

# Low Sample Complexity Participatory Budgeting

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**Abstract:** We study low sample complexity mechanisms in participatory budgeting (PB), where each voter votes for a preferred allocation of funds to various projects, subject to project costs and total spending constraints. We analyze the distortion that PB mechanisms introduce relative to the minimum-social-cost outcome in expectation. The Random Dictator mechanism for this problem obtains a distortion of 2. In a special case where every voter votes for exactly one project, [Fain et al '17] obtain a distortion of  $4/3$ . We show that when PB outcomes are determined as any convex combination of the votes of two voters, the distortion is 2. When three uniformly randomly sampled votes are used, we give a PB mechanism that obtains a distortion of at most 1.66, thus breaking the barrier of 2 with the smallest possible sample complexity.

We give a randomized Nash bargaining scheme where two uniformly randomly chosen voters bargain with the disagreement point as the vote of a voter chosen uniformly at random. This mechanism has a distortion of at most 1.66. We provide a lower bound of 1.38 for the distortion of this scheme. Further, we show that PB mechanisms that output a median of the votes of three voters chosen uniformly at random have a distortion of at most 1.80.

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