oTree-QVSR: An Open-Source Application for Quadratic Voting Survey Research

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Abstract

Quadratic Voting (QV) is a collective decision-making mechanism that enables participants to express the intensity of their preferences by purchasing votes at a quadratically increasing cost. Despite the growing interest in QV within economics and finance, standardized experimental tools remain scarce. This paper introduces oTree-QVSR, an open-source application built within the oTree framework that facilitates the design and implementation of QV surveys in both laboratory and online settings. Unlike prior standalone QVSR survey platforms such as Civicbase, oTree-QVSR leverages oTree's experimental architecture—including real-time interaction, session control, and seamless integration with other behavioral tasks. The app enables researchers to specify voting options, allocate vote budgets, define cost functions, and combine QV with other modules such as market, risk, or coordination games. By embedding QVSR within the oTree ecosystem, this tool lowers the technical barrier to experimentation, promotes reproducibility, and expands the repertoire of standardized applications available to behavioral economists and finance researchers. oTree-QVSR thus bridges methodological developments in survey research with the rigor and flexibility of controlled experimental design.

1. Introduction

Decision-making in financial and economic contexts often involves aggregating heterogeneous preferences across individuals. Traditional one-person-one-vote systems provide equal weight to all participants but fail to account for varying intensities of preferences. Quadratic Voting (QV), introduced by Lalley and Weyl (2018), offers a novel mechanism that allows individuals to purchase votes on issues, with the costs increasing quadratically. This property incentivizes truthful revelation of preference intensity, potentially leading to more efficient outcomes (Posner & Weyl, 2018).

QV has gained attention in domains such as corporate governance, survey research, and public finance (Goeree & Zhang, 2017; Masur, 2017). Recent work has extended QV to survey research, most notably through the CivicBase platform(Bassetti et al., 2023). Their results highlight the promise of QV as a general-purpose tool for eliciting preferences. Similar findings come from experiments in human–computer interaction and public opinion research, where QV elicited preferences more aligned with incentive-compatible benchmarks than Likert scales (Cheng, Li, & Karahalios, 2021). Theoretical work has also compared QVSR with Likert from a decision-theoretic perspective, showing when respondents may strategically misreport under each format (Cavaillé, 2020).

While CivicBase is an open-source, standalone web platform, it is less adaptable for integration with broader experimental designs. oTree-QVSR is purpose-built for experimental control and seamless integration with behavioral and economic experiments. By embedding QVSR within oTree, researchers can combine preference elicitation with canonical experimental tasks such as asset markets, risk elicitation, or public-goods games, thereby extending the methodological reach of Quadratic Voting into incentive-compatible settings.

oTree itself provides a flexible, modular environment for interactive experiments across laboratory, online, and hybrid settings (Chen, Schonger, & Wickens, 2016). It supports real-time interactions between participants, customizable session parameters, automated data export, and cross-app communication through standardized model and session configurations. Researchers can implement multiplayer coordination, market trading, voting, or survey tasks using a consistent Python-based API and deploy them locally or on cloud servers. These capabilities have made oTree a foundation for many canonical experimental tools, including the bubble game (Palan, 2015; Angerer et al., 2016), the bomb risk elicitation task (Crosetto & Filippin, 2016), and public-goods and bargaining games widely used in behavioral finance.

Building on this infrastructure, oTree-QVSR introduces a dedicated module for implementing Quadratic Voting surveys within the oTree ecosystem. It enables researchers to specify voting options, endowments, and cost functions, and to integrate QV mechanisms directly with other experimental tasks. By embedding QVSR within oTree, this tool lowers the technical barrier to experimentation and extends the methodological toolkit available for studying preference aggregation, decision-making under incentives, and collective choice.

2. The oTree-QVSR Application

2.1 Architecture and Features

oTree-QVSR is implemented as a standard oTree app and can be seamlessly integrated into any experimental project. The application is structured around three configurable elements:

- Options: The set of alternatives available for voting, defined as a list in settings.py.
- Vote credits: The total number of vote credits available to each participant.
- Quadratic cost function: The cost of allocating v votes to an option is v^2, ensuring convex costs that limit extreme allocations.

The user interface allows participants to allocate votes through interactive buttons, with real-time feedback on costs and remaining credits. The backend records vote allocations, quadratic costs, and total credits spent in JSON format, ensuring compatibility with subsequent data analysis workflows.

