Norman Schofield · Gonzalo Caballero · Daniel Kselman *Editors*

Advances in Political Economy

Institutions, Modelling and Empirical Analysis

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median voter has a lower income than the mean voter. This voter, then, has more incentive to demand redistributive taxation (see Rosenthal and Eibner 2005, Nelson 1999) because she bears less of the burden. Holcombe and Caudill (1985) show that the median voter can bear no tax burden at all. In this case, the median voter prefers an insurance system in which she pays only for her own insurance, and wealthier voters pay for the care of those who need care beyond their level of coverage. If this holds, then a healthy median voter would pay less under an insurance scheme than with *Entitlement*; thus her payoff for *Insurance* is d which is greater than or equal to the baseline payoff of 0. This idea is consistent with other research on the link between the median voter's tax share and social spending. For example, Corcoran and Evans (2010) find that a reduction in the median voter's tax share induces higher local spending on public education. Thus the expectation of the majority coalition on the dimension of general taxation is zero personal contribution to paying for the cost overrun on healthcare.

4.3 Median Preferences on Healthcare Policy

The next step to identifying the payoff to MIP is to see what the median on healthcare dimension expects to pay and to receive. Adding the premise that the distribution of health is skewed similarly to that of wealth but in the substantively "opposite" direction, we assume that the mean "level of sickness" is above the population median, meaning that most healthcare costs (due to the costly specialized care and severe disability maintenance) are demanded by a relatively small minority of the population.

As an illustration, consider a hypothetical example with binary types in the population on each dimension. Suppose, to keep it simple, that individuals who comprise the principal at the interim stage know their health type as well as their wealth type, and the probabilities are .2 of the wealthy type on the dimension of wealth, and .2 of the sick type on the dimension of health. Then the joint distribution in the voting population deciding on healthcare policy given that cost overruns are made up from general taxation becomes as in Table 2.

Notice in the illustration in Table 2 that in this rather extreme case 64 percent of the electorate will not need to pay anything for their own healthcare AND are not going to be in the fiscal pool for general taxation. Relatively to the baseline payoff from *Entitlement* policy, with its uniform tax, they are thus saving some positive amount d, as reflected in the payoffs to the MIP in Fig. 3.

In real circumstances, the distributions of health and/or of wealth might be relatively more centered, yet the coalition with preference for *Insurance* might still

Table 2 A hypothetical distribution of types in the electorate

	Poor	Wealthy
Sick	.16	.04
Healthy	.64	.16

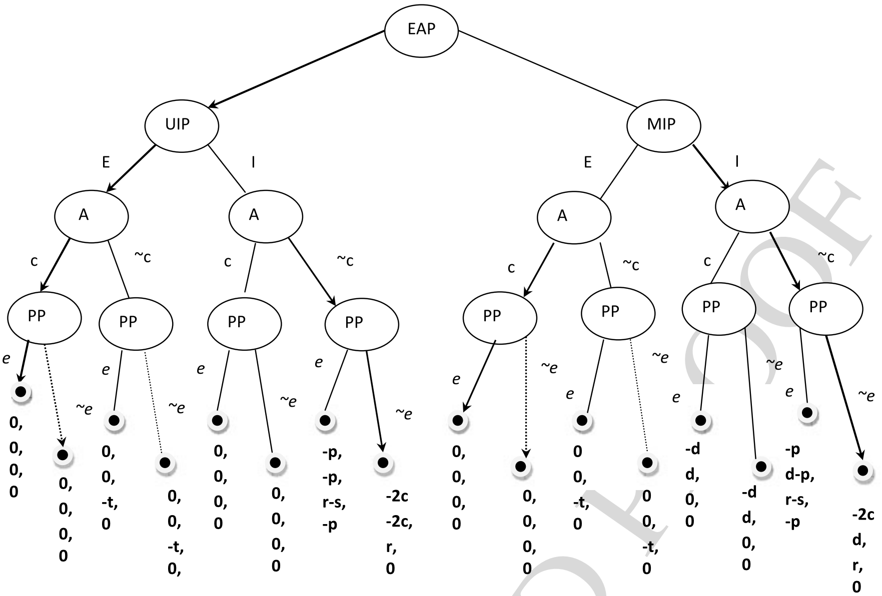

Fig. 3 Choice of the decision rule for Healthcare policy at the constitutional (Rawlsian) stage (the payoff of the ex-ante principal (EAP) is the first payoff)

exceed majority—due to those groups that are exempt from participation in the policy but can vote on its adoption.

