Informational Limits to Democratic Public Policy[1]

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I. Introduction: Information, Scarcity, and Elections

There is considerable survey evidence that voters know very little about government policies or the backgrounds and personalities of important governmental officials. On the other hand, there is also considerable evidence that democratic polities work quite well. Clearly, if democratic outcomes were based entirely on the limited information available to a "typical voter," democratic policies could not be very effective, and polities based on majority rule would evidently be doomed to endless mistakes and failure. That is to say, even the best democratic government imaginable might adopt policies that are far from perfect, because voters know so little about public policy issues. Yet the experience of the past century suggests that democratic polities are attractive rather than repulsive polities. The citizens of long standing democracies have the highest incomes and longevity on earth. How is this possible?

One possibility explored below is that majority rule, itself, aggregates voter information in a manner that allows far better policy decisions to be chosen via elections than would be possible if policies were made directly by a "typical" voter. Condorcet's jury theorem implies that majoritarian outcomes are often *better informed than any of the participating voters*. None the

[1] This paper has benefits from numerous discussions with David Levy, James Buchanan, Gordon Tullock, Robin Hanson, Brian Caplan, Don Witman, John Lott, and many other colleagues over the years. They, of course, are blameless for the analysis developed below.

less, there are limits to the information aggregating ability of majority rule, which in turn limit the scope of effective democratic policy. These limits are also explored in this paper.

Although the informational limits of voters have long been lamented by pundits and pollsters, most rational choice based analysis of democracy neglects informational problems in order to focus on the institutional limits of democracy. That literature addresses such question as: Does the problem of cyclic majorities imply that majority rule cannot be used to make collective decisions? Are majoritarian outcomes random or dominated by institutional agenda setters? Are interest groups able to operate behind the scenes in a manner that distorts public policies away from those preferred by voters, and are there substantial rent-seeking losses from those activities? How well do governmental agencies implement and enforce legislative decisions? Are there agency problems within the executive branch of government that legislative oversight fails to solve? Are budgets, as a consequence, too large or too small, and are policies too oriented toward special interest groups of various kinds? and so forth. The analytical work of this research program attempts to understand how democratic institutions operate, the associated empirical work demonstrates that the results of that analysis do, in fact, explain much about real democratic polities. The normative literature assesses the relative merits of the political outcomes predicted by the positive literature, and suggests possible policy or institutional reforms to improve political and economic performance. That literature demonstrates that thoughtful institutional design can assure majoritarian stability and reduce rent-seeking losses.

This paper addresses a quite different, although complementary question. Namely, what are the informational limits of public policy? In other words, suppose that all the normative agency and stability problems focused on by the mainstream public choice literature are solved with institutional reforms; how well would democracy work, given the information available to voters?

The informational limits of public policy are neglected in most public choice analyses for a variety of reasons, including analytical convenience. In most rational choice models of politics, voters and politicians are assumed to be able to make decisions that are largely unaffected by information problems. In effect, voters and politicians are assumed to have complete information about the full range of policy options available to them and their future

consequences--whether electoral or with respect to future welfare. The future in these models is not always known with certainty, although voters are widely assumed to *know as much as it is possible to know* in the environment under study. In most cases, voters and politicians are assumed to know the probability distributions that characterize the causal relationships of interest or the behavior of other political actors. These assumptions to facilitate analysis of problems not driven by informational problems, and allow the various non-informational consequences of rational choice to be developed with a minimum of analytical clutter.

The purpose of this paper is not to criticize the many careful studies that have been facilitated by ignoring informational problems. However, in some cases, informational problems are at the heart of the matter to be examined and such assumptions are not so easily justified.

The purpose of this paper is to examine some of the neglected consequences of unavoidable information problems associated with democratic politics. The analysis suggests that informational problems remain important in settings where voters are rationally ignorant, and may ultimately limit the scope and effectiveness of public policy within well-functioning democracies. The jury theorem can not perfectly solve all of the information aggregation problems faced by modern democratic governments. However, the informational limits are not as binding as implied by survey evidence, but it is constraining none the less.

This paper explores the information aggregating properties of majority rule. It demonstrates that majority rule can reduce the impact of rational decisions by voters to economize on information, and also explores the extent to which expert-bureaucrats and public information policies might reduce the problem of voter ignorance. Simulations are used to explore some of the small sample properties of elections where voters assess the relative merits of candidates by estimating a "quality of candidate" function in which candidate quality is determined jointly by observable and non-observable candidate characteristics.

Section II of the paper reviews the rational ignorance and Condorcet jury theorem literatures. Section III of the paper uses simulations to demonstrate the power and limits of the jury theorem in cases where voters have just very small (although complete) data sets. Section IV demonstrate that rational ignorance is a greater problem for democracy than limited data. Rational ignorance substantially increases the likelihood that electoral outcomes are mistaken.

Section V reviews public policies that can reduce information problems and improve the efficiency of majority rule. It notes that experts are unlikely to solve the problems discovered in section IV. Section VI summarizes the results and suggests extensions.

Overall, the analysis suggests that neither the aggregating properties of majority rule nor experts can completely solve the problem of voter ignorance.

II. The Rational Ignorance Literature and Condorcet's Jury Theorem

There is a long, although somewhat sparse literature that attempts to analyze how information problems affect political decision making. For example, the early Italian school of public finance attempted to analyze the effects of information biases, what came to be called fiscal illusion, on public policies, Puviani (1897, 1903). The Italian school argued that politicians exploit voter ignorance by using taxes that were difficult for ordinary individual to assess while exaggerating the benefits of government programs and downplaying their costs. A related problems was tackled by Downs (1957) and Tullock (1972) who attempted to analyze voter incentives to be well informed. Both Downs and Tullock argued that voters would gather little information about public policy, because their decisions were very unlikely to affect electoral outcomes. As a consequence, voters might systematically under estimate the benefits or costs of public policy, because of entirely rational decisions to economize on information. Rational ignorance, thereby, provides a possible micro foundation for fiscal illusion and mistaken public policies.

Survey data is largely in accord with these predictions. Voters rarely know who important political figures below presidential or prime ministerial levels are, and often are confused about which candidate favors which policy, Neuman (1986).

A parallel literature, rooted in Condorcet's jury theorem (1785), suggests the problem of uninformed voters may not be a major problem for democracies. For example, Lupia and McCubbins (1998) and Austin-Smith and Banks (1996) argue that democratic decisionmaking is not mistake prone. The jury theorem and the statistical properties of medians combined with electoral competition between political parties implies that voters may not need very much information for democracy to yield "correct" policy outcomes. Lupia and McCubbins argue that party labels have enough informational content that voters rarely mistakenly vote for the

"wrong" candidate. Wittman (1995) argues that information problems are no worse in political markets than they are in private markets. These papers and others that more directly explore the implications of Condorcet's jury theorem suggest that the policy choices made by majority rule tend to be far more accurate than one would expect based on survey evidence on voter knowledge.

