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Measuring Inequality of Opportunity Using Sampling-Based Shapley Decomposition:
Application to Australian Data 2002-2015

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In this paper, we measure inequality of opportunity in Australia between 2002 and 2015 accounting for a large set of observed circumstances. Following recent work in the measurement of inequality of opportunity, we divide income inequality into factors beyond individuals' control (circumstances) and factors within individuals' control (effort). On the one hand, our analysis shows that the conventional methods in measuring inequality of opportunity result in an upward bias when there is a large set of circumstances. On the other hand, our analysis also shows that, the method of measuring the individual contributions of circumstances leads to an underestimate result due to correlation among circumstances, so that summing up all contribution estimates as an overall measure of inequality of opportunity will incur a downward bias.. To address these issues, we use a sampling-based Shapley decomposition approach to measure the overall contribution of circumstances to income inequality for each year and the contribution of each circumstance variable. This approach allows us to reduce the bias due to a sparse division given a large set of circumstances and to massively improve computational efficiency. Based on this approach, we find that on average, at least 17.50% of income inequality in Australia is due to factors regarded as "circumstances". Inequality of opportunity slightly declines during 2002 and 2015 and it fluctuated less than income inequality during this period. Using the Shapley decomposition, we identify circumstances such as parents' socioeconomic status and geographic locations contributing the most to income inequality, while the effect of the indigenous status increases during this period.