THE HANDBOOK FOR RADICAL LOCAL DEMOCRACY v2.0

RadicalxChange

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Executive Summary

This Handbook is a toolkit for local policymakers and engaged citizens to take new approaches to some of the most pressing political problems. From voting and citizen engagement to investment in shared public goods to e-scooter regulation, this Handbook addresses crucial urban issues from a simple, clarifying point of view. Namely, we think that excessive concentrations of power, whether private or public, inhibit democracy and distort markets. Informed by leading research in economic incentive design, RadicalxChange represents a new "middle path" through the dilemmas of public versus private, left versus right, and market versus design. In this spirit, this Handbook presents three new policies and walks through applications of each to several urban issues. The policies are:

Quadratic Voting (QV). QV allows voters to express the intensity of their votes, rather than simply voting yes/no or ranking their choices. In doing so, QV protects minority interests and discourages polarization. It is a fundamentally better way to get citizens engaged in democratic processes.

Quadratic Finance (QF). QF is a new public funding formula that solves the classic "free rider" problem and addresses under-investment in public goods. With QF, individuals can contribute directly to local public projects. Projects with wider bases of support receive larger matches from public funds. QF has the potential to revolutionize campaign funding and local infrastructure projects, among many other areas.

Self-Assessed Licenses Sold via Auction (SALSA). SALSA is an innovative licensing structure that cuts through the false dichotomy of public versus private ownership. Under SALSA, a private individual holds an asset so long as she maintains the highest self-declared value for that asset in a public marketplace, standing ready to sell the asset to any willing buyer at their declared price. It promotes both efficiency and equality in a range of settings: commercial land, public road usage, bike and e-scooter sharing programs, just to name a few.

A call to action. This work is not merely academic. We are working to develop software platforms for the mechanisms discussed in this article, in partnership with Polco in the United States, as well as Democracy Earth, CONSUL, and others globally. Many startups and established companies are likewise operationalizing RadicalxChange ideas and proving their viability. We encourage readers who are interested to email us at info@radicalxchange.org, visit https://radicalxchange.org/, and follow us on Twitter at @RadxChange.

Quadratic Voting

WHAT IS QUADRATIC VOTING?

Quadratic Voting (QV) is a new voting system that allows voters to express the intensity of their preferences. Rather than simply voting yes/no or ranking their choices in order, voters spend “voice credits” across a range of choices. Quadratic Voting incorporates the advantages of other enhanced voting systems, such as ranked-choice, while going further in terms of allowing voters to easily express complex preferences. The research behind QV shows that it reduces polarization and allows voters to coherently weigh in on more complicated questions.

QV has begun expanding beyond academia. For example, in 2019 the Democratic Caucus of the Colorado House of Representatives successfully used Quadratic Voting to decide which spending bills to prioritize.[1] The experiment was a success, and cutting-edge institutions[2] all over the world are now adopting Quadratic Voting for both internal and public decision-making processes.

HOW DOES IT WORK?

In Quadratic Voting, each voter starts with an equal budget of “voting credits”. They can then allocate these credits to different voting issues as they please. To illustrate, picture a ballot with 10 issues or questions on it. Each voter likewise has 10 voting credits, and each vote “costs” one voting credit. So, they may simply choose to spend her 10 voting credits by casting one vote on each issue. But if she prefers to concentrate her voting power on a particular issue, she must pay a special cost for doing so. This cost is calculated as the **square of the number of votes cast.** In other words, if she chooses to vote twice on an issue, she must spend four voting credits (because two squared equals four). Similarly, if she chooses to vote three times on an issue, she must spend nine voting credits (because three squared equals nine). This dynamic is illustrated in the graphic on the next page.

1 Peter Coy, *A New Way of Voting That Makes Zealotry Expensive*, Bloomberg (May 1, 2019), https://www.bloomberg.com/news/articles/2019-05-01/a-new-way-of-voting-that-makes-zealotry-expensive.
2 Presidential Hackathon, Government of Taiwan, https://presidential-hackathon.taiwan.gov.tw/en/.

Credits	Votes
●○○○○○○○○○	1
●●●●○○○○○○	2
●●●●●●●●●○	3

Ideally, a Quadratic Voting ballot is set up with a number of proposals or candidates to choose from. Voters use their budget of voice credits--the size of which does not matter--to cast votes either for or against the proposals or candidates on the ballot.

Here is a premade spreadsheet that can be straightforwardly adopted for any Quadratic Vote.

REAL-WORLD USE-CASES

I. Citizen-facing decisions (elections, referenda, etc.)

Quadratic Voting can be done in large groups as well as small. As with any public election, it is important that the voting be done privately and that the identity of the voters be verified so that no one can vote more than once.

QV is primarily a decision tool--it cannot necessarily determine the question that needs to be asked. Because the selection of which options are on the “menu” matters, ballots should be constructed through transparent deliberative processes and/or curated by trusted authorities.

II. Small group decisions within government bodies.

Instead of taking one-by-one, up-down votes on a series of proposals, committees can collect all issues and present them in one ballot for QV. After all the issues have been discussed and debated, members can vote privately and submit their votes simultaneously.

Example: Colorado State Government

The graph on page 10 shows the smooth prioritization curve that the Quadratic Voting process yielded for the Democratic Caucus in the Colorado State Representatives, who used it to prioritize a long list of spending bills in 2019.[3] This solved a very clear problem. In 2018, before using QV, the Democratic Caucus used a different process where each representative simply received 15 votes to cast for the 15 bills that they felt deserved funding.

3 Peter Coy, *A New Way of Voting That Makes Zealotry Expensive*, Bloomberg (May 1, 2019), https://www.bloomberg.com/news/articles/2019-05-01/a-new-way-of-voting-that-makes-zealotry-expensive.

That process generated what Representative Chris Hansen called a “big blob” of bills with roughly the same number of votes,[4] and no clear preferences between them. By contrast, QV generated a clearly ordered list, showing which bills have the most support and how steeply the support declines as one proceeds down the list. It is easy to think of other examples where this kind of prioritization curve would be desirable. For example, consider the front office of a sports team, which needs to decide not only how it orders an upcoming class of draft prospects, but also where in that ordered list the largest quality “drop-offs” occur. A Quadratic Vote would allow the whole scouting team to combine its assessments of a long list of draft prospects, thus identifying the quality drop-off points, and giving accurate information about the team’s degree of enthusiasm for each different player.

4 Brian Eason, *$120 million in requests and $40 million in the bank. How an obscure theory helped prioritize the Colorado budget*, Colorado Sun (May 28, 2019), https://coloradosun.com/2019/05/28/quadratic-voting-colorado-house-budget/.