Elementary statistical theory implies that even a small sample is sufficient to allow individuals to form unbiased (although imprecise) estimates of any phenomena. The jury theorem based literature implies that the micro foundation of fiscal illusion provided by the "rational search" interpretation of the Downs and Tullock hypothesis is fundamentally incorrect. Democratic outcomes would not be systematically biased even in cases where voter information is very limited as long as the data collected is accurate, or is accurately filtered. So, the source of fiscal illusion, if it exists, cannot be of small samples that result in search models, Stigler (1961). Voters can radically economize on policy relevant information without undermining the accuracy of majoritarian decisions, or the viability of democratic policy formation.

The information aggregating effect of elections yields accurate policy assessments or candidate choices, insofar as the median error term in a large sample asymptotically approaches that of the underlying uncertainty. This would be the case if median estimates are both unbiased and very accurate (Levy and Peart, 2002). This property of majority rule is demonstrated in the simulations developed in section III of the paper, as a point of departure. The jury theorem does not imply that mistakes are never made, but that democratic outcomes are not systematically biased. *However, there are other ways in which a voter's may economize on data collection than sample size.*

Congleton (2001) suggests that fiscal illusion and other forms of biased expectations are not based on small samples, but rather are consequences of *complete ignorance* of policy relevant information. If voters economize on information costs by collecting *no data* about a subset of policy relevant parameters, voter information is incomplete in different sense than analyzed by the jury theorem literature. Such voters are *ignorant rather than poorly informed* about relevant policy parameters and implications. Confusion on this point exists because the Downs and

Tullock discussions of rational ignorance are unclear about what is being "sampled" by voters, and exactly what is meant by rational ignorance.

When information about some relevant parameters are *not available, not gathered, or not analyzed*, biased expectations are very likely. Indeed, Congleton (2001) demonstrates that ignorance implies that unbiased estimates cannot be formed by even the most conscientious and rational voter. In such cases, fiscal illusion and other biases characterize voter expectations and the public policies based on them. The simulations in section IV of this paper demonstrate that majority rule is substantially less likely to produce good decisions if rational ignorance is widespread. The jury theorem can ameliorate, but does not solve, the problem of rational ignorance for democracies.

III. Majority Rule as an Estimator: How "Informed" Is the Median Voter's Vote?

A. Delegation and Voter Choice in a Setting of Informational Scarcity

Reflect for a moment on the problem that all voters face in choosing among candidates and their proposed policies. First, the future cannot be observed in the present. So, whatever choice that a voter makes is necessarily based upon estimates of some kind. Second, these estimates can only be based on what is known at the time a choice is to be made. That is to say, only historical data can be used to assess candidate based on their anticipated policy decisions.

In elections between candidates, voters will normally have more information about the quality of incumbents than about challengers. The quality of judgment that an incumbent exercises is revealed by his past actions, and can be used to predict his future performance. The performance of a challenger is necessarily more difficult to assess, until he or she takes office and subsequently makes policy decisions. Challenger quality, consequently, is estimated more indirectly and less accurately than that of incumbents, which is one of the many advantages of incumbency if voters are risk averse, Congleton (1986).

Third, in either case, predicting the relative merits of incumbents and challengers requires a "model" of some kind, in either case. The future has to be predicted, since it cannot be directly observed. Given a model, whether intuitive or mathematical, voters can what ever data they have available to estimate candidate quality and platforms and rank the candidates (or parties) competing for elective office.

Fourth, in a world where information costs are trivial, a voter's estimated model of candidate quality and of the future consequences of their policies might be based on very substantial data sets. However, in a world where time and attention are scarce resources, the "data base" of one's political forecasts will tend to be very limited for good economic reasons. Survey evidence suggests that the models used will ordinarily not be very sophisticated and that voter estimates of model parameters will be based on very small data sets. Evidently, the private returns from accurate predictions tend to be fairly small, even in cases where voters have clear financial interests in the policies at issue (which they often do, Congleton, 2001).

In a setting where information is costly, statistical theory implies that voter estimates will tend to be fairly inaccurate. However, this does not necessarily imply that the outcomes of competitive elections are similarly inaccurate.

Consider the following model, which captures the essential features of the decision problem outlined above and will be used to simulate electoral outcomes. Suppose that two candidate compete for elective office and that their platforms have completely converged to the median voter's ideal point. In this case, voters can only rationally distinguish between the candidates if the candidates differ in some other relevant dimension, for example, competence or in some other index of quality.[2] Suppose further that it is well known that the quality of candidate *i* is a linear function of one observable characteristic, E, (perhaps experience or intelligence) and one unobservable characteristic, H, (perhaps honesty).

For the purposed of the simulations, both E and H are assumed to be randomly distributed among candidates. E is distributed uniformly, $U(E_L,E^H)$ with $E^L = - E^H$. Unobservable characteristic H has mean a and variation $u_i \sim U(h^L, h^H)$ with $h^L = -h^H$. The quality of a particular candidate *i* is:

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[2] The point here is to simplify the analysis rather than to argue that this actually exact convergence actually takes place. The models and simulations can also be used directly to model referenda on two policies or two politicians in cases where decisions are based on a single measure of quality (private net benefits, economic growth rates, or quality of life index). Similar assumptions are used in most jury theorem papers, although most such papers assume that the "yes no" choice is "estimated" directly rather than indirectly with a model.

To extend the analysis to a multitude of voters with different objective functions is a somewhat more difficult project that will be undertaken in future research. However, in such settings, the analysis should be thought of as that of a single more or less homogenous group within the electorate.

$$Q_i = a + bE_i + u_i \quad (1)$$

where E_i and u_i are specific values for candidate i. Unfortunately, the challenger's quality cannot be directly observed before he takes office. It could only be perfectly predicted if a, b, E_i, and u_i were known beforehand. However, *H* is unobservable, and parameters *a* and *b* are not known to voters, a priori, but have to be estimated by each voter.

Note that in the electoral setting modeled here, that it is the estimation process rather than voter preferences that creates differences of opinion about the relative merits of candidates. Candidate positions have converged to identical platforms and all voters agree about the determinants of candidate quality. Consequently, any disagreement about the relative merits of the candidates reflect differences in the estimated values of *a* and *b*.

