Quadratic Voting as Efficient Corporate Governance

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INTRODUCTION

Since Professors Adolf A. Berle and Gardiner C. Means's classic book of 1932,[1] the agency costs of corporate governance have played a central role in discussions about corporate law. Berle and Means observed that in the modern publicly held corporation, shareholders cannot realistically control managers, which means that managers can take a range of actions that transfer the corporation's wealth to themselves rather than to the shareholders.[2] In modern terms, corporations are beset with agency problems. Large portions of corporate law can be understood as an attempt to minimize agency costs.

The central problem is that the managers of the corporation exercise control over its activities and have inside information about which activities are profitable and which are not. Large corporations have thousands or millions of shareholders because shareholders seek to diversify their holdings and so avoid buying all or nearly all of a firm's shares. But by the same token, shareholders lack information about the workings of a corporation and thus have trouble judging the managers' decisions. As a result, managers can take actions that fail to maximize the value of the corporation and instead transfer value to the managers themselves.[3]

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[1] Adolf A. Berle and Gardiner C. Means, *The Modern Corporation and Private Property* (Macmillan 1932).

[2] See id at 120.

[3] For a survey of managerial expropriation of funds, see Andrei Shleifer and Robert W. Vishny, *A Survey of Corporate Governance*, 52 J Fin 737, 742 (1997). For recent discussions, see, for example, Jean Tirole, *The Theory of Corporate Finance* 17 (Princeton 2005).

Examples of such managerial opportunism are well known. At the extreme, managers can simply expropriate some of the firm's assets. This is unusual in advanced countries, but managers can accomplish the same goal *sub rosa* by overpaying themselves, diverting corporate opportunities to independent entities that they control, overinvesting in perquisites like fancy office suites, building empires so as to enhance their sense of importance, and so on. Some commentators have blamed the financial crisis of 2007–2008 on poor corporate governance at major financial institutions.[4]

There are two direct mechanisms for controlling managers. First, shareholders enjoy voting rights with respect to major actions like mergers, elections of members of the board of directors, amendments to corporate charters, and stock issuances. Second, the law provides remedies when managers engage in the worst forms of self-dealing, like appropriating assets.[5] Managers are also, of course, indirectly constrained by other factors, such as product-market competition and the threat of takeover.

Our focus is on the voting system. The idea behind voting is that if shareholders can exercise the vote, they can block transactions that do not maximize shareholder value. But there is also an obvious problem with shareholder voting. A voter (or coalition of voters) with a majority of shares (and hence votes) can outvote the minority and so cause the corporation to make decisions that transfer value from minority to majority, including decisions that do not maximize firm value. Since investors can anticipate such majority opportunism, they will pay less for equity than they otherwise would.

We propose a superior form of corporate voting known as Quadratic Voting (QV), which is based on theoretical work by Weyl.[6] Under QV, shareholders do not obtain voting rights along with their shares. Instead, everyone interested in a corporate outcome that is subject to a vote may buy as many votes as he wants for the purpose of casting them in that particular election. The price of the votes is a quadratic function of the number of

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[4]   See, for example, David H. Erkens, Mingyi Hung, and Pedro Matos, *Corporate Governance in the 2007–2008 Financial Crisis: Evidence from Financial Institutions Worldwide*, 18 J Corp Fin 389, 397–402 (2012); Lynne L. Dallas, *Short-Termism, the Financial Crisis, and Corporate Governance*, 37 J Corp L 265, 281–93 (2012).

[5]   See Tirole, *The Theory of Corporate Finance* at 17 (cited in note 3). See also Shleifer and Vishny, 52 J Fin at 742 (cited in note 3).

[6]   E. Glen Weyl, *Quadratic Vote Buying* (University of Chicago Working Paper, Apr 1, 2013), online at http://ssrn.com/abstract=2003531 (visited Mar 2, 2014).

votes purchased. For example, one can buy one vote for $1, two votes for $4, and three votes for $9. One can also buy fractions of votes, again for the square of the fraction. The proposal subject to the vote is approved if the number of votes in favor exceeds the number of votes against. The money collected from the voters is transferred to the corporate treasury, and thus ultimately distributed to the shareholders, except that large shareholders (with more than 1 percent of stock) would receive back only 1 percent of the money collected from the votes they personally buy. Any excess thus generated would be distributed pro rata by shares directly to the rest of the shareholders. The voting process is confidential, and collusive arrangements and side payments would be illegal and subject to enforcement under antitrust law.

Under reasonable conditions, QV guarantees an efficient outcome, which reduces agency costs by preventing managers from implementing major decisions that benefit them at the expense of the firm, and preventing large shareholders from directing the corporation to enrich themselves at the expense of minority shareholders. There are also a number of positive second-order effects. QV increases the value of corporate votes, so that more will be held; and this further constrains managers and large shareholders, reducing agency costs. QV may improve the incentive of investors to gather information about firms and to vote. Finally, as we will discuss, QV may render unnecessary certain legal protections of shareholders, such as the appraisal remedy and poison pills, which scholars have long regarded as costly and imperfect.[7] For all these reasons, QV should lower the cost of capital.