5 Analysis

We can now apply backward induction to the game with the payoffs generated from the above discussion. In the subgame starting with the move by UIP on the left hand side of the tree in Fig. 3, if *Insurance* is the policy, the PP obtains a negative payoff of $-p$ if he *Enforces* the rules and does not treat a patient who has not purchased sufficient coverage. Given that preference of PP, the Agent knows that she can safely *not comply*, because she does not risk the payoff r–s, and instead she can obtain the positive payoff r.

If the policy is *Entitlement*, the PP has no difference in payoffs due to his choice, because all citizens are covered under *Entitlement* and so he has to provide care under both *enforce* and *not enforce*. The Agent, in this case does better by *complying*—and obtaining the baseline payoff of 0 than by *not complying* and obtaining $-t$ if she stays out of the workforce (which is what it takes to *not comply*).

At the top of the subgame, then, the UIP knows that it faces a choice between the baseline payoff, 0 and covering emergency care, $-c$, so the UIP will opt for *Entitlement*.

In the subgame on the right hand side starting with the move by MIP, however, the situation differs. Here, the left hand side of the tree is identical to that in the UIP subgame, with Agent complying. And on the right hand side, the PP will still opt not to enforce the rules. Given the choice by PP, the Agent, similarly, knows that she can safely *not comply*.

But the MIP's preferences are different from the UIP's and so with the same expectation with regard to the outcomes, he makes a different move. The median voter, at most, pays only for her own insurance. And she is also exempt from the general tax which will be used to cover the care of those who will *not comply*. This lower personal cost to the median voter results in a higher utility than the baseline payoff, thus, the MIP will opt for *Insurance*.

The move by EAP in Fig. 3 shows the decision at the Rawlsian "veiled" stage. Our EAP, anticipating the outcomes in the Unanimity and Majoritarian subgames and their respective consequences, will opt for *Unanimity*, thus avoiding a lower payoff, $-2c$, from paying for emergency care instead of regular care.

6 Alternate Coalitions

To this point, we have not considered the possibility that emergency health care is inferior to regular care not just in its cost, but in the health outcomes as well. Introducing that assumption now allows us to suggest the potential for other coalitions that could arise with regards to health care coverage systems. In particular, if we assume that the value of emergency care is less than that of regular care (or, more generally, that the expected utility from emergency care is lower than that from regular care) then the poor and unhealthy are less likely to be as satisfied with the emergency care as their sole health care option as they would be with access to regular care. If a poor person pi's utility from care that she would receive under Entitlement, R, minus her uniform tax that she would pay, T_{pi}, were higher than her utility from emergency care, E, i.e. if

$$U_{pi}(R - T_{pi}) > U_{pi}(E)$$

then pi would prefer the Entitlement option.

Similarly, if a wealthy person, rj, pays lower taxes under *Entitlement* than her own health premiums and other payments under *Insurance*, d_{rj}, combined with her burden of funding the emergency care of the sick poor, IT_{rj}, then she would also prefer *Entitlement*, as long as the following holds (where I is health care from *Insurance* while R is health care from *Entitlement*):

$$U_{rj}(R - T_{rj}) > U_{rj}(I - d_{rj} - IT_{rj}).$$

If the combined population in the two above groups is large enough to constitute a majority, then these groups can form a coalition and adopt Entitlement even at the legislative stage.[7]

[7] If, in addition to differences in values of emergency versus regular care, we include high enough uncertainty as to one's own health status, we have the potential for everyone to opt for Entitlement.