In the informational setting of interest here, voters all use very small data sets to estimate the quality of candidate relationship. The smallest data set that can be used to estimate a linear model consists of two data points. With the aim of reducing voter information to the minimum sufficient for purposes of estimation, it is assumed that all voters know the quality, *Q*, and value of the observable characteristic, *E*, for the incumbent and one other successful, although different, reference politician from the past. This might be the case, for example, if the voters had lived in different jurisdictions in the past, or simply tended to focus on different historical figures when evaluating the relative merits of politicians.[3]

The estimated quality of the challenger and incumbent will vary among voters insofar as voters use different data sets. Indeed, "small" difference in voter "samples" can generate quite large differences in estimated candidate quality functions. Figure 1 depicts two such estimates for voters who focus on quite different reference candidates. In the case depicted, the difference in the estimated candidate quality function causes these two voters to disagree about the relative merits of the current incumbent and that of the challenger. (Imagine, for example, using James Madison or Jimmy Carter as reference politicians, with George Bush as the incumbent.) In figure 1, Voter 2 favors the incumbent over the challenger, and Voter 1 favors the challenger over the incumbent.

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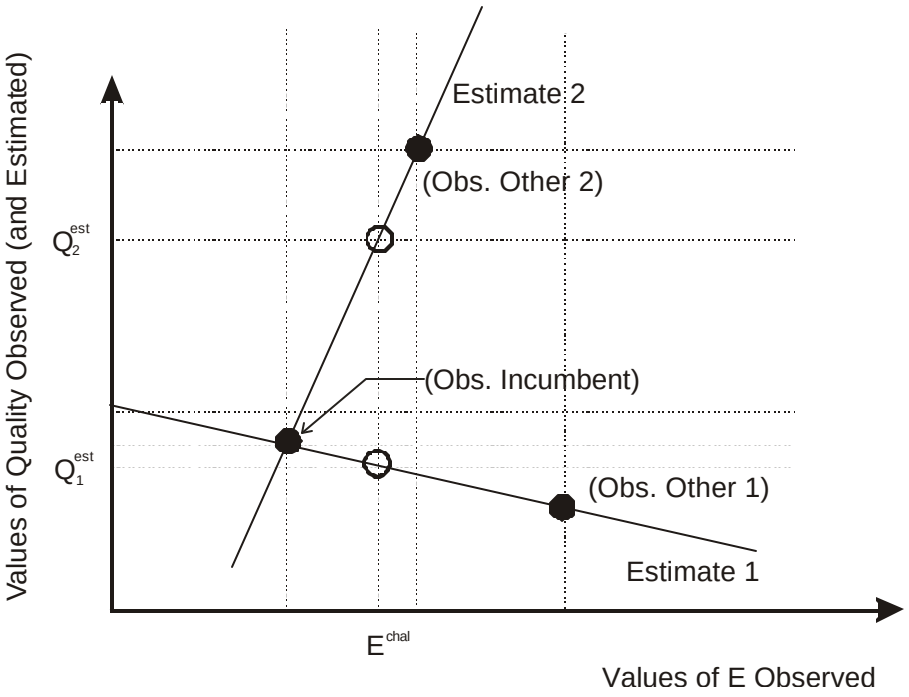
[3] The same argument can also be applied to policy areas, themselves, where voters may all have different experience with existing public and private programs that are used as the basis of estimates of a program's relative merits.

Figure 1

Variation in Voter Estimates
of Candidate Quality
For Voters with Different Data Sets



In the case of analyzed here, these differences are entirely the result of informational differences (the use of different reference candidates) rather than voter preferences or candidate policy positions.

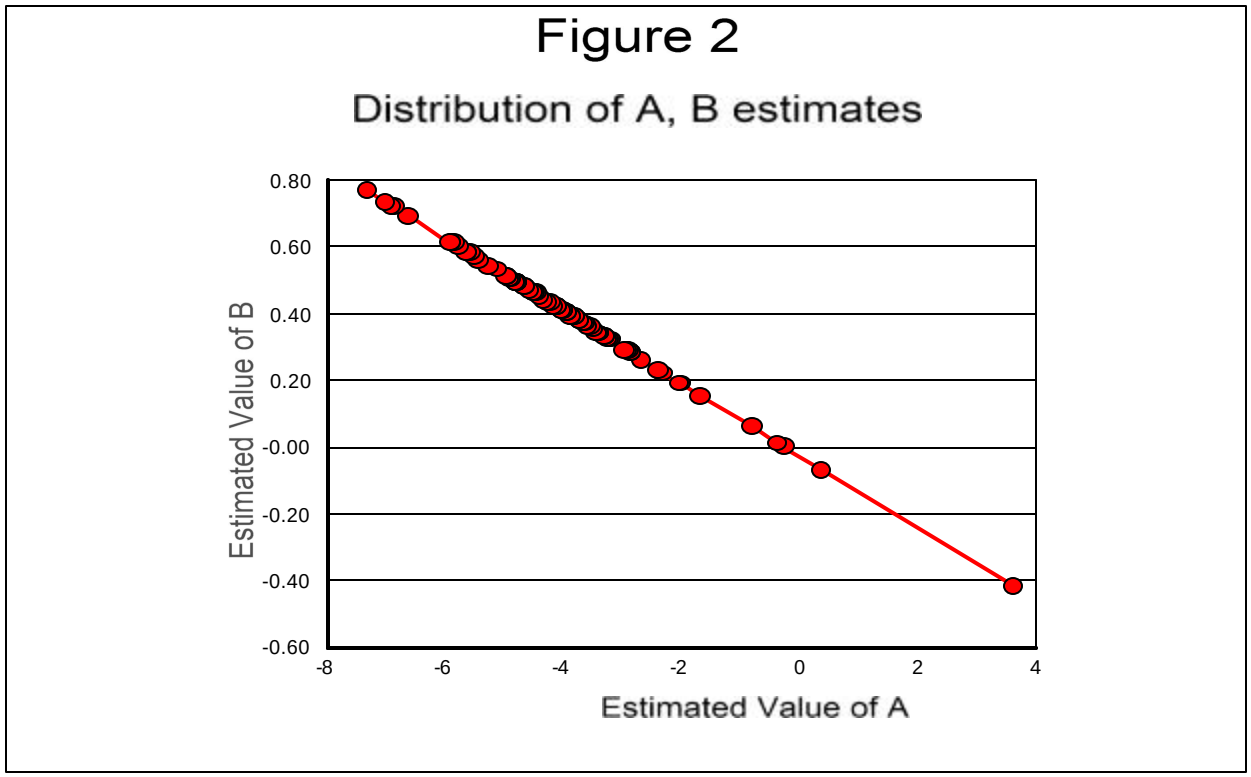
Small differences in small data sets can lead to a very wide range of voter opinions about candidate quality, because every observation tends to be an influential data point. Indeed, many unbiased voter estimates will appear absurd or crazy. None the less, the median estimate may still be an accurate estimate of the *true* underlying quality of the candidate.

B. Majority Rule as an Information Aggregation Device: the Power of Condorcet's Jury Theorem

Consider the range of estimates that would result in the case in which reference candidates are drawn randomly from a distribution in which the observable characteristic is uniformly distributed, $E \sim U(-10, 10)$ and the stochastic component of the unobservable

characteristic, u, is uniformly distributed, $u \sim U(-2, 2)$, where $H = -4 + u$, and $Q = H + (0.4)E$. The true underlying candidate function is, thus, $Q_0 = -4.0 + 0.4\,E_0 + u_0$.