Colorado 2019 Quadratic vote distribution

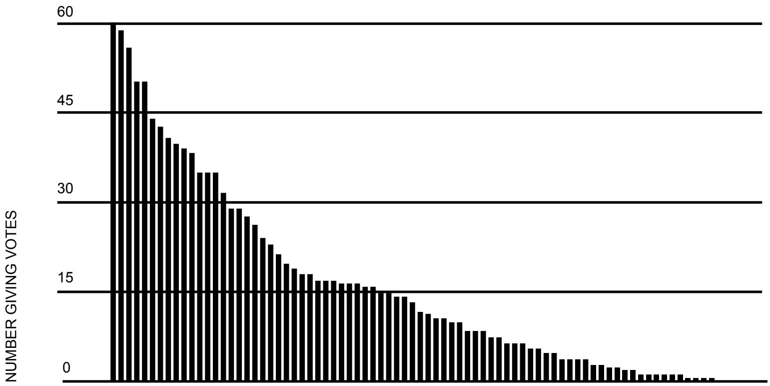


Table Of results For Colorado Quadratic vote (top 25)

60	Equal Pay For Equal Work Act
59	Demographic Notes For Certain Legislative Bills
55	CDPHE Maternal Mortality Review Committee
52	Youth Mental Health Ed & Suicide Prevention
52	Grants For Property Tax Rent & Heat
44	Mental Health Parity Insurance Medicaid
43	Health Care Cost Savings Act Of 2019
40	Increase Student Aid Application Completion Rates
38	School Nurse Grant Program
38	Comprehensive Human Sexuality Education
37	GreenHouse Gas Pollution Impact In Fiscal Notes
36	School Incentives To Use Colorado Food & Producers
33	Expand Child Nutrition School Lunch Protection Act
33	Sexual Assault While In Custody Or Detained
33	Office Of Public Guardianship Operation Conditions State
31	Court Administrator Reminder Program Increase Tax
29	Credit Allocation Affordable Housing Modify Innovative
29	Motor Vehicle Income Tax Credits Wildfire Mitigation
27	Wildland-Urban Interface Areas Child Care Expanses Tax
25	Credit Low-income Families Investment In Primary Care
23	To Reduce Health Cost CO Child Abuse Response And
22	Evaluation Network Child & Youth Behavioral Health
29	System Enhancement Regulate Student Education Loan
29	Servicers
18	Colorado Resiliency Office Reauthorization Funding

III. Surveys to gauge relative importance of issues.

Quadratic Voting has been shown to outperform the typical methods of preference-strength measuring (i.e., rating on a scale of 1-5, also known as a “Likert Scale”).[5] We recommend that local governments and/or individual elected officials use QV to understand voters priorities. For instance, a candidate running for city council could survey residents in her area to understand how strongly they feel about climate change versus improvements to education versus public transportation. Without imposing constraints on voters’ priorities through QV, it can sometimes seem like every issue is “the” most important one at any given time.

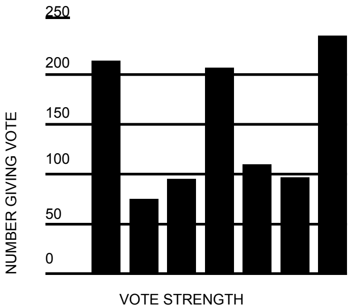
The figures on the following page, from research by David Quarfoot,[6] show the advantages of Quadratic Voting over a conventional survey methodology (called Likert scales). Using the conventional Likert scales, many respondents assert that they feel strongly negatively or strongly positively. But a Quadratic Voting survey asking the same question reveals that respondents’ strength of feeling is much more closely clustered around the midpoint — indicating weakly positive or weakly negative preferences. This result is actually not surprising. Using conventional surveys, respondents can express extreme views at no cost. In Quadratic Voting, however, respondents must pay in voice credits to express an extreme view. This incentivizes them to think carefully about which issues really matter the most to them, thus providing much richer information to the survey-taker.

5 Charlotte Cavaillé, Daniel L. Chen & Karine Van der Straeten, *A Decision Theoretic Approach to Understanding Survey Response: Likert vs. Quadratic Voting for Attitudinal Research*, 87 University of Chicago Law Review 22 (available at: https://lawreview.uchicago.edu/sites/lawreview.uchicago.edu/files/3Chen_WEB_FINAL.pdf).
6 David Quarfoot et. al., Quadratic Voting in the Wild: Real People, Real Votes (unpublished manuscript) (Mar. 30, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2755844.

COMPARING QUADRATIC VOTING RESULTS USING WITH LIKERT SCALE POLLS

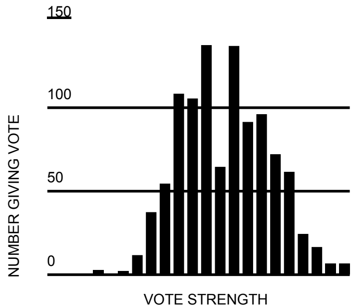
Likert Votes for repeal Obamacare

FIGURE X

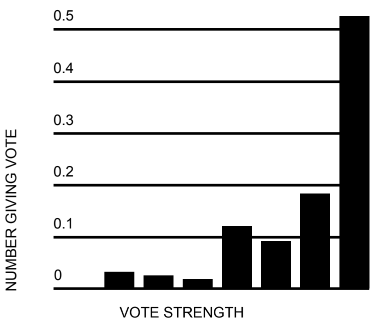


QV votes for repeal Obamacare

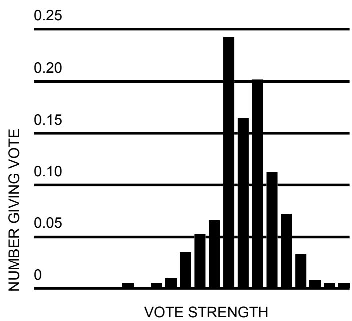
FIGURE Y



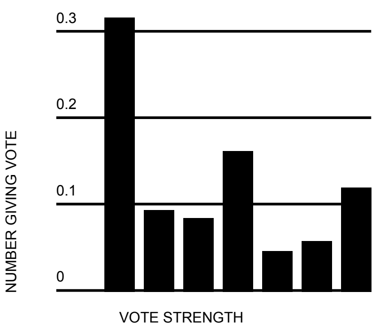
Likert Votes for Pay Woman Equally



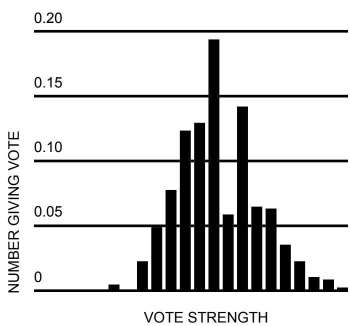
QV Votes for Pay Woman Equally



Likert Votes for Ban Abortion



QV Votes for Ban Abortion



WHY IS QV BETTER THAN OTHER VOTING SYSTEMS?