I. QUADRATIC VOTING

Most groups make collective decisions about public goods by some form of one-person–one-vote democracy, or one-share–one-vote in the corporate case. This contrasts sharply with the systems modern economies use to allocate private goods, in which those who care more about a good receive more of it. Because typical majority-rule voting systems in democracies do not allow individuals to express intensities of preference, they are not efficient in creating public goods in the way that the market is efficient in allocating private goods. As a result, economists have

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[7]	See Part II.D.

proposed alternative social-choice "mechanisms" that incorporate intensity of preference and provide individuals with an incentive to optimally disclose their true intensity of preference.[8] Unfortunately, these mechanisms have thus far suffered from various severe defects that make them impractical. For example, the most canonical of these mechanisms, that proposed by Professors William Vickrey, Edward H. Clarke, and Theodore Groves,[9] can be turned to the purposes of any two individuals who collude in their participation in the mechanism or any one individual who can manufacture a second, false identity.[10]

QV, as described above, avoids these difficulties while allowing intensity of preference to be expressed. To see why this rule incorporates the true intensity of individuals' preferences, consider two different individuals. The first individual has a net value for building a bridge of $1000; that is, she would be willing to pay $1000 to see the bridge built. The second individual opposes construction of the bridge and is willing to pay $500 to avoid the taxes its building will impose on him. Both individuals think that the vote on the bridge is likely to be close enough so that each vote they purchase moves the chance that the bridge is built or not in their desired direction by 1 percent. Because both are rational and neither has a very large impact on the decision, they share the same value of this estimate and it is independent of the number of votes they buy so long as this number is not too large.

How many votes will the first individual buy in favor of the bridge being built? Each vote gains her a value of $.01 \times \$1000 = \$10$. If she buys only one vote, she spends $1 and receives a benefit of $10. If she buys 2 votes, she spends $4, and so for a marginal cost of $3 ($4 − $1), she gains another $10. What about 3 votes? Three votes cost her another $5 ($9 − $4), still less than the marginal gain of $10. If she buys 4 votes, she pays $16, while if she buys five votes she pays $25, so it is better for her to buy 5 votes rather than 4—because the cost of the additional

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8   See, for example, Alessandra Casella, Aniol Llorente-Saguer, and Thomas R. Palfrey, *Competitive Equilibrium in Markets for Votes*, 120 J Polit Econ 593, 593–99 (2012).

9   William Vickrey, *Counterspeculation, Auctions, and Competitive Sealed Tenders*, 16 J Fin 8, 14–27 (1961); Edward H. Clarke, *Multipart Pricing of Public Goods*, 11 Pub Choice 17, 22–26 (1971); Theodore Groves, *Incentives in Teams*, 41 Econometrica 617, 622–29 (1973).

10   See Lawrence M. Ausubel and Paul Milgrom, *The Lovely but Lonely Vickrey Auction*, in Peter Cramton, Yoav Shoham, and Richard Steinberg, eds, *Combinatorial Auctions* 17, 23–24 (MIT 2006).

voting power ($9) is less than the gain ($10). If she buys 6 votes she pays $36, $11 more than if she buys 5 votes, but gains only $10 in value from doing so. Thus she won't buy the sixth vote. Using a little bit of calculus we can solve for her optimal number of votes v. The value she gains, in dollars, from buying votes is $10v$, while the amount she loses from the cost of votes is v^2. Setting her marginal cost equal to her marginal benefit of buying votes, her optimal number of votes is $10 = 2v$ or $v^* = 5$. So she should buy exactly 5 votes.

On the other hand, the individual who is willing to pay $500 to *avoid* the bridge being built will buy negative votes (votes against the bridge). His utility from votes is $-5v - v^2$. By the same logic, he will optimally buy votes $v^* = -2.5$. More generally, an individual with utility u from the bridge buys votes $v^*(u) = \frac{.01 \times u}{2}$, because the chance that she changes the outcome is $.01$. The decision is made based on total votes, which are the same as the total value of $\frac{.01}{2} u$. But this is positive if and only if the sum of everyone's utilities is as well. That is, the system will make a decision in favor of whichever outcome (building or not building the bridge) maximizes the total utility because everyone buys votes in proportion to the intensity of his or her preference. QV is thus efficient, as long as the approximating assumptions we used above hold.

In particular, Weyl shows that as long as the distribution of preferences is commonly known and some technical assumptions are satisfied, the probability that the decision is made incorrectly approaches 0 as the number of voters n grows large at rate $\frac{1}{\sqrt{n}}$.[11] If the distribution of preferences is not commonly known and individuals must make guesses about it based on their own preferences or the total number of voters is small, matters are subtler. However, QV is still fully efficient under reasonable conditions, and much more efficient than voting under a broad range of cases.

What is so special about the quadratic rule? Why couldn't individuals just pay proportional to the number of votes they buy? The key is that the quadratic rule is the only one under

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[11]   The rate depends on the tail properties of the distribution of valuations, and the result reported here is based on the conservative assumption of a Pareto-tail coefficient of $\alpha = 3$. If tails of the valuation distribution are thinner than this, then the rate of convergence is faster. Weyl, *Quadratic Vote Buying* at *14 (cited in note 6).

which the cost of the *marginal* vote is proportional to the number of votes already bought. If, as we assume, the marginal benefit of a vote increases at a linear rate, then the marginal cost of the vote must also increase at a linear rate; that is possible only if the total cost of votes increases by the square of the number of votes.

By way of contrast, suppose that votes had a fixed linear cost of, say, $7. Then the first individual would be willing to buy an enormous number of votes, as each is worth $10 to her, and the second individual would be willing to buy none. The first individual would thus act as a dictator, buying the whole election even if there were 10 or 100 other individuals all of whom would be willing to pay $500 to avoid the bridge being built.[12] It is this disproportionate power afforded to those who are willing to pay most that makes standard, linear vote buying so unattractive and is likely the reason so many are opposed to corruption of politicians, "empty voting" for corporate governance (in which individuals buy votes without having to buy shares using derivative contracts), and other cases in which an individual can linearly buy influence in a collective decision. As we discuss in the next Section, this problem can be severe even if votes are linked to shares.