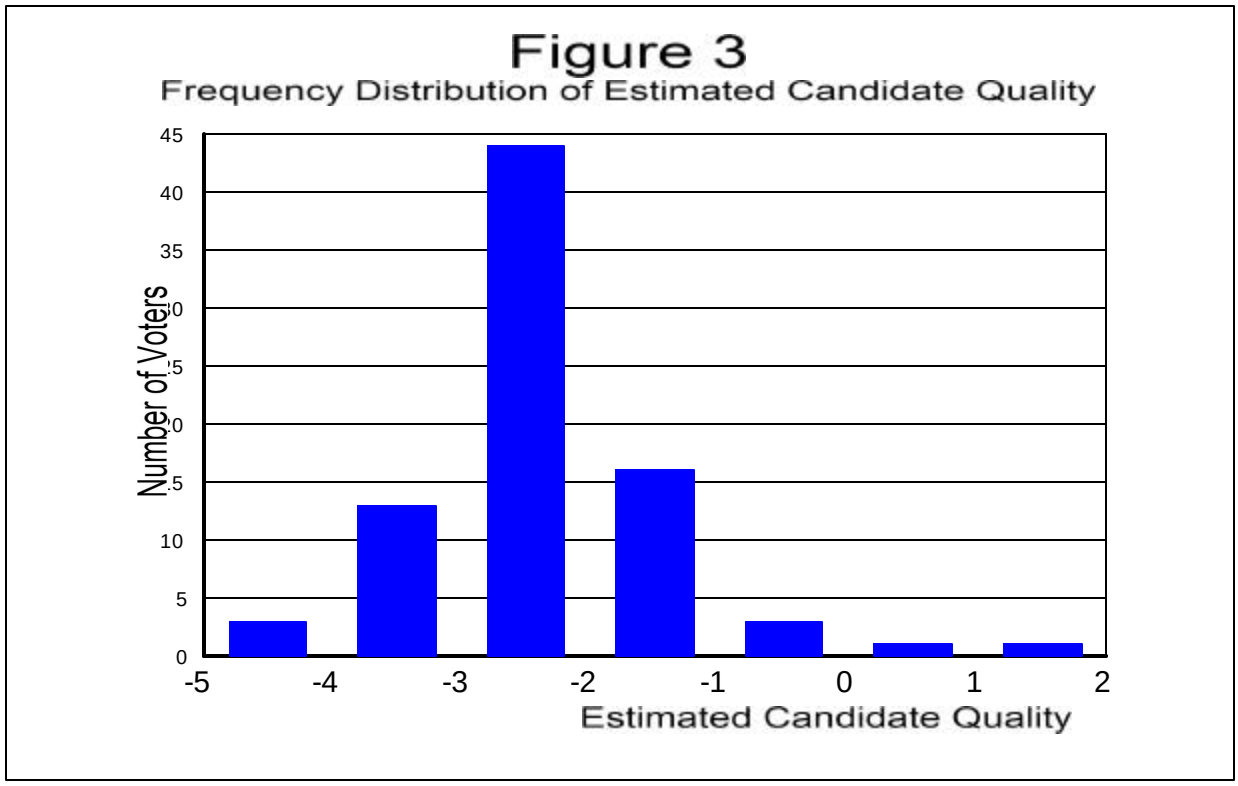
Figure 2 depicts a somewhat truncated scatter diagram of voter parameter estimates of $Q = a + bE$ for a population of 101 poorly informed voters. Each voter knows the incumbents quality and observable characteristic E. Each voter also knows the quality and observable characteristic of one other office holder drawn from the same distribution of possible candidates. The high and low tails have been left out so that the middle eighty percent of the estimates can be examined more easily. (The complete range of B estimates ranged from +6 to -9, and that of A ranged from -57 to 83.)



The linear relationship between the estimated A and B parameters is a consequence of the assumption that voters have only two data points, one of which is in common, and is without particular interest. What is of interest is the wide range of voter estimates of the underlying parameter estimates. Even after the outliers are neglected, many of the voter estimates are "way off," "absurd," indeed, impossible Yet, it is evident that the central

estimates are accurate estimates of the underlying quality of candidate function. (Recall that the true values of the *a* and b are -4.0 and 0.4 for these simulations.)

Voters use their estimated model of to determine the quality of the challenger, given values of the observable variable, *E*. Figure 3 depicts a truncated frequency distribution of estimated challenger quality for the above group of voters. Estimated challenger quality is obtained by substituting the value of the observable quality indicator of candidate quality, which in this case is assumed to be +4.0, into the estimated equation.



The entire range of estimated quality for the challenger varies from +47 to -32. *Many of these are actually impossible, but are none the less consistent with voter experience.*[4] Within the "moderate" 80 percent of the electorate tabulated in figure 3, the assessments of challenger quality varies far less, but the range of opinion is still considerable, from +2 to -5. The actual quality of the

[4] In the simulations, voters are unaware of the true underlying distribution of possible candidate qualities E and H, although they know that the true quality relationship is linear. The possible range of candidates varies from -4 + (.4)(10) + 2 = 2 to -4 + (.4)(-10) - 2 = -10. Many of the estimates imply that voters believe the challenger to be far better or far worse than is actually possible (which often appears to be the case in American politics).

challenger is -2.4 = -4 + 0.4 (4). Note that *the distribution is centered over the true quality* of the challenger. Indeed, in the case depicted, the median voter has a very accurate estimate of challenger quality, -2.39. The median voter is not always this accurate, but such accuracy is common in the simulations. On average, the median voter gets it right.

The more accurate is the median estimate of challenger quality, the more likely it is that an election will select the right candidate or policy. (The better candidate is objectively known in the simulations, but, of course, is not often known in real elections).

The accuracy of electoral outcomes can be explored more fully by simulating a series of elections where incumbents, reference candidates and challengers all vary by election. (Voters will make fewer mistakes when there are large differences between challenger and incumbent and be more likely to make mistakes when the two are similarly in quality.) In the next series of simulations, a series of 100 elections is simulated for electorates of various sizes. The incumbent, reference candidate, and challenger are all drawn from the same distribution of candidate characteristics, and change in every election.

As before, the candidates are drawn from a pool of candidates with characteristic E distributed uniformly from -10 to +10 and Hi = -4 + u_i with $u_j \sim U(-2,2)$. The competency function is the same as that used above, which allows the effects of the various electoral settings to be compared. Table 1 lists results from six series of simulations for electorates composed of 11, 101, 501, 1001, 2001, and 4001 voters.[5]

[5] The larger electorates take several simulations take several hours to run on a modern lap top, because finding the median requires the rank order of voter estimates. The number of calculations performed in the uncompiled code used for the simulations is on the order of the number of voters factorial. N! rises rapidly as the number of voters increases, for example, 101! is approximately 10^{160}.