QV is superior to traditional one-person-one-vote (“1p1v”) and ranked-choice voting because it allows voters to express the intensity of their preferences. In so doing, QV protects minority groups and discourages polarization. We will demonstrate these features in comparison to 1p1v, though the same demonstrations hold true versus ranked-choice as well. Finally, we will finish this section by explaining why the cost of voting must be quadratic, rather than any other method of allocation to reveal intensity.

<u>QV protects minorities.</u>

QV solves the classic “tyranny of the majority” problem with 1p1v in which a majority which only slightly favors a certain option can drown out a minority which cares intensely for that option.

<u>QV reduces polarization.</u>

QV reduces polarization because it makes it increasingly costly to have a loud voice on any one particular option. Thus, for instance, candidates for office have an incentive to get many voters to allocate at least some credits toward them. Thus, candidates will receive more total votes if they can get a broad base of moderate support, rather than relying on a small base to spend all their credits on them.

The chart on the next page gives an example of how QV solves these two problems.

In these two examples, we compare the results that would occur under QV versus 1p1v (assuming that voters would cast their 1p1v vote for the single choice that they feel most strongly about). In the QV example, all voters have 100 credits to allocate among the three candidates.

In the first example, below, two voters feel very strongly about the far left candidate while one feels strongly about the far right candidate. Because voters can express their intensity with some precision, the center left candidate emerges victorious under QV.

QV REDUCES POLARIZATION

	Quadratic Voting			
	Far left	Center left	Center right	Far right
Voter 1				
Credits	50	30	20	
Votes	7.1	5.5	4.5	-
Voter 2				
Credits		20	30	50
Votes	-	4.5	5.5	7.1
Voter 3				
Credits	50	30	20	
Votes	7.1	5.5	4.5	-
Total votes	**14.1**	**15.4**	**14.4**	**7.1**
		WIN		

	One-person-one-vote			
	Far left	Center left	Center right	Far right
Voter 1				
Credits				
Votes	1	-	-	-
Voter 2				
Credits				
Votes	-	-	-	1
Voter 3				
Credits				
Votes	1	-	-	-
Total votes	**2**	**-**	**-**	**1**
	WIN			

In the next example, below, two voters feel strongly in favor of the far right candidate, while one voters feels extremely strongly in favor of the far left candidate (imagine, for instance, that the far left candidate has pledged to protect the civil rights of people in voter 1’s ethnic minority group).

QV PROTECTS MINORITIES

	Quadratic Voting			
	Far left	Center left	Center right	Far right
Voter 1				
Credits	100	0	0	
Votes	10.0	-	-	-
Voter 2				
Credits	10	20	30	40
Votes	3.2	4.5	5.5	6.3
Voter 3				
Credits	10	20	30	40
Votes	3.2	4.5	5.5	6.3
Total votes	**16.3**	**8.9**	**11.0**	**12.6**
	WIN			

	One-person-one-vote			
	Far left	Center left	Center right	Far right
Voter 1				
Credits				
Votes	1	-	-	-
Voter 2				
Credits				
Votes	-	-	-	1
Voter 3				
Credits				
Votes		-	-	1
Total votes	**1**	**-**	**-**	**2**
				WIN

<u>Simply allowing voters to “reallocate” votes creates a problem.</u>

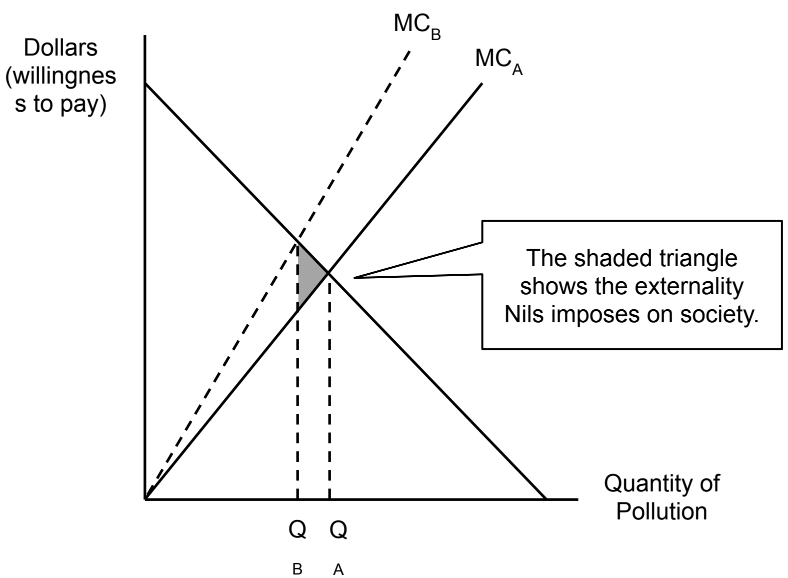
Letting voters reallocate votes to issues they care more about is an old idea with a clear appeal. It would be a boon to democracy if people could indicate how strongly they feel about issues, in addition to which choice they prefer. Yet, simply allowing people to concentrate their votes on single issues has failed to become a popular democratic practice, because it leads to a serious problem. Namely, people and groups who aggressively concentrate their votes nearly always win their favorite issues. It encourages everyone to concentrate their votes on single issues as much as they can stand to, meaning that the ballots stop capturing voters’ views on other issues, which they care about more moderately. It ultimately impoverishes the voting process.

QV retains the flexibility and benefits of allowing vote reallocation — but it solves the “loudest voices in the room” problem. It does so by (1) allowing voters to reallocate their votes, while also (2) imposing a precisely calibrated, non-monetary cost on voters who choose to do so. The “cost” increases with the degree of concentration so that the more they concentrate their votes, the fewer votes they get to cast overall. As it imposes this increasing cost, QV may also improve the quality of the democratic process by encouraging voters to learn more about issues or candidates they are unfamiliar with.

The next section shows why the cost of voting must be *quadratic*, rather than any other allocation scheme.

Why the cost of voting must be quadratic.

