as being born into better neighbourhoods or attending superior primary schools, these initial advantages can be compounded over time. Algorithms designed to be merit oriented, such as those recommending candidates by matching them with past successful individuals (known as 'Doppelgangers'), could inadvertently perpetuate these disparities. This is because they often overlook the unequal opportunities contributing to past success, and thus their decisions may not guarantee fair assessments of the opportunity factors considered in our study. The resulting cycle of path-dependent job seeking and matching could limit social mobility and contribute to polarisation in attitudes towards redistributive policies. This stems from varying understanding among citizens about the algorithms' true nature,

[23] In the vignette study, under two scenarios akin to information-seeking treatments, participants were asked to indicate their belief about what percentage of managers would check the relevant information (i.e., the training program history or department assignment) before deciding about how to award the bonus. They assumed that a relatively high fraction (around 66%) of supervisors would investigate the sources of workers' unequal opportunities, which is higher than the actual rate of information seeking in the main experiment. These contradictions are worrisome in that they suggest a passive role of decision-makers in getting to the bottom of the sources of inequality, while they simultaneously think that inequality in opportunity is very important and believe that others will do the work to bring fairness to unequal situations.

particularly under possibly misguided assumptions that automated processes are objective and, thus, inherently fair. Our study underscores the importance of fostering public awareness of how decision algorithms function, and cautioning against automatically assuming that computerised decisions are always fair and just. Hence, an essential direction for future research lies in examining people's fairness attitudes in contexts involving AI-driven unequal opportunities, recognising that these algorithms' primary goal is merit-based selection, but their lack of consideration for unequal circumstances may lead to fairness concerns.

Finally, a potential direction for future research is to examine attitudes towards one worker being distinctly advantaged or disadvantaged over the other through other possible sources of unequal opportunities. Some possible sources of advantage that could be simulated in an experimental setting include bribery/corruption, cheating and nepotism. Unlike our cases of educational and employment opportunities examined here, which are random and thus arguably moral-free, these other sources possess some moral valence and are, therefore, qualitatively different. Such a direction can help extend the objective of our line of inquiry, which seeks to better understand preferences for redistribution under heterogeneity in underlying opportunity.

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Additional Supporting Information may be found in the online version of this article:

Online Appendix
Replication Package

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