Table 1
Electoral Outcomes as Estimates of Candidate Quality

Electorate Size	Average Challenger Quality in Sample	Median Estimated Challenger Quality	Standard Error of Median Est. Candidate Quality	Number of Electoral Mistakes
11	-4.114	-4.068	2.68	13
101	-3.808	-3.975	2.77	14
501	-3.884	-3.827	2.63	14
1001	-3.964	-3.979	2.34	13
2001	-4.07	-4.093	2.31	10
4001	-3.787	-3.746	2.43	13

100 elections are simulated for each community of voters, electoral outcomes are tabulated, and sample statistics computed. The incumbents, reference candidates, and challengers are drawn from the same distribution, and vary in each election.

The power of the jury theorem is clearly evident in these simulations. First, note that the median voter's estimate of challenger quality is, on average, very accurate, even in small electorates. The average difference between the median estimate and the average true value is less than 2 percent in each of the election series. Second, the size of the electorate does not matter very much, in spite of the extremely limited information base used by voters to assess candidate quality and the wide range of voter estimates of candidate quality (recall figure 3). The standard error of the median estimate of challenger quality falls only slightly as the size of the electorate increases. That is to say, median estimates rapidly approach the prediction limits determined by the underlying stochastic nature of the phenomenon.

On average, the median voter gets it right, or at least nearly right, even in small electorates (committees), although errors are still be made in a given election.[6] The last column

[6] The present simulations one do not assume, as often done in work on the jury theorem, that a

tabulates the number of electoral mistakes made over the course of the 100 elections simulated. In more than ten percent of the cases, the median voter's estimate of challenger quality is wrongly placed above or below the incumbent's quality. In these cases, the wrong candidate wins the election--that is to say the less competent one.[7] However, perhaps surprisingly, these electoral mistakes are *not caused by the very small samples* that voters base their candidate evaluations on. Rather, the errors are consequences of the random component of unobservable characteristic H.

Statistical methods allows unobservable characteristics to be estimated only *on average*. Thus, some estimation errors are unavoidable.

The effect of that the range the unobservable variable has on electoral mistakes is analyzed in the next series of simulations. In these simulations, the population of voters is fixed at 101, and the range of the stochastic portion of the unobservable variable is varied from $u\sim(-0.1, 0.1)$ to $u\sim(-5.0, 5.0)$. The simulation results are graphed in figure 4.

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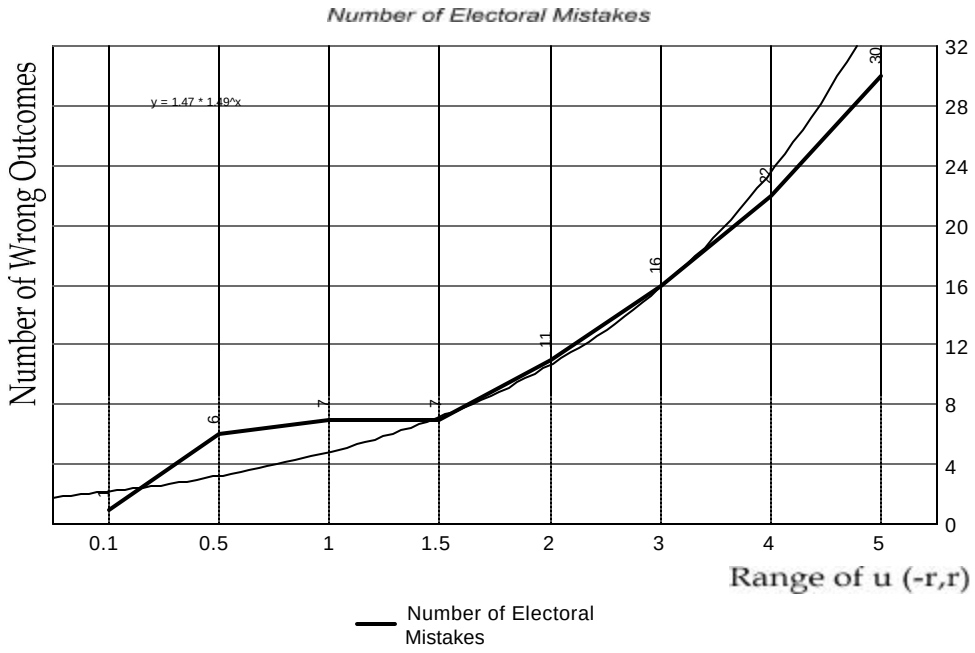
particular voter is more likely to be right than wrong, as is often assumed in work on the Jury theorem. The probability of precisely estimating a real number is essentially zero, and so the probability of getting it "right" is also zero. All that is necessary is that voter estimation methods and data sets be unbiased. Levy (2003).

[7] Similar mistakes would occur in referenda over policies where voters attempt to estimate the net benefits associated with two alternative policies, rather than candidate quality. An analogous referendum would require ranking the status quo relative to a proposed alternative. Mistakes would occur in this case when voters over or underestimate the true net benefits of the new policy relative to that of the status quo.

Figure 4



In cases where the range of the stochastic portion of the unobservable variable is narrowly distributed, the median voter makes essentially no mistakes. In such cases, the power of the jury theorem is maximized. As the variance of the unobservable determinant of quality increases, the number of electoral mistakes also increase. For example, if *u~U(-2,2)*, the range used in the previous simulations, the median voter incorrectly casts his or her vote a bit more than 10 percent of the time, as noted above. When the unobservable characteristic is more widely distributed, as with u~U(-5,5), the mistake rate climbs to nearly 30 percent.

These simulations demonstrate that the probability that the median voter gets it right varies with the variation in the unobservable characteristic *H*. It remains the case that the median voter on average chooses the right candidate or policy, but many mistakes will be made in cases where unobservable stochastic factors are important. The smaller this variation, the more likely the median voter is to correctly assess the relative quality of the incumbent and the challenger. The larger is this variance, the more error prone are electoral outcomes. Unobservable stochastic determinants of candidate quality fundamentally limit the power of

Condorcet's jury theorem, within a finite population of voters, as it would any estimation method.

Overall, the simulations to this point have demonstrated that *majority rule can be a relatively efficient method of aggregating information in cases where voters understand the model and collect just a bit of information about all relevant details*. Even in small electorates, such as committees or juries, the median estimation error in this case is approximately zero, and thus very uninformed voters can generate surprisingly accurate policy or candidate assessments. Condorcet's jury theorem augmented by modern statistical inference implies the median of a series of very poor but unbiased estimates tend to be a very accurate estimator (Levy and Peart, 2003).