Imagine that a town wants to decide on the right amount of pollution to allow.[7] The first bit of pollution allowed enables the residents to carry on valuable economic activity, but less so as pollution increases (reflected by the downward-sloping demand curve below). Meanwhile, pollution exerts an *increasing* marginal social cost on the town (a little pollution is okay, but it gets more dangerous as it increases). One resident in particular, Nils, has bad asthma and so is especially harmed by pollution. The town's marginal cost of pollution without Nils is labelled MC_A below and with Nils is labelled MC_B below. The externality that Nils imposes—what an economist would call the "deadweight loss"—is the grey triangle, which shows the decline in total welfare as the town moves from its pollution amount without Nils to its pollution amount with Nils.



7 This example is taken from Eric Posner & Glen Weyl, *Radical Markets* 97-105 (2018). For a more technical proof, see Jon X. Eguia Nicole Immorlica, Katrina Ligett, Eric Glen Weyl & Dimitrios Xefteris, A New Consensus Protocol: Quadratic Voting With Multiple Alternatives (unpublished manuscript) (April 4, 2019) (available at: https://ssrn.com/abstract=3319508).

Because this deadweight loss is a triangle, its values grows in proportion to the square of the distance between the two marginal cost lines. In effect, Nils is asking the rest of the town to sacrifice increasingly valuable activity as it reduces pollution. This growth in the externality is quadratic. Thus, imposing a quadratic cost on Nils's voting is the only way to ensure that his private cost of voting aligns with the town's overall welfare. In this highly stylized example, we can imagine the town's residents voting across a range of issues, on which some other town residents impose particularly large externalities, as Nils does with pollution. Thus, voters can express an intense preferences on one issue, at a quadratic cost, in exchange for less voting power on other issues.

IMPLEMENTATION TIPS

<u>Fraud, collusion, and vote-buying.</u>

Fraud, collusion, and vote-buying are problems in all democratic systems, and Quadratic Voting is no exception. The integrity of results and/or the benefits of Quadratic Voting can be undermined if parties agree in advance how to vote, or vote multiple times, or vote on behalf of others. Therefore, private voting and fraud-free voter rolls are essential to building a secure, unhackable system. While this is less imperative, keeping votes private even after they are cast also helps make the system more secure — because then malicious parties trying to buy others' votes cannot verify compliance.

<u>How many issues, and which ones, should be on the ballot?</u>

The more issues there are on the ballot, the more complex the tradeoffs voters can make, and the more nuanced information the process will yield. Therefore, where possible, it is a good idea to put a reasonably large and diverse set of questions on the ballot, touching different subject matter areas that are likely to have different levels of importance for different voters or groups of voters.

Whole numbers.

The process of Quadratic Voting is easier for voters to understand using whole numbers. Therefore, it helps to force voters to allocate square numbers of voting credits to each option. For example, on each issue, you can permit them to allocate 1, 4, 9, 16, or 25 credits. This way, the ballot system can clearly communicate the costs of vote concentration by displaying that 16 credits → 4 votes, 25 credits → 5 votes, and so on. It might seem that compelling voters to use square numbers would reduce the flexibility of the process, but the disadvantages are extremely marginal.

Paper ballots.

It is entirely possible to conduct Quadratic Voting using paper ballots, but it requires voters to check their own work to ensure that they are doing it properly. Simply provide a worksheet that maps the number of “counted” votes to the correct costs in voting credits, such as:

Votes	**Voice Credit Cost**
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100

Then ask voters to indicate the number of votes they wish to cast on each issue, keeping track of spent voting credits on a simple worksheet.

Spreadsheets or simple surveys.

Quadratic Voting interfaces can be implemented in the form of simple spreadsheets or programmable surveys.

Software applications and blockchains.

Democracy Earth builds robust Quadratic Voting platforms, including the one used by the Democratic Caucus of the Colorado House of Representatives. Deora has also built an excellent system. These platforms can readily be deployed by organizations or governments who are in a position to verify the identity of users.

Moreover, the potential for Quadratic Voting on decentralized blockchain applications is extremely exciting. However, as of this writing, there is no simple (decentralized) way of verifying that blockchain users are real, unique humans. This means blockchain-based Quadratic Voting still depends on some centralized, authoritative verification of voter identity.

Still, technologists are hard at work addressing the challenge of decentralized identity verification. This technology is likely to unlock exciting new possibilities for truly decentralized governance, and we believe Quadratic Voting will play a crucial role in these emerging systems.

Quadratic Finance

WHAT IS QUADRATIC FINANCE?

Insufficient funding for public goods is a foundational problem in public policy, especially for local governments. The proverbial “tragedy of the commons” occurs because individuals have natural incentives to “free ride” on others’ contributions to public goods.

A 2018 paper[8] by Vitalik Buterin, Zoe Hitzig, and Glen Weyl proposed a new mechanism design, Quadratic Finance, that addresses this problem by redesigning the philanthropic “matching fund.” It optimizes matching funds’ usefulness by prescribing larger matches for projects or causes that received donations from more people.

Namely, the total funding for a proposal is the square roots of each private contribution, summed up, and then squared. We’ll go through this formula step-by-step in the next section. The research behind Quadratic Finance shows that it optimally aligns individuals’ private incentives with the public good. Thus, QF actually solves both the “information problem” (government doesn’t know how much of each public good to provide) and the “free rider” problem (individuals will under-contribute and free ride on others’ contributions to public goods).[9]

8 Vitalik Buterin, Zoe Hitzig & Eric Glen Weyl, Liberal Radicalism: A Flexible Design For Philanthropic Matching Funds (unpublished manuscript) (Dec. 2018), https://ssrn.com/abstract=3243656.
9 Alex Tabarrok, The Liberal Radicalism Mechanism for Producing Public Goods, Marginal Revolution (Sep 27, 2018), https://marginalrevolution.com/marginalrevolution/2018/09/liberal-radicalism-mechanism-producing-public-goods.html.

HOW DOES IT WORK?

Let's say we have a matching fund of $50. There are three proposals for public projects (Fix Streets, Build Playground, and Improve Cell Coverage), and three participants in the Quadratic Finance process (Alicia, Bertha, and Cecilia). Their contributions to the three proposals run as follows:

	Fix Streets	Build Playground	Improve Cell Coverage
Alicia	$9	$1	$1
Bertha	$1	—	$64
Charles	$4	$16	—
Pledged Amount	**$14**	**$17**	**$65**

First, think about why different individuals might value these three proposals differently. Likely, they derive different private benefits from the different public goods. Alicia really hopes to see the potholes fixed on the streets, but likes the other proposals as well. Bertha cares a little bit about the streets, and doesn't much want a playground in her neighborhood — however, she runs a business that requires her to drive around town and take phone calls constantly, so she is likely to become more successful if the cell coverage improves. Charles, meanwhile, really wants a playground — he has several children who lack good places to play.