7 Conclusion

Organization and financing of healthcare is characterized by an apparent general preference for something that, at least in the US, the legitimate and democratic political process is not quite able to supply—some sort of a fair single-payer system. This makes healthcare one in a class of issues for which the established political process seems to be a "wrong" decision structure. There are other issues with similar manifested qualities which linger unresolved or unaddressed possibly for similar reasons—maternity and parental leave and pay policies, and societal support for childcare, pollution control, and banking regulation come to mind. All of these situations are among the special case of collective action problems described above. Among the developed democracies, so similar in so many other regards, some seem to have much easier time grappling with such issues than others, suggesting that the theoretical story to explain the variation might involve institutional differences. We here suggest that those institutional differences are to be found at the constitutional level.

We claim that these "hung" issues are so problematic because the decision-making rule applied in their attempted resolution is "suboptimal", given the distribution of preferences and the technology of the good provision. In the tradition of Buchanan and Tullock (1962), we show that, given the preference distribution, *for that issue*, the society would have preferred a different decision rule if it were possible for it to revert to the ex-ante, rules-choosing, constitutional stage and to pick rules for one issue at a time.

Our conclusions here are two-fold. First, with regard to the healthcare policy, or any policy in this set of collective action problems, we show that the socially preferred rule for producing such policy is not majoritarian. We tentatively suggest that it approximates the unanimity given our assumptions. This means that the socially preferred approach to healthcare given the modern state of technology of that industry is to treat the issue as (quasi-)constitutional, rather than to relegate it to the on-going legislative process. In practice, this could manifest in giving it the status of a positive right or an entitlement and fixing its funding principle outside of the ebb and flow of the policy process, much as is done in the US with Social Security.

Second, on a grander scale, our findings lead us to argue that reliance on the policy process to address all issues, including those that significantly evolve and transform and those that newly emerge, is fraught with efficiency losses. Health care is but one example where access to the "constitutionalization" of an issue could be of benefit. Rigid and impervious to amendment, constitutions which evolve mostly by interpretation may engender political environments that are particularly unfit to take up such issues.

There are numerous arguments in favor of single-payer entitlement health care systems ranging from assertions that it reduces health care risks for citizens and avoid inequities (Blumenthal and Hsaio 2005) to that it is more socially efficient than private insurance systems (Sieberg and Shvetsova 2012). Regardless of their benefits, single payer systems may fail to be implemented if the decision procedure itself is not selected carefully. Our model shows that the legislature is not necessarily the best venue to decide ALL issues of importance for the society at large. Some majority choices, while understandably best for their particular coalition, are particularly costly to society overall. Behind the veil of ignorance, the ex-ante principal would have recognized this potential and opt to have these matters decided as constitutional.

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Part II
Modelling

Challenges to the Standard Euclidean Spatial Model

Jon X. Eguia

1 Introduction

Spatial models are useful to represent political competition over policy issues. If the feasible policies over a given policy issue are endowed with a natural left/right or low/high order, we can represent the set of feasible policies by a subset of the real line. Many policy issues are indeed easily ordered: tax rates can vary from 0 % to 100 %; any budgeted policy item can receive a lower or higher budget; criminal law can specify lighter or harsher sentences; etc. It is standard to assume that agents have a unique ideal policy and that given two policies below the agent's ideal policy, or given two policies above the agent's ideal policy, the agent prefers the policy closer to the agent's ideal. Preferences satisfying this assumption are *single-peaked*. If agents' preferences are single peaked over the real line, simple majority rule is transitive (Black 1948); furthermore, the median ideal policy among all the agents' ideal policies defeats any other policy if the number of agents is odd and it cannot be defeated by any other policy when preferences are aggregated by majority rule (Black 1958). Since the median policy cannot be defeated by any other, electoral competition between two candidates leads to policy convergence: both candidates choose the median policy (Downs 1957, building on Hotelling's (1929)), even if the candidates have diverging policy preferences (Wittman 1983; Calvert 1985).