Figure 1: oTree-QVSR interface

2.2 Open Source Availability

oTree-QVSR is open-source software, distributed under the MIT License. The source code and documentation are available on GitHub at: https://github.com/njogumbau/qvsr. Detailed instructions for installation, customization, and integration are provided in the repository's README file.

2.3 Installation and Quick Start

oTree-QVSR can be added to any existing oTree project with minimal setup.

Researchers can either clone the GitHub repository or copy the qvsr app folder into their oTree project directory. The application runs on standard oTree dependencies (Python ≥ 3.9, oTree ≥ 5.10).

Installation Steps

Clone or download the repository:

- git clone https://github.com/njogumbau/qvsr.git
- Copy the qvsr directory into your oTree project.

Add the app to your SESSION_CONFIGS in settings.py:

```
SESSION_CONFIGS = [
  dict(
    name="qvsr_demo",
    display_name="Quadratic Voting (QVSR) Demo",
    num_demo_participants=1,
    app_sequence=["qvsr"],
    # --- QVSR parameters ---
    qvsr_options=["Tax Cut", "Green Bonds", "R&D Subsidy"],
    qvsr_credits=25,
    qvsr_cost_fn="quadratic",     # or "concave_pilot" or a callable
    qvsr_allow_negative=False,    # allow negative votes? default is False
    qvsr_feedback=True,           # show live budget/cost feedback in UI, default is True
  ),
]
```

Launch oTree locally and open a demo session:

- otree devserver

The interface allows participants to allocate votes interactively with real-time feedback on costs and remaining credits. Data can be exported as CSV from the oTree admin interface.

2.4 Configuration Parameters Reference

oTree-QVSR is designed for flexible customization through a small set of parameters.

- qvsr_options (list[str]): List of policy or survey items to vote on.
- qvsr_credits (int): Number of vote credits allocated to each participant.
- qvsr_cost_fn (str): Cost function used for pricing votes. Defaults to "quadratic".
- qvsr_allow_negative (bool): Enable negative votes if desired. Default: False.
- qvsr_feedback (bool): Display live feedback on remaining credits and total cost. Default: True.

2.5 Custom Cost Functions

Users may define alternative pricing schemes by editing __init__.py:

- def quadratic_cost(v): return v*v
- def concave_cost(v): return int(1.8 * v**1.6)

COST_FUNCTIONS = {"quadratic": quadratic_cost, "concave": concave_cost}

This modular structure allows the cost function to be swapped or extended with minimal code changes.

3. Applications

The oTree-QVSR framework extends the reach of Quadratic Voting (QV) from theoretical constructs to applied research in decision-making, survey design, and behavioral finance. By embedding QV within a flexible experimental environment, researchers can examine how individuals allocate votes under budget constraints and trade-offs across competing policy or market dimensions. The following subsections highlight representative domains where this tool enhances experimental control, scalability, and analytical depth.

3.1 Collective Decision-Making

Quadratic Voting refines traditional one-person-one-vote systems by enabling individuals to express both the direction and intensity of their preferences (Lalley & Weyl, 2018; Masur, 2017). Experimental evidence indicates that QV can improve allocative efficiency when participants comprehend its convex cost rule and when budget constraints are transparent (Goeree & Zhang, 2017).

Using oTree-QVSR, researchers can test these dynamics in group settings where participants allocate vote credits across multiple public projects, each with increasing quadratic costs. The system records allocation patterns, allowing analysis of welfare outcomes, efficiency, and equity. Its modular design also permits variations in institutional framing—such as public versus private voting or pooled versus individual budgets—making it suitable for studying governance design, deliberation, and collective action mechanisms.

3.2 Survey Research and Regulatory Valuation

QV can enhance survey research by eliciting the intensity of respondents' preferences, addressing the limitations of ordinal measures such as Likert scales and conjoint analysis. Evidence from human–computer interaction and political psychology shows that QV captures richer preference structures and mitigates ceiling effects (Cheng et al., 2021; Cavaillé et al., 2025). However, the cognitive demands of understanding convex pricing and managing vote budgets can affect accuracy and engagement, while framing and endowment structures influence willingness to spend (Cheng et al., 2025; Cavaillé et al., 2025).