The matching would work as follows. First, take the square roots of each of the contributions for each proposal, and add them up.

	Fix Streets	Build Playground	Improve Cell Coverage
Alicia	3	1	1
Bertha	1	—	8
Charles	2	4	—
Sum of Roots	**6**	**5**	**9**

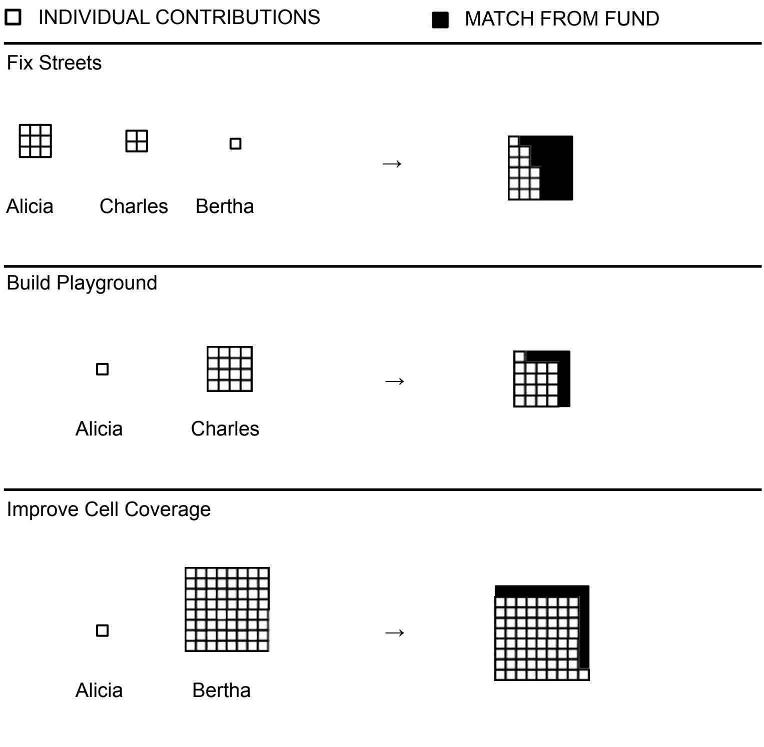
Now, square each of those amounts to get the final funding amount:

	Fix Streets	Build Playground	Improve Cell
Funding Amount	**$36**	**$25**	**$81**

Recall, however, that the Quadratic Finance matching fund only supplies the difference between the total funding amount and the pledged amount:

	Fix Streets	Build Playground	Improve Cell Coverage
Funding Amount	**$36**	**$25**	**$81**
Pledged Amount	**$14**	**$17**	**$65**
QF Match	**$22**	**$8**	**$16**

The total amount of matching funds allocated is $46, which is less than the available $50, so the remaining $4 may be saved. Notice that the cell coverage proposal got the smallest match as a percentage of its contributions (16/65), while the street fixing proposal got the largest (22/14). That's because the cell coverage proposal had the most concentrated support (most coming from Bertha), while the street fixing proposal had comparatively even, broad-based support from Alicia, Bertha, and Charles. The illustration below further emphasizes this point by showing the QF contributions as the white squares and the matching dollars as the black squares.



Limited Matching Budgets

In many cases, particularly where there are many participants, the Quadratic Finance formula will suggest very large matching amounts that exceed the matching budget. This is not a problem. You simply allocate the matching budget between the competing proposals “pro rata”, according to the matching amounts they would have received if you had an infinite budget. This remains a far more optimized use of matching funds than doling them out according to a predetermined ratio, such as 1-1 or 2-1.

REAL-WORLD USE-CASES

Infrastructure investments.

Every local government has a "wish list" of infrastructure projects, repairs, and other public goods to which it would like to allocate budgetary funds. Imagine if instead of trying to prioritize these projects internally, and seeking additional funding sources ad hoc, it simply posted the "wish list" publicly, and called for donations. Then, the government could use its own budget as a pool of "matching funds" following Quadratic Finance. Not only would this help solicit private contributions, it would also better conform to democratic values by ensuring that the most broadly supported projects got the most public funding, and that the smallest donors benefited from the largest relative matches. The process would generate much more information about the community's true priorities.

The following QF matching process could be used to fund infrastructure projects in a way that is more democratic and less present-biased than current funding schemes. The pool of "QF contributors" in this process could consist of all citizens or only owners of business that use particular types of infrastructure.

> *Step 1—Project proposal phase.* QF contributors can submit project proposals and vote on each others proposals (using QV) in an online system. Then, infrastructure planners in the city go through the list of leading vote-getters to ensure compatibility (e.g., the city should not allow QF to operate on both "expand the dam" and "close the dam" options).

> *Step 2—QF.* Contributors can allocate their own funds among the projects available and receive matches according to QF. For large projects, the project's proposer can set a threshold amount for funding, so that funders can be assured that their contributions won't get triggered until a certain amount of funding is reach such that the project can be completed.

Campaign finance.

A matching fund can subsidize candidates' campaigns for office. The Quadratic Finance mechanism would ensure that candidates with a very narrow base of support—such as those with a small number of wealthy backers—would receive minimal public support.

> *Step 1—Candidates register to run for office.* Before any funding is disbursed through QF, candidates must acquire a certain number of signatures to get on the ballot for a particular office.
>
> *Step 2—Repeated time windows for QF matching.* Within each pre-set window of time (e.g., one month) a certain amount QF funding is released for matching. At the end of each month, matches are disbursed to candidates. This step ensures that an initial burst of widespread support cannot create an unstoppable cycle of momentum for any one candidate. Candidates must have repeated, widespread support to continue unlocking large matches.
>
> *Step 3—Elections.* The jurisdiction holds elections. If appropriate, the use of Quadratic Voting may further enhance the quality of elections.

WHY IS QF BETTER THAN CURRENT FUNDING METHODS?

The difficulty of funding public goods.

Public goods (that is, goods that benefit everyone, non-exclusively) are hard to fund through private markets. Because nobody can capture their benefits, everybody tries to "free ride" and supplies less than their fair share of the shared benefit. It is a classic problem in economics.

Centralized funders, like governments and philanthropists, often step in and try to correct this market failure. But they create issues of their own. Specifically, they sometimes fund things that the community would not have freely chosen.

The appeal of matching funds.