In practice, though, individuals who feel intensely about an issue will try to use their financial resources to influence the outcome, usually by spending on persuading the population to vote their way. In our democratic system, such spending is constitutionally protected.[13] While such expenditures may have some of the decreasing returns to expenditures embodied in QV and thus may roughly approximate efficiency, there are many reasons to think an explicit vote-buying scheme would work better. First, by formalizing the exactly correct rule, QV enhances efficiency and provides a procedure that is simpler and more reliable for participants than the status quo is. Just as the introduction of fiat money, accounting, and formal contract law made informal systems of reciprocity and exchange that prevailed prior to the modern era into a widespread and efficient market economy, QV could turn the somewhat chaotic system of bidding for influence more systematically efficient. Second, expenditures on persuasion under the current system are largely wasted,

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[12]   For a formalization of this argument, see Casella, Llorente-Saguer, and Palfrey, 120 J Polit Econ at 599–611 (cited in note 8).

[13]   See *Buckley v Valeo*, 424 US 1, 19 (1976).

while the revenue raised on QV would be distributed back to the population or spent on valuable projects. Finally, QV would discourage further expenditures on persuasion intended to push nearly indifferent voters slightly one way or the other. Because votes are costly and the system incorporates preference intensity, persuasion would aim to convince everyone that a policy or candidate would increase their utility more than the alternative rather than just breaking indifferences for swing voters.

Vote buying seems to carry negative connotations, but it is crucial to notice the difference between QV and standard, linear vote buying. For one thing, the buyer does not pay a particular voter (or shareholder) but society (or the corporation), so the payments are spread among all voters rather than concentrated in a few. But, more important, the quadratic formula blunts the impact of money and hence wealth on outcomes. If Mitt Romney had wanted to spend nearly his whole personal fortune, $100 million, to win the presidential election, that would be his right, but he could buy himself only 10,000 votes, a substantial number but hardly enough to guarantee victory given that President Obama's margin was nearly 5 million votes.[14] And at the same time, the money he spent could be used to pay off the deficit, fund government programs, or cut taxes rather than being wasted on advertisements.

An important concern with other mechanisms economists have proposed was that they allowed for easy and severe collusion: any two individuals willing to collude, or any individual passing himself off as two individuals, could get whatever outcome they wish and pay nothing. Collusion is also possible under QV, but is much less serious. Consider again the example of Mitt Romney. If he were able to collude with 99 other people, or to take on 99 other false identities, he could divide his $100 million into 100 groups of $1 million and purchase 100,000 votes instead. This is much more than he would be able to do on his own. However, he would run into two obstacles. First, 100,000 votes still is not enough to swing many large elections. Second, especially if a secret ballot were enforced and fraud illegal, it would be hard to maintain such collusion. His collusive partners would have a strong incentive to pocket the money and not buy the votes, and if he tried to pass himself off as 100 different people

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[14]   Federal Election Commission, *Federal Elections 2012: Election Results for the U.S. President, the U.S. Senate and the U.S House of Representatives* (July 2013), online at http://www.fec.gov/pubrec/fe2012/federalelections2012.pdf (visited Mar 2, 2014).

he would likely be caught. Thus, because under QV individuals need to collude with or pretend to be a large number of other individuals to make a significant difference in the amount of influence they can exert, its sensitivity to collusion is not excessive. Weyl makes these arguments quantitatively precise and formal.[15] We thus believe that QV's benefits in terms of allowing individuals to express the intensity of their preferences outweigh its costs in terms of collusion or fraud. In the corporate context, in which contract and antitrust laws can be used to deter collusion and First Amendment rights to political spending are not at issue, the problem of collusion is even more limited.

II. QV and Corporate Governance

A. Corporate Voting and Its Pathologies

A publicly traded corporation is normally operated by its management, under the loose supervision of the board of directors. Shareholders have no say in day-to-day decisions. When a firm enters a major transaction, however, management must seek the approval of shareholders and sometimes other stakeholders such as creditors. Major transactions include mergers, certain large sales of assets, financial transactions like stock issuance that could dilute the value of existing shares, and bankruptcy reorganization plans (in which creditors can vote as well). We will focus on these types of transactions and use a merger as our running example.[16] But shareholders can vote in other contexts as well, including in elections of members of the board of directors and on amendments to the corporation's charter.

The voting rules are largely determined in the charter, but they are subject to certain (relatively limited) legal requirements. Votes are cast by share, not by shareholder; a shareholder

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[15]   See Weyl, *Quadratic Vote Buying* at *16–22 (cited in note 6).

[16]   A small literature discusses mechanism design for mergers and acquisitions. See, for example, Steven J. Brams and Joshua R. Mitts, *Mechanism Design in M&A Auctions*, 38 Del J Corp L *13–19 (forthcoming 2014), online at http://papers.ssrn.com /sol3/papers.cfm?abstract_id=2256763 (visited Mar 2, 2014); Peter Cramton and Alan Schwartz, *Using Auction Theory to Inform Takeover Regulation*, 7 J L, Econ & Org 27, 30–32 (1991); Alexander S. Gorbenko and Andrey Malenko, *Strategic and Financial Bidders in Takeover Auctions*, J Fin *14–24 (forthcoming), online at http://papers.ssrn.com /sol3/papers.cfm?abstract_id=1559481 (visited Mar 2, 2014). These papers discuss the process that the board of directors should be required to use when soliciting bids; by contrast, our focus is on the process that shareholders use to constrain the board of directors when it comes time to approve the merger or acquisition.

who owns 100 shares has 100 votes. Shareholders can thus accumulate votes by buying additional shares. Voting is by majority or supermajority rule. For example, approval of a merger requires a majority of outstanding shares in most US states; various supermajority rules are used in some other countries.[17] Minority shareholders can thus be outvoted.

