Voting Systems:
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Quadratic Voting:
On the example of Collusion on VCG mechanism slide:
- the explanation is right, but the example will be better if we have 5 voters rather than 4 voters as we have on the slide, because of the number of payments calculated based on all valuation.

QV - Extreme cases

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$$v_i = sign(u_i)\left(\frac{2p}{a}\right)^{\frac{1}{a-1}} |u_i|^{\frac{1}{a-1}}$$

- a = 1, dictatorship of most intense voter
- a = ∞, reduced to 1p1v
- QV is an optimal intermediate point between the extremes of dictatorship and majority rule.

- If a goes to 1, then a small increase in utility will require an infinite number of votes.
- If the value of a goes to infinity, the valuation of utilities for all people is having only slight differences (utility is slightly better than people's valuation).
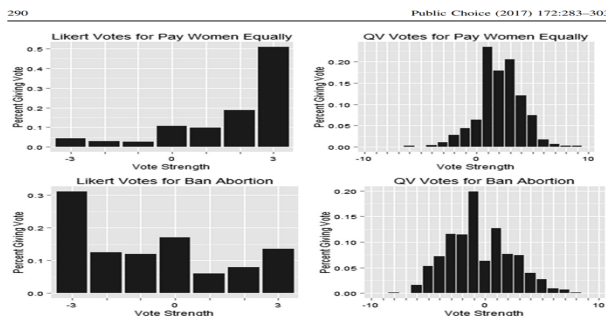
Likert scale vs QV

Fig. 1 Voting distributions on two proposals (paying women equally and banning abortion) in the Likert-only (n = 1095) and QV-only (n = 1048) test conditions

- Voice credits distributed for each respondent: 100
- Likert scale is widely used in many sociology, psychology experiments.
- The problem for the Likert scale is usually they reported the median or mean value, the problem with this is oftentimes the Likert scale doesn't consider ordinality. As we can see on the W shape result on the Likert votes for Ban abortion, people can either hate it,

be neutral, or like it, so the mean/median aggregation can't be robust enough for interpretation
- The threshold of preferences can be different across the population and it is possible that quadratic voting can essentially help with restricting budget and see an overall preference for a set of problems. The student points out: if only extreme values are captured, then it might not represent the true population of preferences on society => this where the QV can help.
- For the Likert Scale, the threshold of how a voter goes from a lower score to the next higher score is unclear.
- Need to be examined more

Knapsack Voting
- Example case: teacher want to grade students' project in architecture class using the value for money (knapsack) technique with LP relaxation
    - A student points out: this might introduce bias because students might have different knowledge on evaluating the subject
    - Order can also affect the evaluation
    - Professor points out: computing the total number of disagreements is actually pretty useful since it can make a close solution to the best with less effort than asking students to comment or grade for all projects.
- The Participatory Budgeting paper and framework: the online tools they proposed made a huge impact on society.
- Comment on the fractional participatory budgeting: it adds more layer on the complexity and it will be difficult to implement on the paper voting format.

After class discussion
- Is it possible for the government to frame/direct the people preference on the knapsack voting
    - Definitely possible, the government can use this to direct the people's preference by selecting the only projects that can benefit certain people. In my personal opinion, I think this is where transparency is important from the proposal submissions to the accepted project so we can know and trace the provenance of each proposal, who are responsible, who will benefit the most.
- Quadratic Voting mechanism with bank/deposit voices credit might lead to another problem in society which is 'vote markets' / free trade
- The knapsack is almost always working on a small set of problems (project), will be harder on the bigger number of project, need more tradeoff on maximizing the result
- Role of computing (computer scientist): How we can elicit true preferences without a hard computation mechanism.