Matching funds are a valuable fundraising tool for public goods, which helps address this problem. In essence, they allow centralized funders to collaborate with decentralized donors. Central funders (who provide matching funds) and small donors (who provide the "matched" funds) each use their money to incentivize one another in the service of a shared goal.

Matching funds have several clear benefits:

* They harness decentralized information about what should be funded
* They make philanthropic or government spending more efficient and responsive
* They help maximize fundraising by giving central funders and small donors greater incentive to contribute

Most matching funds are unsystematic and sub-optimal.

Matching funds usually use a basic template, with little or no optimization or design thinking. It goes like this: Donations are matched according to a simple ratio, such as 1-to-1, until the matching funds run out.

This can be dramatically improved upon. To see why, it's helpful to notice that traditional matching funds sometimes accomplish nothing. Suppose that there are two large donors for a cause. Donor One establishes a matching fund of $1,000,000. Donor Two then makes his dona- tion of $1,000,000 — which he would have made anyway— exhausting the matching fund. The matching fund thus accomplished nothing. It did not increase the amount of money raised, nor increase the number of contributors to the cause.

For an example of an unsystematic matching fund system, look at the chart describing the New York City campaign finance matching funds from 2019:

	Mayor	Public Advocate and Comptroller	Borough Pres- ident	City Council
Contribution limit	2000$	2000$	1500$	1500$
Matching rate		$8 to $1		
Maximum matchable per Contributor	250$	250$	175$	175$
Maximum matchable per Election	2000$	2000$	1400$	1400$
Maximum Public Founds Per Election	5,464,500$	3,461,250$	1,230,000$	142,000$

Who chose the 8-1 matching rate, and why? Why are the individual maximums set at these particular levels? They appear to have been arbitrarily chosen. There is a more efficient and optimized way of allocating matching funds.

IMPLEMENTATION TIPS

Maintaining the integrity of the system.

The effectiveness of Quadratic Finance can be undermined when groups of people collude, or when one person pretends to be many. Therefore, it's important to have rules against collusion. Depending on the context, it might be enough to require contributors to certify that they are not acting on anyone else's behalf.

But where sophisticated exploits are likely to be attempted, or the stakes are very high, something more robust might be required. For example, the size of the match can be reduced when the group supporting a given cause shares characteristics that make them likelier to be colluding, such as being members of the same family or having many social connections. Moreover, capping the matches that may be received by any pair of contributors goes a long way towards mitigating the possibility of collusive donations. RadicalxChange Foundation is happy to assist with anti-collusion strategies.

Connecting Quadratic Finance with other mechanisms.

One of the most exciting possibilities for Quadratic Finance comes from linking it to a different, revenue-producing mechanism, called SALSA (below).

SALSA, as you will see, is a mechanism that asks the possessors of certain assets to pay a precise fee corresponding to the negative externality that their possesion imposes on the rest of society. By collecting fees raised through SALSA, and using them as a source of Quadratic Finance matching funds, one can start to imagine a kind of self-sustaining public good funding ecosystem. (For example, heavy users of infrastructure pay a fee for their use; and those funds go into a matching pool that supports improvements to the same infrastructure.)

Self-Assessed Licenses Sold via Auction — SALSA

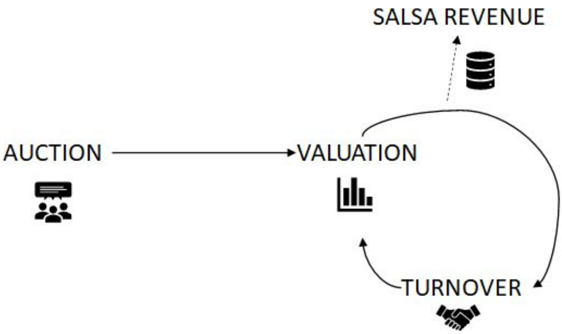
WHAT IS SALSA?

Imagine that a city decides it has space for 100 farmers market stalls, but there are 300 local food vendors interested in selling their products at the market. How should the city decide which 100 can operate? The city could take one of two traditional approaches: (i) first-come, first-served licenses at a flat fee, or (ii) a traditional auction. Unfortunately, both of these methods have significant shortcomings.

Instead, we think that the city should allocate the licenses using a new mechanism called SALSA (Self-Assessed Licenses Sold via Auction). In this system, the stall spaces are sold to the 100 highest bidders via auction. Then, license-holders pay a yearly fee to continue holding the license — this fee is a percentage of each holder's own self-assessed value of the stall license. And — this is where the magic of SALSA happens — if any potential vendor would pay more for a license than the holder's declared self-assessment, the holder must sell the license at this new, higher value, unless she increases her own value (and subsequently pays the annual fee on this new, higher value).

HOW DOES IT WORK?

A step-by-step example.



Step 1. Sell a set number of licenses. We recommend using a Dutch auction (i.e., descending price) or a Channel auction.[10] (In a Channel auction, there is a lower bound price, which gradually rises, and an upper bound price, which gradually descends. Buyers are committed to buy, for at least the lower bound price, but may purchase directly at the upper bound price at any time.)

Step 2. Holders post their self-assessed valuations in an online platform and pay annual fees on them (e.g., a 20% fee). As mentioned above, the right annual fee rate will be somewhere between zero and the turnover rate (i.e., the probability that a higher-value pur- chaser comes along within a year).

Step 3. Purchasers who value the asset higher may buy it at any time in the online marketplace.

10 Eduardo M. Azevedo et al., Channel Auctions (August 5, 2019) (unpublished manuscript) (available at: https://ssrn.com/abstract=3241744).

REAL-WORLD USE-CASES

In this section, we'll sketch out two more situations where local governments could apply SALSA, and then provide a list of many shorter examples. We hope this section inspires more ideas — and we encourage you to let us know of any more applications you come up with!

I. Long-term street parking.

Many municipalities offer long-term resident-only parking permits, which allow residents to park for longer periods of time than standard public parking (e.g., two-hour parking). Unfortunately, residential parking permits are frequently either free[11] or cheap.[12] This mechanism runs the risk of allocative inefficiency: for a fixed number of parking spaces/permits, an arbitrarily low fee is unlikely to allocate the permits to those who value them most.

We recommend that municipalities use a SALSA mechanism — open to residents and non-residents alike — to improve allocative efficiency. It's easy to imagine, for instance, that non-residents who work in a given municipality may value a parking space more than a resident who already has one car and has just purchased a second one.

Municipalities could allow the space to be used for non-parking activities too. Some municipalities do this on an infrequent, temporary basis,[13] but there could potentially be large gains both for individual space-users who would value the space and the public who would take in extra revenue from the yearly fee.