The weakness of the voting rules, as well as other corporate-governance mechanisms, is the dominant theme of the corporate-government literature. Scholars focus on two basic problems. The first is managerial opportunism, in which managers implement projects that transfer wealth from shareholders to managers. Such projects could include outright appropriation, excessive executive compensation, the diversion of corporate opportunities to managers, overinvestment in management perquisites, and managerial entrenchment.[18]

The second problem is that of tyranny of the majority, in which majority shareholders use their voting strength to expropriate value from minority shareholders. Again, the way that majority shareholders use their voting power will vary. For example, they could (in principle) vote for outright appropriation of the shares of the minority. But more typically, they use their voting power in more indirect ways—for example, approving mergers and other transactions that benefit the majority at the expense of the minority, issuing shares that dilute minority interests, and so forth.[19]

The voting system thus addresses managerial opportunism by giving shareholders the power to block value-reducing transactions, but creates the problem of tyranny of the majority by giving the majority the power to outvote the minority. A supermajority rule can reduce but not eliminate the risk of value-reducing transfers from a (smaller) minority to a (larger) majority, but also creates the problem of holdouts by a small group who withhold approval until paid off. These additional transaction costs may block efficient transactions.[20] Thus, ordinary voting fails in its fundamental function of aggregating beliefs and

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[17]   See Reinier Kraakman, et al, eds, *The Anatomy of Corporate Law: A Comparative and Functional Approach* 134–36 (Oxford 2009).

[18]   See Shleifer and Vishny, 52 J Fin at 742–43 (cited in note 3).

[19]   See id at 758–59.

[20]   See James M. Buchanan and Gordon Tullock, *The Calculus of Consent: Logical Foundations of Constitutional Democracy* 211–12 (Michigan 1962).

preferences of diverse shareholders to ensure efficient corporate governance.

Even when the system works in theory, managers and majority shareholders can often evade the rules. For example, a corporation may avoid a vote on a merger by creating a shell corporation that buys the target firm.[21] Or a corporation can effectively eliminate the value of voting in director elections by failing to provide shareholders with information about candidates who seek to challenge board choices.

In corporate bankruptcy, the pathologies of the voting rules are also evident. Shareholders cannot be trusted to vote so as to maximize firm value because they do not have residual ownership rights in an insolvent firm. The law gives voting rights to creditors. But different groups of creditors may have different interests, and so the law creates a complicated classification system, requiring majority (by number of class members) and supermajority (by amount of claims) voting by class, and approval of all classes subject to a cram-down exception. The bankruptcy court must also ensure that stakeholders are treated fairly and equally. There is very little reason to believe that these rules maximize the value of firms or treat creditors or anyone else fairly.[22]

B.   The QV Approach

A corporation could implement QV by amending its charter to provide that all shareholder voting would be conducted through QV. In particular, the charter would provide that whenever a board election, charter amendment, or major transaction occurs, a QV election would take place. Anyone—including people with no relation to the corporation—would have the right to participate. Note that shareholders would *not* vote the number of shares they own; large shareholders and small shareholders are in the same position as each other, and indeed in the same position as nonshareholders, who would also have the right to participate. The funds paid in from QV would be disbursed into the corporation's treasury and thus *would* disproportionately benefit large shareholders and would not benefit nonshareholders. However, no shareholder would ever be able to receive back

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[21]   See Stephen M. Bainbridge, *Corporate Law* 348–49 (Foundation 2d ed 2009).

[22]   See Kevin A. Kordana and Eric A. Posner, *A Positive Theory of Chapter 11*, 74 NYU L Rev 161, 230–31 (1999); Philippe Aghion, Oliver Hart, and John Moore, *Improving Bankruptcy Procedure*, 72 Wash U L Q 849, 858 (1994).

(implicitly or explicitly) more than 1 percent of the funds raised by the votes she bought herself. If a shareholder has a greater than 1 percent shareholding, any funds she contributes would be distributed back directly to shareholders, with 1 percent going to her and the remaining funds being directly rebated to other shareholders in proportion to their holdings pro rata, even if these other shareholders are themselves large. This rule prevents the implicit price of votes from being (more than slightly) lower for a large voter compared to a small voter.

QV is superior to majority- or supermajority-rule voting because it ensures ex post efficient outcomes. QV blocks managerial opportunism because managerial opportunism is by definition inefficient. And QV minimizes the tyranny of majority shareholders by preventing majorities from using inefficient projects to transfer value from minorities to themselves.[23] When the majority supports an inefficient merger, the minority will outvote it by buying a larger number of votes. Because the minority loses more than the majority gains, and QV guarantees ex post efficiency, QV will block the transaction. When the majority gains more than the minority loses, the transaction will take place, but it is ex post efficient, and the minority will be protected in part by its payoffs under QV.

Of course, ex post efficiency is not the only, or even the primary, goal in designing a corporate charter. Instead, charter-writers seek to maximize the amount of capital raised, which depends on the marginal value of owning additional shares ex ante, in anticipation of future decisions, rather than total efficiency ex post, as we discuss in Appendix A. While there is no guarantee QV will maximize this ex ante shareholder value, it seems unlikely any mechanism could, given that individuals' incentives ex post will always be based on how the decision affects their *level* of ex post utility rather than their ex ante marginal willingness to pay for shares. Normal voting, for example, seems far less likely to maximize ex ante shareholder value, especially given that the inefficient manipulations by majority shareholders to expropriate minority shareholders (impossible under QV) are a sure-fire way to destroy ex ante value of shares. Maximizing ex post efficiency seems much more likely to align with ex

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[23]   QV fails only when the population of voters is small or there is aggregate uncertainty about the distribution of valuations, and as noted above it outperforms voting typically in these cases. See Weyl, *Quadratic Vote Buying* at *29–30 (cited in note 6).

ante shareholder value than do other equally ex post but also inefficient rules.