Political competition usually involves multiple policy issues. Candidates propose policy bundles with one policy per issue. Multidimensional spatial models represent preferences over policy bundles: each dimension corresponds to a given issue. Starting with Davis et al. (1972), the standard approach is to assume that agents have a

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most preferred alternative in the policy space, and utilities that are decreasing in the Euclidean distance to this point, typically with a linear (Kramer 1977; Wittman 1977; Patty et al. 2009; Degan and Merlo 2009; or Eguia 2012), quadratic (Feddersen 1992; Clinton et al. 2004; Schofield and Sened 2006; or Schofield 2007b,a) or exponential (Poole and Rosenthal 1985) loss function.[1] Other theories allow for more general utility functions, but they preserve the circular Euclidean shape of indifference curves (McKelvey 1976), or they relax the assumption of circular indifference curves but maintain the restrictions that utility functions be differentiable (Plott 1967; Schofield 1978; Duggan 2007; or Duggan and Kalandrakis 2012), quasiconcave (Banks and Duggan 2008), or differentiable and quasiconcave (Kramer 1973).

I present a series of theoretical and empirical results that challenge the assumption that preferences over multiple issues can be adequately represented by utility functions that are linear, quadratic or exponential Euclidean in a multidimensional space. More generally, I present results that call into question whether preferences can be represented by differentiable or quasiconcave utility functions, let alone with Euclidean or weighted Euclidean utility functions.

I divide these theoretical and empirical challenges to standard assumptions in three classes:

I. Concerns about the concavity of the loss function, accepting the Euclidean shape of the indifference curves.
II. Concerns about the shape of indifference curves: convexity, and different weights for different dimensions.
III. Concerns about the shape of indifference curves: separability across issues.

2 Concerns About the Loss Function

Circular indifference curves are a common assumption on preferences in multidimensional spatial models. Circular indifference curves are such that two policy points which are at identical distances from an agent's ideal point are valued identically, i.e. the 'direction' of the perturbation from the agent's ideal point is inconsequential for his or her utility. This is a standard assumption on indifference curves. However, no similar consensus exists on a standard or default assumption on the loss function associated with these indifference curves. Linear or quadratic loss functions are the most commonly used (McCarty and Meirowitz 2007, Sect. 2.5). As noted in the Introduction, exponential functions are also used (Poole and Rosenthal 1985).[2] The choice of the functional form of the utility function in the various theories in the literature appears motivated by convenience or simplicity.

The choice of loss functions is consequential: important results rely crucially on the concavity of the loss function. For instance, in a probabilistic voting model of

[1] D'Agostino and Dardanoni (2009) provide an axiomatization of the Euclidean distance; Azrieli (2011) provides an axiomatization of Euclidean utilities with a quasilinear additive valence term.

[2] In support of their assumption of exponential utility functions, Poole and Rosenthal (1997) argue that (standard) concave utility functions do not fit the data well.

electoral competition with two candidates, Kamada and Kojima (2010) show that in equilibrium candidates converge to the median if voters' utility functions are concave, but candidates diverge if voters' utility functions are sufficiently convex.

Osborne (1995) warns that "*the assumption of concavity is often adopted, first because it is associated with 'risk aversion' and second because it makes easier to show that an equilibrium exists. However, [. . .] it is not clear that evidence that people are risk averse in economic decision-making has any relevance here. I conclude that in the absence of any convincing empirical evidence, it is not clear which of the assumptions is more appropriate*."

Seeking to test voters' risk attitude, Berinsky and Lewis (2007) assume that utility functions take the form $u_i(x, x_k) = -d(x, x_i^*)^\alpha$, where $d(x, x_i^*)$ is a weighted Euclidean distance and α is a parameter to be estimated. They find that the estimate that provides a best fit for voter choices in US presidential elections is $\hat{\alpha} \approx 1$, suggesting that it is appropriate to assume that voters' utilities are linear weighted Euclidean. They interpret this finding as evidence that voters are risk neutral, but Eguia (2009) casts axiomatic doubt on this interpretation: linear Euclidean utilities do not satisfy additive separability, so the preferences over lotteries on a given issue and hence the risk attitude of a voter with a linear Euclidean utility function depend on outcomes on other issues. In other words, voters with multi-dimensional linear Euclidean utilities are not risk neutral. With utilities that decrease in weighted Euclidean distances, additive separability (i.e. independence of preferences over lotteries on one issue with outcomes on other issues) requires that the loss function be quadratic (Eguia 2011b). The only way to reconcile additive separability (which under Euclidean indifference curves requires a quadratic loss function) with Berinski and Lewis's (2007) finding (with Euclidean indifference curves a linear loss function provides the best fit) is to discard the assumption of Euclidean indifference curves, and to check if under different shapes of the indifference curves, we obtain a best fit with a parameter for the loss function that is consistent with additive separability. This leads us to the second class of concerns: concerns about the shape of the indifference curves.