11 Boston Considers Charging for Residential Parking Permits, NECN (Jun. 29, 2018), https://www.necn.com/news/new-england/Boston-Considers-Charging-for-Residential-Parking-Permits-486985971.html.
12 Request a Residential Parking Permit, City of Cambridge MA, https://www.cambridgema.gov/iwantto/requestresidentparkingpermit.
13 PARKing Day, City of Cambridge MA, https://www.cambridgema.gov/CDD/Projects/_Transportation/parkingday.

II. Shared mobility (bikes and e-scooters): a "dynamic cap plus SALSA" proposal.

Cities across the world are facing regulatory challenges related to micromobility (i.e., bikes and scooters that provide "last mile" mobility solutions). Implementing a fixed cap on the number of vehicles allowed would resurface the undersupply problem of taxi medallions that we discussed above (i.e., how can a municipality know exactly how many scooters its citizens demand?). However, because micromobility companies are often well-funded and pursuing network effects, cities that do not regulate supply risk becoming flooded with unused vehicles taking up valuable public space and making urban life unpleasant.[14]

Some cities are considering "dynamic caps," whereby the number of vehicles each company can deploy expands and contracts according to the "usage rate" of the vehicles.[15] We think that a SALSA mechanism could further enhance the effectiveness of a dynamic cap.

Under our proposed solution, a "dynamic cap plus SALSA" companies would purchase vehicle licenses at auction from the city and then would engage in the self-assessment and exchange process that we have described in detail above — the firms could reallocate vehicle licenses among themselves in an online marketplace and would pay a yearly holding fee based on their self-assessed value. The dynamic cap would be based on the city's overall usage rate, rather than the usage rate of any one particular company.[16]

14 For a rather extreme example, see, e.g., Alan Taylor, The Bike-Share Oversupply in China: Huge Piles of Abandoned and Broken Bicycles, The Atlantic (Mar. 22, 2018), *https://www.theatlantic.com/photo/2018/03/bike-share-oversupply-in-china-huge-piles-of-abandoned-and-broken-bicycles/556268/*.
15 Polina Marinova, Lime Investor Sarah Smith: It's 'Inevitable' That E-Scooters Are Coming to Every Major Market, Fortune (Feb. 7, 2019), *https://fortune.com/2019/02/07/lime-funding-sarah-smith-bain-capital-ventures/*.
16 When the dynamic cap needs to shrink (e.g., because of a decrease in demand, population decline, etc.), the city would randomly purchase back the required number of licenses at self-assessed value from their holders.

Finally, citizen welfare could be further enhanced with interoperability, whereby users could view the location of and pay for a ride on any company's vehicle in the same app/platform. This way, rather than competing for network effects (and flooding cities with duplicate vehicles in the same areas), companies would compete on price and experience quality.

<u>More Examples.</u>

Below is a list of potential further applications of SALSA. This is by no means comprehensive — we encourage you to experiment with others!

* *Temporary vending opportunities.* Food truck space licenses, really any sort of vendor stall, especially things in the "pop up" vein, because transaction/reallocation costs would be minimal.

* *Road space/transportation units.* Cap on number of "vehicle licenses" (i.e., vehicles allowed to drive in a city), as a more efficient alternative to cordon or congestion pricing.

* *Public facility use.* Reserving public fields / tennis / basketball courts. With this application, it is probably important to have "windows" of time in which people can buy out your reservation, so that people aren't, e.g., getting bought off a field in the middle of a soccer game.

* *Natural resources.* Grazing rights, mineral, fishery/ hunting, farming rights, which are frequently sold off at arbitrary prices.

* *Public attention resources.* Citywide public wifi supported by advertisements, where advertisement slots are maintained via SALSA (i.e., rather than funded by tax dollars).

* *Privatization of public facilities.* In 2008, Mayor Daley of Chicago awarded a 75-year lease[17] to a private consortium, allowing them to manage the city's parking meters. The deal has turned out to be a terrible albatross for the city and its residents. A SALSA system asking the lessee to periodically self-assess its franchise, and pay a fee against that (or surrender it to another operator), would have protected the public interest.

17 Chris Lentino, Chicago to Pay $20 Million to Parking Meter Company in 2018, Illinois Policy (Nov. 2, 2017), https://www.illinoispolicy.org/chicago-to-pay-20-million-to-parking-meter-company-in-2018/.

WHY IS SALSA BETTER THAN OTHER APPROACHES?

In this section, we will contrast SALSA with the two approaches traditionally taken by cities. To return to our initial farmers market stall example, these two traditional approaches would be:

i. First-come, first-served licenses. The city could set a flat fee for a stall and allocate the licenses to the first 100 vendors who complete some registration process.

ii. Auction. The city could auction off the stall spaces to the 100 highest bidders.

These two approaches both have significant shortcomings in terms of both efficiency and social equity. Here are some of the issues they create, and how SALSA solves them:

Black markets. A flat license fee for a limited number of licenses (i.e.,first-come, first-served) runs the risk of corruption and the creation of black markets.[18] For instance, a 2011 Wall Street Journal article explains that New York City charged $200 for a two-year food-cart permit license.[19] But the permits fetched tens of thousands of dollars on the black market — revenue that could have gone to the city.

Even a well-run public auction will run into the following types of "holdout" problem, rooted in the fact that people's values change over time and new people, with higher values, may enter a city after the auction.

Assembly cost holdout. Sometimes, a large-scale project requires assembling several assets together in a package (think multiple parcels of land needed for a railroad right-of-way). However, once any single asset-holder realizes that a buyer needs to assemble several assets, she can raise the price of her own asset to extract some of the gains from the potential projects — and, if all asset holders behave

18 See generally Chapter 2 in Susan Rose-Ackerman & Bonnie J. Paflika, Corruption and Government: Causes, Consequences, and Reform (2016).
19 Prices for Food-Cart Prices Skyrocket, Wall Street Journal (Mar. 9, 2011), https://www.wsj.com/articles/SB1000142405274870475.

this way, projects that would be productive may not get done. SALSA solves this problem by allowing instantaneous purchase at self-assessed values.

Lazy monopolist. Sometimes, an asset-holder just doesn't want to sell to someone who values the asset more because they don't feel like it, even though they themselves aren't putting it to productive use. Imagine a stall license holder who just never checks her email, and so fails to see that many potential vendors are making high offers to her. SALSA solves this problem by requiring asset-holders to transfer the asset to someone who values it more.