Democratic decisions grounded in very small but unbiased (complete) samples on matters where the basic relationships are understood by voters will on average to advance the true underlying interests of the median voter--not because the median or any other voter knows enough to accurately assess alternative programs, but because the election process in such cases is an efficient information aggregation process. Although mistakes will be made insofar as unobservable stochastic variables matter, *voter decisions can economize on information without causing problems for democratic decision making--even in cases where the majority of voter estimates are very inaccurate.*

IV. Limitations of the Jury Theorem with Rationally Ignorant Voters

In the simulations above, the power of the jury theorem is a result of the complete and independent information possessed by voters, and its limit was a consequence of the irreducible uncertainty of the issue voted on, here candidate quality. In less favorable circumstances majority rule may be a less effective information aggregation device.

Two other types of information or data problems come to mind. First, individuals may not independently choose their data sets. For example, much of the information that voters have about candidates and parties comes from mass news outlets rather than from their own direct experience. In effect, independent reporters collect the data, and voters use that data to make their predictions. The use of media data, even if that data is unbiased, reduces the effective sample size of the electorate, and also makes voter information potentially susceptible to manipulation. However, the simulations imply that a few hundred data points are sufficient

to allow majority rule to make accurate decisions, so lack of independence is not a major problem unless news and other data sources are concentrated and tightly controlled.[8]

Second, and of greater interest for the present analysis, are estimation problems associated with rational and natural ignorance. In many cases, voters will choose to remain completely uninformed about a subset of relevant parameters in order to economize on information. This method of economizing on information is fundamentally different from simply reducing sample size in its effects on voter expectations. Ignorance implies that some useful parameters go unestimated, and that the estimates of those parameters that are estimated may be systematically biased. The result will not just be estimates of candidate or policy quality that are widely dispersed, but voter estimates that are systematically incorrect.

Rational ignorance, thus, creates another kind of informational challenge for majoritarian policy making. Unfortunately, it is a problem that is not necessarily ameliorated by the jury theorem.

In the choice setting modeled above, three types of rational and natural ignorance can be analyzed. First, voters may completely understand the underlying quality of candidate relationship, but decide to economize on information by gathering no information about the observable candidate quality characteristic, E. Such rationally ignorant voters might approximate E with its expected value, namely 0, and base their assessment entirely on the unobservable variable, H. Such voters would vote for the incumbent only if they believe that the incumbent is of above average quality based on knowledge of a reference candidate, because they would expect the challenger to be of average quality, $E(Q) = a$. Whether a particular incumbent is considered to be above or below average depends on the reference group used by a particular voter.[9]

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[8] In cases where the independence assumption used in the simulations is questionable, the electoral results become somewhat less accurate as the underlying number of independent data points used (indirectly) by voters. Indeed this is one justification for using relatively small samples for simulations rather than looking at asymptotic properties of estimators used in most of the Condorcet jury theorem literature. The simulation suggests that the small sample properties of majority rule are often very good, as long as the effective data set is nontrivial, the median error term tends to be quite close to zero.

[9] For the two observation data sets used above, these rationally ignorant voters cast their votes for the incumbent if he or she is of higher quality than the reference politician, since this implies that the incumbent is of above average quality, and for the challenger if he is not.

Second, voters may decide to economize on information by ignoring the effect of the unobservable variable, *H*, *and focusing all of their attention on the observable variable*, *B*. This form of ignorance may be a rational choice undertaken with complete knowledge of the model, or the result of natural ignorance if variable *H* is simply unknown to a subset of voters.[10] In either case, the voter may implicitly assign *H* the value 0, and uses information about *E* to estimate the relative quality of candidates. Given the very limited data sets assumed in this paper, these voters know *E* for only two politicians, the incumbent and some other reference politician, and a proportionate quality relationship can be estimated as $(Q_{inc} - Q_{other})/(E_{inc} - E_{other})$.

Third, voters may decide to remain rationally ignorant (or be naturally ignorant) about both determinants of quality, *Q* and *E*. In this case, voters choose between incumbent and challenger based on some other basis, uncorrelated with performance in office. They might, for example, vote expressively on the basis of hair or eye color.[11] For the present purposes, it is assumed that such voters randomly attribute "quality" to the incumbent and challenger. These voters, unlike the other two types of rationally ignorant voters do not have biased assessments, but totally uninformed ones. They vote randomly and do not affect electoral outcomes on average, although they may contribute to electoral mistakes in a given election.

The simulations below explore the case where that the population of voters is composed of all four types: the poorly informed voters used in our first series of simulations and all three types of rationally ignorant voters. In order to distinguish the mistakes induced by rational ignorance from those associated with irreducible uncertainty on mistaken electoral outcomes, voting outcomes for five ranges of the unobserved variable, u, are simulated. Two populations of poorly informed and rationally ignorant voters are simulated for each of the four variances, 4:6 and 1:9, to explore the effect of electorates that are more or less composed of rationally ignorant voters.

Electoral mistakes are tabulated for each subgroup of voters and for the overall electoral result, which allows the ameliorating effects of the jury theorem to be assessed within

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[10] See Fremling and Lott (1996) for analysis of errors generated by model errors as opposed to the data limits focused on this paper. Clearly, the problem of bias is much greater when the basic structure of the quality of candidate function is unknown and must be puzzled out by each voter before quality can be estimated.

[11] See Tullock (1972) and Brennen and Lomasky (1993) for analyses of expressive voting.

each subgroup and for the electorate as a whole. The results of eight series of simulations are tabulated in table 2.

Table 2
Electoral Mistakes
in Populations of Poorly Informed and Rationally Ignorant Voters

Simulations: 100 elections, with 202 Poorly Informed Voters, and 101 of Each Type of Rationally Ignorant Voter

Range of *u*	Poorly Informed Electorate	Rationally Ignorant of B Electorate	Rationally Ignorant of H Electorate	Rationally Uninformed Electorate	Overall Electoral Mistakes
+/- 0.1	0	27	35	40	0
+/- 1.0	5	28	34	55	5
+/- 2.0	13	17	33	48	14
+/- 4.0	28	31	37	45	23

Simulations: 100 elections, with 51 Poorly Informed Voters, and also 51 of Each Type of Rationally Ignorant Voter

+/- 0.1	1	25	54	49	28
+/- 1.0	5	19	34	55	24
+/- 2.0	15	27	49	43	38
+/- 4.0	21	24	36	51	32

The top half of table 2 demonstrates that majority rule can also ameliorate problems associated with voter ignorance (bias) in cases where a sufficient number of voters have unbiased estimates (complete small samples). In circumstances where poorly informed voters are a large group of voters, although not necessarily a majority, electoral outcomes are only slightly more error prone than in cases where only poorly informed voters exist. The errors and biases of the rationally ignorant groups roughly offset each other, and the electoral outcomes

are largely determined by the unbiased poorly informed group of voters, even in relatively difficult circumstances. Indeed, in the case where there is only a small unobservable stochastic factor, majority rule yields essentially error free results even though very substantial error rates occur in each of the rationally ignorant subpopulations.