3 Concerns About Convexity of Preferences

A first concern about the assumption of utility functions that depend on the Euclidean distance is that some issues may be more important than others, and hence utilities ought to be weighted, generating elliptical (rather than circular) indifference curves in the case with two dimensions. If all voters assign the same weights to these dimensions, the problem is trivially solved, and Euclidean circles reinstated, by rescaling the units of measure of each dimension according to its weight. If different groups of voters assign different relative weights to the various dimensions, then it is not possible to rescale the dimensions so as to use unweighted Euclidean utilities, and we must instead use weighted Euclidean utilities with different weights for different voters (Miller and Schofield 2003).

A deeper concern is that preferences may not be representable by weighted Euclidean utility functions: indifference curves may have shapes that are not elliptical. Weighted Euclidean utilities represent a particular class of convex preferences. Preferences are (strictly) convex if the upper contour set defined by each indifference curve is (strictly) convex; that is, if the set of policies preferable to policy x is convex, for any x. Representable (strictly) convex preferences are representable by (strictly) quasiconcave utility functions. If preferences are not strictly convex, they cannot be represented by Euclidean utility functions, neither unweighted nor weighted ones. The curvature imposed by Euclidean utilities is simply not adequate to represent the preferences.

An alternative assumption to Euclidean preferences is city-block preferences, which define square indifference curves (with squares tilted at a 45 degree angle relative to the axes of coordinates), and are representable by utility functions that are decreasing in the l_1 distance $\|x - x^*\|_1 = \sum_{k=1}^{K} |x_k - x_k^*|$, where x_k is the policy on issue $k \in \{1, \ldots, K\}$. That is, agents with city block preferences calculate the distance between two points by adding up the distance dimension by dimension, as if traveling on a grid (that is why the l_1 or city block distance is sometimes called "Manhattan distance"), and they prefer points closer to their ideal according to this notion of distance. If preferences are city block, their utility representation is not strictly quasiconcave, and it is not differentiable. Classic results on the instability of simple majority rule (Plott 1967; McKelvey 1976) do not apply if agents have city block preferences. In fact, the core of simple majority rule is not empty under more general conditions if agents have city-block preferences (Rae and Taylor 1971; Wendell and Thorson 1974; McKelvey and Wendell 1976; Humphreys and Laver 2009).

Humphreys and Laver (2009) invoke results from psychology and cognitive sciences (Shepard 1987; Arabie 1991) to argue that agents measure distance to objects with separable attributes by adding up the distance in each attribute, which implies that if the object under consideration is a policy bundle on separable issues, agents measure distance according to the city block function.

Grynaviski and Corrigan (2006) find that a model that assumes voters have city block preferences provides a better fit of vote choice in US presidential elections than an alternative model that assumes voters have linear Euclidean preferences. Westholm (1997) finds that a model with city block preferences outperforms a model with quadratic Euclidean preferences, when aiming to predict vote choice in Norwegian elections. However, a binary comparison between city block utilities based on the l_1 metric $\|x - x^*\|_1 = \sum_{k=1}^{K} |x_k - x_k^*|$ and the linear Euclidean utilities based on the l_2 metric $\|x - x^*\|_2 = (\sum_{k=1}^{K} (x_k - x_k^*)^2)^{\frac{1}{2}}$ is unnecessarily restrictive: l_1 and l_2 are special cases of the Minkowski (1886) family of metric functions, which parameterized by δ, gives the distance between x and x^* as:

$$\|x - x^*\|_\delta = \left(\sum_{k=1}^{K} (x_k - x_k^*)^\delta\right)^{\frac{1}{\delta}}. \tag{1}$$