The most unusual feature of QV from the standpoint of corporate law is that anyone—including nonshareholders—can vote. Thus, large shareholders have no greater voting power than small shareholders, and shareholders have no greater voting power than creditors, employees, neighbors, or even ordinary people with no relationship with the corporation. If this feature of QV seems puzzling, note first of all that most people in the world will not exercise their right to vote for the simple reason that they must pay in order to vote, and they are extremely unlikely to outpay, and hence outvote, shareholders and others who have a pecuniary stake in the corporation. This is especially true given the fixed transactions costs of participating in such a vote. Similarly, large shareholders will normally pay more to vote than small shareholders will because large shareholders gain more from the outcome. Moreover, while nonstakeholders can vote, they do not receive any money from the vote purchases of others, as that money goes into the corporate treasury. Finally, bear in mind that even under the current system nonstakeholders can vote merely by taking the (usually) financially trivial step of purchasing a share of stock. The distinction between corporate stakeholders and outsiders has never been very clear.[24]

The main point to keep in mind is that QV guarantees that the transaction will be ex post efficient, thus maximizing the value of the corporation. In this way, QV ensures that shareholder value is maximized. Regular voting rules like majority and supermajority do not ensure ex post efficient outcomes and

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[24] When a corporation such as a mutual or investment fund serves as a common agent for multiple principals, the common agent can buy votes only as one individual. This means, for example, that if the corporation seeks to cast 10 votes, it must pay $100, rather than (say) $10 on behalf of 10 principals who each vote once for $1. This is true even if the funds used to purchase the votes belong to the principals rather than the agent. If principals delegate this decision to the agent, they would not then be allowed to vote a second time themselves, but would be able to monitor the behavior of the agent. This offers a simple means of extending QV to representative and other delegated situations: each individual can vote only under one identity, even when she represents many individuals. By monitoring their agent, these individuals forfeit the right to vote themselves. This leads to efficiency by precisely the same logic that makes QV efficient more generally, so long as the agent acts in the collective interests of the principals, as the votes she will buy on behalf of her principals will be proportional to the sum of their utilities.

so are unlikely to have superior incentives on ex ante behavior.[25] Under normal voting, in the absence of legal protections, outsiders with interests contrary to those of the firm may buy up a majority of shares and inefficiently undermine the firm. Under QV such behavior could occur only when it is socially efficient, which would greatly limit the scope for outside manipulation.

As a result of this feature, QV can be used more often than shareholder voting in the current system. Because QV is more accurate and robust than the current system, it would be reasonable to use it for transactions whose magnitudes fall below the size that currently requires a vote. For this reason, advocates of shareholder democracy should endorse QV.

A recurrent criticism of the current system of shareholder voting is that shareholders have insufficient incentive to inform themselves because part of the benefit of their voting is externalized on other shareholders. Because they do not adequately inform themselves, they either do not vote or vote badly. Because of the close connection between the Vickrey-Clarke-Groves mechanism and QV, the results of Professors Dirk Bergemann and Juuso Välimäki imply that under QV, unlike under standard voting, individuals have an incentive to optimally collect information that is relevant to their preferences and beliefs *so long as these do not have spillovers to what decision is in the interests of others*.[26] Obviously in the corporate context, much information *does* spill over to others as each small shareholder captures only a small part of the value of such information. QV will not provide efficient incentives for information acquisition in this case. Nonetheless, we conjecture, though we have not tried to prove, that QV is superior to traditional voting along this dimension. Intuitively, under voting, one needs only enough information to decide which side one favors. Under QV, one has an incentive to achieve a much finer determination of the intensity of one's preference, which seems likely to increase information acquisition.

More generally, it is well-known that markets do not generally provide efficient incentives for information acquisition. As Professor Jack Hirshleifer argues, information is often underprovided because of the inability of the informed individual to appropriate the total social value of the information; it may also

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[25]   We will discuss one possible limitation on this argument in Part II.D below.

[26]   See Dirk Bergemann and Juuso Välimäki, *Information Acquisition and Efficient Mechanism Design*, 70 Econometrica 1007, 1026–27 (2002).

be overprovided when it is used, for example, to beat another individual to an arbitrage opportunity as is common in high-speed trading.[27] Matters are very similar under QV: information relevant to the overall direction of preferences of many individuals will be underprovided, while information about how close the election is (and thus how valuable votes are) will be overprovided as this information is essentially zero-sum. Thus QV provides all of the benefits, and costs, of a market economy in its incentives for information acquisition, a set of trade-offs that, at least since Hayek,[28] has been considered overall superior to those arising from democratic voting.

One might object that under QV people will refrain from buying large blocks of shares because they do not obtain voting advantages. People with large blocks of shares will have more intense preferences regarding mergers and the like, and so they will anticipate that they will spend more money on voting than people with small blocks of shares. But in the current system, the right to vote is close to worthless.[29] People typically buy large blocks of shares not to obtain voting rights but to obtain a larger portion of the profit of a firm. QV, by guaranteeing that the firm will enter only ex post efficient transactions, should increase rather than reduce the value of equity. Furthermore, the funds raised through the expenditures on votes are added to the value of the corporation, raising the value of shares. It is plausible that this additional revenue will more than outweigh any increased value of shares from accompanying voting rights. For example, in recent experimental work on a voting system closely related to QV, Professors Jacob Goeree and Jingjing Zhang show that the revenue raised makes the overwhelming majority of individuals, even those who end up with much less influence, support QV over voting in experiments.[30] We discuss these results in greater detail in Appendix A.