When an asset-holder is unwilling to sell the asset to someone who would value it more, the public good can be harmed in at least two ways: (1) the higher-valuer, who would have created more economic value, is not able to do so, and (2) the government loses out on the potentially higher tax revenue it would have gained, both from any sales transactions related to the asset, and from any sort of "property tax" paid on the value of the asset.

In general, SALSA addresses the above problems because it disincentivizes excessively high valuations. Asset owners will have to pay a tax based on their self-assessed valuation, so they are disincentivized from declaring a valuation that is too high.

IMPLEMENTATION TIPS

What is the right annual license fee rate?

Some simple arithmetic shows that setting the tax rate equal to the turnover rate (i.e., the percent chance that someone who values the asset higher will come along within any given time period) will incentivize owners to self-assess honestly, at their actual subjective valuation.[20] In addition, the government can reduce the rate slightly to incentivize appropriate investments in the asset. The chart below walks through a sample SALSA rate calculation. As a side effect, as values decrease, low-income people or otherwise credit-constrained people may be able to participate more, relative to situations where with artificially high valuations and holdout problems.

Base rate	20%	Suppose that the turnover rate for farmers' market stall is 20% per year. This means that, for each stall, there is a 20% probability that a farmer who values the stall more will come along in any given year.
↓	↓	↓
Adjusted (final) Rate	5-15%	In settings where there is potential for investment or improvement in the asset, the government will want to set the fee somewhere below this turnover rate. For instance, even in his farmers' market example, a license itself will become more valuable if all the current license holders work hard to appeal to consumers (thus increasing foot traffic) and maybe even make the area around look nicer.

Progressivity. To make the license fee progressive, policymakers can set a small exemption. For instance, the 5-15% rate in the above example might apply to the declared value of the asset minus $1,000.

20 Imagine that there is a 30% chance that a higher-value purchases comes along in any given year. If the asset holder sets her self-assessed value above her actual value by ΔP, then she will benefit by 0.3ΔP (this is the 30% probability that a higher-valuing buyer comes along and buys the asset at the new higher price), but she will also have to pay a higher annual fee on the asset. And if the government sets the fee rate equal to the turnover rate, this will penalize the asset-holder by exactly 0.3ΔP, cancelling out the gain to her from setting her valuation above her true valuation. See pages 57-58 in Eric A. Posner & E. Glen Weyl, Radical Markets (2018).

Notes.

Bundling/packaging units. For some assets, there are such strong complementarities across assets that it would represent a market failure for owners to part with one, but not all, of the assets (e.g., a physical structure and the land upon which the structure stands). In such cases, asset-holders should get to determine what bundle of items constitutes the single “asset” for which they will enter a valuation in the online marketplace. This concern is unlikely to affect operating licenses, like our farmers' market example, but policymakers should keep this concern in mind.

Net asset value. To avoid double taxation, possessors can deduct the value of any mortgages or liabilities related to the asset from their self-assessment for the purposes of paying the self-assessed fee. Thus, possessors are taxed on the net value of the asset to them, but they must stand ready to sell at their listed valuation.[21]

Valuation difficulties. For goods that require inspection by the buyer, the purchaser could freeze the listed price and pay a small percentage to the seller in order to inspect it, before deciding whether to proceed.

Turnover time. A reasonable amount of time to turn the asset over will depend on the asset type.

Asset maintenance. To the extent that maintenance is required, it would be good to have an automated way to monitor maintenance and even subsidize (via reduced tax rate) positive investments made in the condition of the asset.

21 See page 65 in Eric A. Posner & E. Glen Weyl, Radical Markets (2018).

Pitfalls to avoid.

Deciding how many units to allocate. Perhaps the most important risk with a SALSA is generating an artificial undersupply of a given service. Many kinds of services do not need to be restricted in supply — any entrepreneur who wants to provide them can try, and the public at large will benefit from the lower prices and innovation that come with robust competition. When supply is restricted artificially, license holders can earn higher profits by charging higher prices to customers for the scarce good or service. In urban settings, the effects of undersupply due to industry influence frequently hurt the poorest citizens.[22] It is therefore important to ensure that SALSA licensure does not become influenced by industry resulting in artificial undersupply.

Social equity reasons to allocate assets on a non-financial basis. There are many reasons why local governments may not want to allocate resources to those who value them most, related to cultural traditions and notions of fairness apart from willingness-to-pay. For instance, Washington, D.C. has a cultural tradition of go-go music, frequently performed and enjoyed by lower-income residents. If the District decided to allocate a certain number of “street corner music performance” licenses via SALSA, this tradition might not be able to survive.[23] In fact, a situation like go-go music in D.C. may be better suited for Quadratic Voting (see chapter above), in which groups can democratically express their preference intensity.

Legal issues. This document cannot provide legal advice. State and local laws for auctioning public licenses vary widely by jurisdiction. In general, however, local governments are less likely to encounter obstacles to using SALSA for licenses to use government property (such as licenses to operate on city land).

22 For one example, see the following OECD report on the taxi industry, Taxi Services: Competition and Regulation, OECD (2007), http://www.oecd.org/regreform/ectors/41472612.pdf.
23 For a similar discussion, see, e.g., ‘Don’t Mute D.C.’: Bill Aims To Protect Go-Go As District’s Official Music, WBUR (NPR local station) (Jul. 1, 2019), https://www.wbur.org/hereandnow/2019/07/01/go-go-music-washington-dc-gentrification.

Moreover, local governments will often be on strong footing to use SALSA for licenses that have already been cleared for auction by a state legislature, and/or where the local government enjoys the unilateral power to increase license fee. However, local governments must ensure that particular applications of SALSA do not overstep limitations on their power to impose new taxes. This issue is most likely to arise when local governments sell licenses at high prices unrelated to the cost of providing the regulatory scheme, and/or when the revenues from a regulatory licensing scheme go into an unrestricted general fund, rather than being used on services related to the regulation scheme. You should always have your plans reviewed by counsel.

Conclusion

Quadratic Voting, Quadratic Finance, and SALSA are more than just clever, efficient mechanisms. We think they represent a step forward in our ability to manage common resources fairly, and to make complex decisions in groups. There is still a lot of tweaking and experimentation to be done. But we hope you will take up the challenge to apply these ideas and help advance them.

We also want to help! The RadicalxChange Foundation is a willing resource to anyone looking to pilot these or related ideas. Similarly, the RadicalxChange movement has chapters and discussion groups all around the world— so there are likely people in your community interested in helping out. Visit us at RadicalxChange.org or reach out at info@radicalxchange.org to get connected.