However, the bottom half of table 2 demonstrates that the "jury theorem" effect is greatly reduced as ignorance becomes relatively more commonplace among voters. In the case where poorly informed voters are a small minority, the error rates for the electorate as a whole are systematically higher than those of the poorly informed, because *unbiased voters no longer determine the electoral outcome*. Instead, idiosyncratic features of experience and ignorance (the observable and unobservable characteristics of the reference politician focused on) determine the accuracy of majoritarian decision making. *Indeed, the effects of rational ignorance appear to be more important than the difficulty of the estimation problem faced!* (There is no systematic increase in mistake rates for the electorate as a whole as the variance of *u* increases, although there is a systematic increase in mistakes as the proportion of rationally ignorant voters increases.)

However, even towards the bottom of table two, where the range of *u* and the electorate composition are the least favorable to democratic decision making, majority rule still ameliorates the problem of rational ignorance to some extent. The final outcome is less error prone than two of the three rationally ignorant subpopulations, although far more error prone than is the group that collects a small amount of comprehensive information.

Overall the simulations imply that majoritarian errors are jointly produced the irreducible estimation error and the extent of the rationally ignorant subpopulation of voters. The greater is the irreducible stochastic element of the phenomena to be estimated the more mistakes an electorate is bound to make. Similarly, the greater is the fraction of voters who are ignorant, whether naturally or rationally, the more mistake prone is majoritarian policy making. Both these information problems limit the extent to which democracies can enact policies that systematically advance the interests of the median voter, and both imply that public policies will necessarily be imperfect because of informational limitations.

However, only the latter can be remedied directly through public and private policies.

V. Limits of Public Policies to Overcome Ignorance

A. Expertise and Democracy: Dilemmas of the Expert

There is a sizable literature on delegation within firms and a smaller literature on delegation within elected legislatures that suggests that delegation can be used to overcome information problems. If voters are not fully informed, because the cost of being well informed is too high, then why not hire someone else to make the decisions? Both representative governance and the bureaucracy are partly based on such logic.

There are, however, several problems associated with the process of delegation within political systems where voters only infrequently monitor or sanction the performance of their delegates. First, it bears noting, that experts may know more than every individual voter knows in the sense that they have a much more extensive informational base (large and more complete samples and, hence, less ignorance), yet still be more error prone than the results of competitive elections. That is to say, the advantage of delegation within a democracy will often be reduced decision costs rather than improved decisions. Even an expert whose opinions are based upon a fifty times as much information as possessed by a typical voter may be no less error prone than the majoritarian decisions of large electorates.

To see this, consider the case in which an expert has variously 10, 20, 50 or 100 times as much information as a typical voter, that is to say a large sample of reference politicians, and uses regression analysis rather than simple interpolation to estimate the quality of candidate relationship and then estimates challenger quality using all available data. Data sets for such an analysis can be generated using the software and quality of candidate parameters developed above. Expert estimates were generated using reference candidate data drawn from $E \sim U(-10,10)$ and $u \sim U(-2,2)$ distributions used above. Pseudo samples of this data space are used as the basis of regression estimates, and those estimates are used to estimate challenger quality. The results are tabulated in Table 3.

Table 3
Expert Estimates vs. Median Voter Estimates

Sample size	Expert Estimate of A	Expert Estimate of B	Estimate of Challenger Quality	Standard Error of Estimate
N=10	**-4.34**	**0.33**	**-3.02**	**1.48**
N=25	**-4.11**	**0.37**	**-2.63**	**1.14**
N=50	**-4.19**	**0.42**	**-2.51**	**1.09**
N=100	**-4.19**	**0.42**	**-2.51**	**1.14**
Actual Values	***-4***	***0.4***	***-2.4 = -4.0 +.4(4)***	*****
Median Voter*	**-3.79**	**0.35**	**-2.39**	**0.968**

***Median Voter estimates from 10 elections with 1001 person electorates each voter with a sample of N=2, one independent observation and the incumbent.**

As table 3 indicates, experts who are better informed than the typical voter are not always more "informed" than the electorate "as whole" when voter information is complete and processed via majority rule. A larger sample size increases the precision of the expert regression estimates, but in the range tabulated does not yield an estimation result that was systematically better than the average median estimate of a large pool of voters.

B. Choosing Experts and Expert Choices

Perhaps a more intractable problem for democracy is another "dilemma of the expert." Voters must directly or indirectly select the experts who will make policy decisions for them. This is, of course, exactly the exercise addressed by the simulations above. Errors in delegation are affected by the same scarcity of information as candidate choice, because candidate choice is, itself, a form of delegation. The information aggregating power of majority rule implies that it does not necessarily "take one to know one," but it does require fairly complete information to rank self-proclaimed experts.

A third dilemma of the expert is that, once hired, an expert may not be able to use his or her superior knowledge without facing "reelection" problems. In cases, where policy results are not observable within a single election or hiring cycle, it will often be in the interest of

well-informed office holders to put their informed judgment aside, rather than risk being judged incompetent, and enact the policies favored by their less informed principal(s). To act on their informed judgment rather than voter expectations, an elected candidate or appointed senior bureaucrat might risk losing his job in the next election. Voters, after all, have to assess the quality of incumbent decisions and can only use the information that is in their own minds to make that assessment.

Overall, these three expert dilemmas suggests that the delegation solution is also highly imperfect and error prone. Delegated policy prescriptions are unlikely to be significantly better than those that an electorate would select in settings where competition for elective office is intense and voter have just a bit of information on all relevant details. In less favorable circumstances, the wrong expert may well be hired, and public policies might reduce rather than increase median voter welfare. Moreover, poor performance may go unpunished, if the errant policy decisions are not routinely monitored or sanctioned by a rationally ignorant electorate.

C. Reducing Ignorance though Public Policy: Transparency, Public Education, and a Free Press

A variety of public policies can reduce voter ignorance, and most long standing democracies have adopted a variety of such policies. Essentially all well functioning democracies also have long standing policies that reduce information costs. Public education tends to reduce voter ignorance across the board and, indirectly, tends to produce better electoral outcomes. Such constitutional protections as freedom of the press and assembly also reduce natural and rational ignorance by broadening the range of public debate, and broadening the range of variables that citizen-voters are aware of. Democratic governments also collect and publish a variety of statistical members of political and economic performance that allow both experts and laymen (via the newspaper) to more fully appreciate policy issues and policy failures.[12] Elections and referenda, themselves, produce a good deal of information, and induce citizen "sample sizes" to increase and broaden as a variety of case histories are discussed in homes, restaurants, class rooms, and academic seminars.

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[12] Such effects tend to be reduced by national educational curriculums and concentrated ownership of mass media insofar as all voters come to be exposed to the same historical facts, theories, and assessments.