Indeed, a major problem with the current system of shareholder voting is that it compels corporations to inefficiently bundle

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[27]   See Jack Hirshleifer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 Am Econ Rev 561, 567–70 (1971).

[28]   F.A. Hayek, *The Use of Knowledge in Society*, 35 Am Econ Rev 519 (1945).

[29]   See Henry T.C. Hu and Bernard Black, *Hedge Funds, Insiders, and the Decoupling of Economic and Voting Ownership: Empty Voting and Hidden (Morphable) Ownership*, 13 J Corp Fin 343, 348–53 (2007).

[30]   See Jacob K. Goeree and Jingjing Zhang, *Electoral Engineering: One Man, One Vote Bid* *16–18 (Mar 18, 2013), online at http://rangevoting.org/GoereeZhangMar2013.pdf (visited Mar 2, 2014).

the right to receive dividends and the right to vote. The two rights need not go together, as is clear from various preferred stock arrangements in which voting rights are severed or diluted. It is not entirely clear why the law prohibits people from selling their votes independently of their shares. As we discuss in Part II.C, the best argument for the ban on vote buying is that the current legal system requires majority or supermajority voting, and it is easier to circumvent these rules by buying votes alone (given that shareholders without controlling blocks value votes very little) than by buying shares.[31] A more fundamental reason is that linear vote buying would, as described in Part I, lead to the inefficient dictatorship of individuals with intense preferences. But this is precisely the problem solved by QV.

Another possible objection to QV is that it would allow interest groups or others to shut down a corporation they dislike on ideological grounds. If they can buy votes without buying shares, they can destroy a corporation in which they have no economic interest. The problem with this argument is that these outsiders would have to spend an enormous amount of money to buy votes, and this money would go to outvoted shareholders. The transaction is possible only if the social value of the firm taking account of outsider interests is less than zero. Given that it would be in fact cheaper under the current system for outsiders to gain control of and shut down a firm simply by buying a majority of shares, and we virtually never observe such transactions, we are skeptical of this objection. Furthermore, as we discuss in our critique of appraisal remedies in the next Section, unless such a group of outsiders is very large, under QV it is cheaper for them to pay the value of the firm plus a small sweetener to current shareholders so that shareholders will vote in favor of the proposal themselves than attempt to outvote the outsiders directly. Such a prospect can only increase value to shareholders. Corporate bylaws should ensure they do so by prohibiting side payments contingent on the vote, forcing outsiders to pay only shareholders (and not a large group of outsiders) to persuade them to approve their plans. Enforcement of such rules could fall under antitrust law.

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[31] For a discussion on voting markets, see Saul Levmore, *Voting with Intensity*, 53 Stan L Rev 111, 123–24 (2000); Henry T.C. Hu and Bernard Black, *The New Vote Buying: Empty Voting and Hidden (Morphable) Ownership*, 79 S Cal L Rev 811, 852–54 (2006).

QV is not a panacea. It is subject to the same arbitrage risks as majority and supermajority voting. For example, if a board wants to avoid a vote on a merger, it still retains the option to undertake the merger through a shell subsidiary.[32] However, at a minimum, these arbitrage risks are no worse under QV. And if QV is a better system, then shareholders may resist arbitrage (for example, by barring arbitrage transactions in the charter) because they care more about making their preferences felt through voting than they do under the regular system.[33]

C.   Square-Root Voting

Reforms of all types, and not just reforms to corporate law, often encounter a hostile reception simply because they are unfamiliar and are at variance with entrenched norms. QV may face a similar fate because of some of its unusual features. Even though money plays a significant role in shareholder voting—rich shareholders who buy more shares vote more—there may be some uneasiness with explicit vote buying, as one can see from the literature and cases on that topic.[34] Allowing nonshareholders to vote also seems unusual. And the redistribution of funds collected through the QV process would be novel in the corporate context.

To address these concerns, we propose as a slightly more modest alternative a variant of QV that we will call Square-Root Voting (SRV). SRV provides simply that only shareholders vote, and that shareholders have the right to vote the square root of the number of shares they own. A shareholder who owns 1 share gets 1 vote; a shareholder who owns 4 shares gets 2 votes; a shareholder who owns 10 shares gets 3.2 votes; and so on.

SRV is formally almost identical to QV. To see why, consider the perspective of an investor who does not yet own any stock in Corporation X. Corporation X announces its intention to merge

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[32]   We have also not addressed how board voting would work; our focus instead has been on shareholder approval of transactions. Very roughly, board voting could work like this: SRV should be used to elect the directors. Shareholders vote in favor or against various candidates for the board, and those who receive the largest net number of positive votes are elected to the board. Each director is then given a number of tokens equal to the number of net positive votes she received. The director then allocates her tokens across various QV votes over a given period of time. We do not have the space to defend this proposal here, and save it for future research.

[33]   On the other hand, managers set on opportunism may work harder to engage in arbitrage.

[34]   See Part II.D.

with Corporation Y. Under current law, the investor can pur-
chase stock in X (or Y) and then exercise the voting rights asso-
ciated with the share (or shares) of stock. Thus, the investor
might buy the stock both because she believes that the merger
will take place and that it will increase the value of the stock,
and because she hopes to use the voting power to increase the
probability that the merger will take place.