A large-scale field study by us demonstrates QVSR's scalability and policy relevance (World Bank 2024). Conducted across all 79 municipalities in Estonia, we embedded a QVSR module within a three-part questionnaire on local service quality monitoring. Respondents—municipal officials and citizens—first distributed vote credits across broad service categories (e.g., education, infrastructure, and social services) and then allocated additional credits among sub-dimensions within each category, such as teacher quality or road maintenance. This two-tiered design captured preference intensity at both strategic and operational levels, generating detailed "priority maps" across governance dimensions.

The survey was implemented online by Kantar Emor between November 2022 and April 2023, achieving a 79% response rate. Aggregated results were displayed on the Minuomavalitsus dashboard, allowing local governments to compare citizens' priorities with objective performance indicators. This feedback loop turned QVSR into an interactive governance instrument, connecting elicited preferences with administrative decision-making.

The oTree-QVSR module enables researchers to replicate and extend such large-scale designs under controlled experimental conditions. It supports the testing of cost functions, framing effects, and information treatments before real-world deployment, providing a methodological bridge between laboratory experimentation and field-based policy evaluation.

3.3 Corporate Governance

In corporate governance, Quadratic Voting offers a mechanism for shareholders to express varying intensities of preference across resolutions. Traditional voting systems treat all votes equally, which can lead to inefficient outcomes when shareholder interests diverge. QV internalizes the marginal cost of influence, allowing participants to concentrate votes on issues of greatest concern (Lalley & Weyl, 2018; Posner & Weyl, 2018).

Using oTree-QVSR, researchers can simulate shareholder meetings, model capital-weighted participation, and study how liquidity, information asymmetry, or coalition dynamics affect equilibrium outcomes. The platform’s flexibility allows systematic exploration of how QV interacts with institutional constraints and governance rules.

3.4 Experimental Asset Markets

Integrating QV mechanisms into asset market experiments opens new possibilities for analyzing belief intensity and information aggregation. Research in experimental finance and risk elicitation (Palan, 2015; Angerer et al., 2016; Crosetto & Filippin, 2016) shows that individuals often misstate confidence or overreact to signals. QV-based trading tasks could enable participants to express belief strength through quadratic vote purchases tied to market outcomes.

oTree-QVSR facilitates these hybrid designs, linking QV decisions to payoff-relevant tasks. This integration allows investigation of how preference intensity relates to trading volume, price discovery, and coordination efficiency, advancing behavioral finance and mechanism design research.

4. Limitations and Future Work

While oTree-QVSR offers a standardized and flexible implementation of Quadratic Voting for survey research, several limitations remain. QV requires participants to reason about convex costs, which can create cognitive demands compared with simpler response formats (Cheng, Li, & Karahalios, 2021). Outcomes are also sensitive to how budgets and endowments are framed, influencing willingness to spend and the expression of preference intensity (Eguia & Xefteris, 2021).

Field deployments such as the World Bank (2024) study show that comprehension and participation improve with clear interfaces and real-time feedback, yet heterogeneity in attention and numeracy still constrains efficiency. Future research should test alternative cost functions, improved user interfaces, and cross-context replications to evaluate robustness and external validity.

5. Conclusion

This paper introduced oTree-QVSR, a configurable, open-source module for implementing Quadratic Voting surveys within the oTree framework. The application lowers the technical barrier for deploying QV experiments and extends oTree’s ecosystem with a mechanism for eliciting preference intensity. Its flexibility makes it suitable for diverse research contexts, including shareholder voting, regulatory consultation, and public-goods provision.

Unlike standalone platforms such as CivicBase(Bassetti et al., 2023), oTree-QVSR integrates Quadratic Voting directly into the oTree architecture for real-time session control, participant interaction, and data collection. This enables researchers to embed QV mechanisms alongside canonical experimental tasks—such as asset-market or public-goods games—creating richer, multi-stage designs that connect voting behavior to economic decision-making.

Field implementations, including our nationwide Estonia study, illustrate the scalability and policy relevance of QVSR. By standardizing its implementation within a widely adopted behavioral platform, oTree-QVSR bridges the gap between survey-based preference elicitation and controlled laboratory experimentation, advancing research on collective decision-making, incentive alignment, and policy evaluation.

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