The simulation results suggest that the long-standing informational policies of long standing democracies *are not historical accidents*, but rather are necessary conditions for majoritarian decision to produce tolerable policy outcomes. Without the relatively low information costs produced by public education, a free press, government statistics, and the publication of legislative decisions, the data sets of voters would be even smaller and more narrow than survey evidence indicates to be the case, and consequently far more electoral mistakes would be made.

Mistake prone democracies would be susceptible to subversion from within; as, for example, mistakenly elected "democratic" leaders take actions to consolidate power by reducing electoral competition and public information.[13] Voters, themselves, might also opt for a less democratic regime if sufficient numbers come to believe that majority rule is inherently mistake prone, as has occasionally been the case in South America, and more recently in Liechtenstein. Mistake prone regimes are also more prone to overthrow from external sources insofar as security threats are systematically misjudged. Historically, it seems clear that mistake prone polities do not long survive in a world when other regime types make fewer mistakes.[14]

Consequently, the long-standing democracies that we observe today tend to be ones that have solved the worst information and agency problems of majoritarian based polities, whether by good fortune or design.

However, to say that existing informational policies within long-standing democracies work tolerably well does not imply that they work as well as they might. Neither elected officials nor the bureaucracy will be inclined to provide as much information about their failures as about their successes. The data sets provided by government agencies, consequently, tend to be "noisy" and biased in a manner not so different from that provided by other interest

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[13] This has, of course, happened historically in many places around the world, for example throughout Africa during the 1960s.

[14] On a more optimistic note, it may be the case the complexity of modern industrial democracies can only be untangled through majoritarian election processes. That is to say, modern democracies may be systematically less mistake prone than modern dictatorships, because the policy problems facing governments with modern industrial economies are far more complex than in prior times. In this case, the institutions of well functioning, if imperfect, democracies may well replace those of their more mistake prone authoritarian alternatives. Dictators may have a more difficult time solving the dilemma of the expert than democracies for reasons alluded to above.

groups. This problem can be reduced to some extent by creating informative agencies that are outside the normal political and budgetary processes. For example, in the US the CBO and GAO serve this role to some extent. The mass media and private think tanks play a similar role.

In general, there are a variety of institutional devices that can encourage greater transparency in governance and more informative analysis of past policies.[15]

VI. Conclusions: Informational Limits to Public Policy

This paper has explored the informational limits of democratic policy formation. The results suggest that the extent of those limits are jointly determined by the aggregating properties of majority decision making, the underlying uncertainty of the problems being addressed, and the extent of voter ignorance.

In cases where complete information is readily available and median voter results obtain, majority rule will make remarkably accurate policy decisions even in cases in which voters have very little information. This statistical property of democratic decision making has been well understood among those who study the jury theorem, but is less well known to the broader range of scholars who study public choice or public policy in general. The simulations presented above make some the previous analyses of the jury theorem more concrete and demonstrate that the jury theorem extends to relatively small samples, as in committees or in cases where few voter observations are truly independent of one another.

The simulations also allow the consequences of other informational imperfections to be studied in a small sample context. Both irreducible uncertainty and ignorance have been shown to cause majoritarian decision making to be less than perfectly accurate. Uncertainty about the future implies that electoral mistakes cannot be avoided even in a perfectly functioning democracy with an informed electorate. Voter ignorance implies that other mistakes will be made as well. Rational ignorance undermines the power of the jury decision by introducing systematic (but largely unpredictable) biases into the electoral process.

Rationally ignorant voters are far more error prone than "sample constrained" voters, and, as a consequence, so is democratic decision making. The "jury theorem" effect moderates

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[15] For example, there is some evidence that bicameralism and the use of referenda increase public information by increasing public debate and control of public policy issues, Frey and Stutzer (2003), Benz and Stutzer (forthcoming 2004).

the effects of rationally ignorant voters if there are a sufficient number of unbiased voters in the electorate, but majoritarian outcomes become increasingly error prone as the number of rationally ignorant voters increases relative to voters with broader information sets. Both the systematic errors generated by rational ignorance and the unsystematic ones associated with unobservable stochastic variables, *limit the scope and effectiveness of democratic policy making*.

Only in areas where voters have reasonably broad, if shallow, knowledge of policy parameters and outcomes--as would be the case for many true public goods--are majoritarian decisions likely to be effective in the sense that public policy systematically advances the interests of the majority, or at least those of the median voter. In other areas, ignorance and limited data implies that policies will be error prone in the sense that the policies put in place worsen rather than increase the welfare of the median voter. In such policy areas, the power of the jury theorem can easily be exaggerated.

Such information-based mistakes may, thus, be the ultimate limit of democratic public policy. This is not because imperfect information is the only problem faced by democratic polities. A broad strand of the public choice literature indicates that there are a variety of agency and decision problems associated with political decision making. However, imperfect information is a more fundamental problem. Given perfect information, competitive elections, and a symmetric distribution of voter interests; most agency problems would be solved democratically, as voters demand and candidates deliver appropriate institutional reforms. Without a relatively broad information base, these institutional solutions may not be adopted, either because they are neglected by rationally ignorant voters or because of errors in judgment about their need or effectiveness.

With or without well designed institutions, it is clear that the feasible domain of effective public policy in democracies is largely determined by voter ignorance and underlying uncertainties. Democratic policies cannot effectively extend into policy areas in which mistakes are more likely than successes, nor to areas where new policies are likely to make citizen voters worse off than they would have been in the absence of those policies. Where this last absolute boundary lies is partly determined by the relative abilities of majoritarian governments and markets to make informed decisions using diffused information.

Of course, this absolute limit on effective democratic policy may not be a binding constraint. For the purposes of the median voter, the proper domain of democratic policy is determined by the relative effectiveness of markets and democratic institutions as instruments of advancing his or her personal goals. For the purposes of constitutional design, the proper domain of public policy may be somewhat more restrictive than that desired by the median voter insofar as truly general rather than majoritarian interests are to be advanced. It is possible that the desired range of government policies is sufficiently modest that informational aspects of democratic decision making are not critical for success.

However, in either case, informational policies and issues will partially determine the proper domains of collective and individual autonomy, because it affects the relative effectiveness of private and collective means of advancing individual goals. Both markets and governments have to address a wide range of information problems, Hayek (1945) and Coase (1937), in order to advance individual interests, whether narrow or broad. The analysis of this paper suggests that democratic decision making will make mistakes and that these mistakes tend to make democratic governance less effective than it may appear in models that ignore informational problems. Whether a similar analysis of markets would similarly weaken support for markets has not been analyzed in this paper. Thus, little directly can be said about this broader issue. The results to this point do, however, suggest that good public policies are mostly likely to be made in areas where voters have some direct knowledge of the consequences of public policy. In other areas of policy, biases and mistakes will be commonplace.

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