Under QV, the investor chooses the number of shares that
she buys solely for the purpose of optimizing payment streams.
She separately buys as many votes as is optimal for her to influ-
ence the outcome. Under SRV, the investor effectively buys
stocks for their voting power. Because she can expect to resell
them for the same price that she buys them for, she incurs only
the opportunity cost of buying them. SRV ensures that this op-
portunity cost increases at a quadratic rate, and in this way re-
sembles QV. If the ban on "empty voting" (trading votes and
shares separately, as discussed in the next Section) were
dropped, SRV would be even closer to QV, differing only in the
fixed number of potential votes.[35]

Yet SRV differs from QV in several ways that may be im-
portant as a matter of symbolic political rhetoric but are of little
importance substantively. Most important, under SRV share-
holders vote as they normally do; the only difference is that their
voting power increases at a decreasing rate as the number of
votes they cast increases. This approach differs in degree but not
in kind from voting rules established in the charters of many
corporations, for example, through the creation of classes with
different voting rights, as are used for poison pills. SRV also
does not permit nonshareholders to vote and does not require
the collection and the redistribution of funds. These similarities
to existing practices may make SRV more palatable to judges
and corporate boards than is QV, at least in the short term, and
may smooth the way for the adoption of more explicit QV in the
long term.

D. Legal Issues

As noted earlier, corporate law gives corporations a great deal
of freedom to fashion voting systems. Although most corporations

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[35] This fixed supply is irrelevant as it determines, by the laws of supply and de-
mand, endogenously only the multiplier in front of the quadratic term in the price of
votes. Because this multiplier is irrelevant to all of the properties of QV, it makes no dif-
ference.

use regular majority or supermajority rule for major transactions like mergers, charter amendments, and board elections, there is a great deal of variation. For example, through a series of agreements with shareholders of Facebook, Mark Zuckerberg has 57.1 percent of voting control even though his economic stake in Facebook is only 28.4 percent.[36]

A corporation could provide in its charter that shareholders would have the conventional right to a share of the firm's profits, but that there would be no right to vote attached to each share. Instead, whenever the firm holds a vote, anyone registered as a shareholder at the time of the vote would have the right to participate.[37] Each shareholder, regardless of how many shares he owns, would have the same voting power: the right to cast one vote for $1, two votes for $4, and so on. The payments would be made to the corporation, which would either deposit them in its treasury or put them in a fund, which would then be distributed pro rata to the shareholders at the conclusion of voting.

The major legal obstacle to QV is the somewhat qualified ban on vote buying, but the law on vote buying does not directly apply to QV despite its name. Indeed, existing law is better interpreted as directed at vote *selling—by* shareholders—not vote buying in the QV system, in which the corporation, not a third party, sells the vote and the consideration is deposited in the corporate treasury. Thus, the traditional per se rule against vote selling does not apply to QV on its terms.

Moreover, the rationale for that per se rule was that

> each stockholder should be entitled to rely upon the independent judgment of his fellow stockholders. . . . The apparent rationale is that by requiring each stockholder to exercise his individual judgment as to all matters presented, "[t]he security of the small stockholders is found in the natural disposition of each stockholder to promote the best interests of all, in order to promote his individual interests."[38]

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[36]   Evelyn M. Rusli, *Zuckerberg Takes Control, You Get $100*, NY Times DealBook Blog (NY Times Feb 8, 2012), online at http://dealbook.nytimes.com/2012/02/08 /zuckerberg-takes-control-you-get-100 (visited Mar 2, 2014).

[37]   As we noted earlier, voting rights need not be limited to shareholders; but we suspect that in the early stages of its adoption, corporations are likely to confine voting rights to shareholders.

[38]   *Schreiber v Carney*, 447 A2d 17, 24 (Del Chanc 1982), quoting *Cone v Russell*, 21 A 847, 849 (NJ Eq 1891).

Even if this rationale were accepted, it would not provide an objection to QV, because QV in fact advances the interest of small shareholders much more effectively than ordinary voting (with or without vote buying) does.

Delaware courts now reject any per se rule against vote buying and instead ban vote buying when it is fraudulent or violates a test of "intrinsic fairness."[39] Clearly, there is nothing fraudulent about QV. The intrinsic fairness test is rather obscure, but we also see nothing unfair about QV since it ensures ex post efficiency and, as we discuss below, will usually ensure compensation for outvoted minorities.

A number of academics have launched a separate line of attack on vote buying. A controversy erupted a few years ago over "empty voting," in which parties engage in financial engineering in order to separate the vote and the economic value of the share it is attached to.[40] For example, the owner of a share lends the share to an investor for a very brief period of time during which a corporate vote is held. The investor exercises the vote during this period but does not bear any economic consequences of the vote since the impact of the vote on the value of the firm takes place after the share is returned to the owner. An investor can also buy a share in order to obtain the voting right while fully hedging against any change in the value of the share.

Traditional, linear vote buying, whether in this form or another form, usually leads to inefficient outcomes.[41] But these outcomes result only when vote buying takes place in a regular voting system and thus, crucially, is linear. In fact, precisely the same analysis that Weyl uses to show the efficiency of QV implies that linear vote buying is inefficient.[42] A broad class of vote-buying rules nests democracy, dictatorship, and QV all as special cases. Thus vote buying in general, and QV in particular, should not be tarnished with the same brush as is linear vote buying and its dictatorial results. As discussed in the previous

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[39]   *Schreiber*, 447 A2d at 25–26; *Crown EMAK Partners, LLC v Kurz*, 992 A2d 377, 388 (Del 2010).

[40]   See Hu and Black, 79 S Cal L Rev at 828–32 (cited in note 31).

[41]   For an informal account, see Levmore, 53 Stan L Rev at 124 n 25 (cited in note 31); Hu and Black, 79 S Cal L Rev at 850–51 (cited in note 31). For a formal account, see Holger Spamann, *Derivatives Trading and Negative Voting* *7–17 (Harvard Olin Faculty Discussion Paper No 730, Sept 2012), online at http://www.law.harvard.edu /programs/olin_center/papers/pdf/Spamann_730.pdf (visited Mar 2, 2014). See also Robert B. Thompson and Paul H. Edelman, *Corporate Voting*, 62 Vand L Rev 127, 162–66 (2009).

[42]   See Weyl, *Quadratic Vote Buying* at *40 (cited in note 6).

Section, "empty voting" and vote buying combined with appropriate rules (square-root voting) leads to a fair and efficient outcome.

Indeed, even if QV were deemed illegal, SRV would almost certainly survive a legal attack. Under SRV, the shareholder does not explicitly buy votes; she merely exercises the right to vote that accompanies her share. The fact that she can possess votes only equal to the square root of the number of shares does not, even indirectly, implicate vote buying.

QV (or SRV) is not only lawful; it also reduces the need for corporate law that protects shareholders from managerial opportunism and minority shareholders from large-shareholder opportunism. Because QV blocks such opportunism, the protections are not necessary.

The most important such protection is the appraisal remedy. If majority shareholders engineer a merger that appears to offer unfair payoffs to the minority, the minority can seek protection in court by demanding an appraisal remedy.[43] If it is successful, the corporation must pay minority shareholders the actual value of the shares, as determined by a court after a lengthy and complex valuation proceeding.

In a QV system, the ability to freeze out minority shareholders would be greatly diminished or even eliminated. There are two reasons for this. First, because QV blocks inefficient mergers, the majority would be unable to effect inefficient mergers in order to transfer value to itself. The majority would be able to engage in such opportunistic behavior only when the merger is efficient. Second and more important, QV is particularly unfavorable when a single shareholder or small group of shareholders attempt to impose their will on a majority. In Appendix B we show that, because of the small numbers, QV is *not* efficient in this case: it is biased against the small manipulative group! In particular, no individual or small group of shareholders can ever profitably succeed in outvoting other shareholders with any significant probability when the number of other shareholder-voters is large. Even when they do (with very small probability) win such a vote, the payments they make will typically fully compensate other shareholders for their loss. Thus, a shareholder or small group of shareholders seeking to execute such a plan would find it cheaper and more reliable to pay the

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43   See *Kaye v Pantone, Inc*, 395 A2d 369, 375 (Del Chanc 1978).

shareholders enough of the surplus of such a transaction to make them want to vote for the transaction themselves. Intuitively, because the costs of voting are quadratic, and so the cost of casting the marginal vote increases at a greater-than-linear rate, it is cheaper as a small group to incentivize others to vote in your favor than it is to attempt to outvote them yourself. This self-interest provides a far more effective check on opportunism than does the bureaucratic and inaccurate appraisal process. The only case when appraisal could do better is when information is hidden from shareholders and is revealed through the appraisal.

A related and promising application of QV is in the area of poison pills. In response to a wave of hostile takeovers in the 1980s, many corporations amended their bylaws so as to make it more difficult for outside investors to succeed in their takeover efforts. A typical poison pill provides that when an outside investor obtains shares above a threshold (typically, a significant minority), then insiders may purchase additional shares at a discount (for example, 50 percent).[44] Thus, insiders can buy up shares in order to obtain votes to oppose the takeover. Managers defend poison pills, claiming that takeovers frequently destroy jobs and disrupt operations. Shareholder activists argue that poison pills entrench management so that it does not pay for its mistakes by losing control of the corporation.

Poison pills are controversial but generally lawful in the United States, although not in all countries, and even in the United States, they can be challenged under general principles of corporate law. Now consider a poison pill that incorporates QV or SRV. A corporation could amend its bylaws to provide that any hostile takeover be subject to a vote under SRV. SRV does away with the threshold requirement (which is arbitrary) and replaces the simple discount rule with the more fine-grained quadratic function, which effectively makes it cheap for dispersed shareholders to vote for or against the merger but costly for large shareholders including management to oppose it. Since SRV guarantees ex post efficient results, it should ensure that takeovers are approved only when they are efficient. Poison pills

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44   See, for example, Richard Siklos, *News Corp. Sued over Poison Pill Move*, NY Times C3 (Oct 8, 2005).

should be lawful and immune to challenge as long as they comply with these principles.[45]

CONCLUSION

QV holds great promise as a mechanism for eliciting people's private valuations. It is well suited to the corporate context, which lacks the norm of one-person–one-vote and in which law and tradition permit people to use money to signal the intensity of their interests in managerial decisions. As with any innovation, QV merits experimentation prior to widespread adoption to help reveal potential weaknesses that eluded our analysis given the novelty of QV compared to the many centuries of experience with voting. The flexibility of corporate charter law allows for such small-scale experimentation by innovative, early-adopting firms that could then be studied by others and, if successful, spread. In the longer term, if such experimentation is successful we believe that QV could be useful in other settings. Professors Scott Duke Kominers and Weyl advocate its use as an alternative to eminent domain in land assembly;[46] Posner and Weyl incorporate it into a proposal for reforming Chapter 11;[47] and Weyl suggests variants that might be plausible for committee or broader public decision making even if an aversion to "money in politics" persists.[48]

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[45]   For a brief argument along these lines, see Eric Posner and Glen Weyl, *How to Make Poison Pills Palatable*, NY Times DealBook Blog (NY Times July 17, 2013), online at http://dealbook.nytimes.com/2013/07/17/how-to-make-poison-pills-palatable (visited Mar 2, 2014).

[46]   Scott Duke Kominers and E. Glen Weyl, *Concordance among Holdouts* *24–25 (Harvard Institute of Economic Research Discussion Paper, Sept 2012), online at http://ssrn.com/abstract_id=1591466 (visited Mar 2, 2014).

[47]   Eric A. Posner and E. Glen Weyl, *Voting Rules in Chapter 11: A Proposal for Reform* (unpublished manuscript 2013) (on file with authors).

[48]   Weyl, *Quadratic Vote Buying* at *38–41 (cited in note 6).