Political Economy of Local and Participatory Governance

Elizabeth Hunt
Nuffield College

Thesis submitted for the degree of DPhil in Economics, Trinity Term 2010

Abstract

Chapter 2 compares government consultation via an opinion poll and a "citizens' jury". In a jury, about fifteen volunteers spend several days learning about a policy choice before voting. If the public is ill-informed, the government trades-off "information" against "participation". Jurors have better information than poll respondents, but constitute a smaller sample. Moreover, participation costs may bias the jury sample. Indeed, the literature suggests that costs might induce "neutrality"—over-representation of the minority to the extent that the result is uninformative. I show that although the minority will often be over-represented, "neutrality" is a knife-edge result here so juries may be worthwhile. Extensions consider compensating jurors and excluding "special interests".

Chapter 3 uses evidence from the allocation of regeneration funding to motivate a model in which central government may ask councils to compile apparently pointless dossiers to apply for money, because the dossiers provide information about councils' competence. I then consider when the government might prefer a simpler but less flexible auction-type process.

The UK government's ability to "ring-fence" money, obliging councils to spend it on its priority, is central to chapter 3. Chapter 4 develops the analysis of auctions in this context. With variations in competence, ring-fencing effectively imposes type-specific minimum bids. I characterise equilibrium bidding and show that the ring-fencing constraint may not only increase bids, but actually induce councils to contribute resources.

Continuing the themes of participation and competence in the policy process, chapter 5 examines parish councils' use of a general spending power. I find parishes with more well-educated and older citizens—groups with generally higher political participation—are more likely to use their powers. Further investigation suggests that these citizens matter because they are involved in governance, rather than because they exert democratic pressure. This has implications for wider neighbourhood governance policy.

Acknowledgements

I would like to thank my supervisors, Clare Leaver and David Myatt, as well as Ian Jewitt and participants at the Departmental Post Doctoral and D.Phil. Research Workshop, the Gorman Workshop and the Public Economics UK PhD Workshop. Financial assistance from the ESRC (award number PTA-031-2005-00110) is gratefully acknowledged.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Politicians and commentators from across the political spectrum have called in recent years for a "new politics"—one that is not only more responsive to the public, but also more participatory and more localized. For example, in a speech in 2009, Conservative Party leader David Cameron (Cameron, 2009) called for a "radical redistribution of power. From the state to citizens; from the government to parliament; from Whitehall to communities... from bureaucracy to democracy", while in a recent speech the prime minister, Gordon Brown, has argued for both more direct public access to decision makers, and "[letting] people exercise that power in the places that matter to them most, the towns, cities and local communities where they live" (Brown, 2010).

Similar processes can be observed in many other countries. Perhaps the most well known example of citizen engagement at the local level is the Brazilian city of Porto Allegre's "participatory budgeting" process, which began in 1989 (Fung and Wright, 2003) and gives almost complete control over the municipal budget to citizens and citizen-representatives elected in open public meetings. Estimates suggest up to 10% of adults in the city have been involved at some stage of the process (Fung, 2002).

Over the last decade, the participatory budgeting concept has spread in various (usually weakened) forms to Europe as well as Africa and Asia (see The Participatory Budgeting Unit), and there are many other examples of an increasing emphasis being placed on citizen and neighbourhood participation by city and other local governments, especially in the United States and Canada (see, e.g., McGrath (2009), Fung and Wright (2003), City of Ottawa (2010)). At the national level, examples of attempts to increase direct citizen engagement include US President Obama's "Open Government" agenda based on "transparency, public participation, and collaboration" (Obama, 2009) and the Singaporean government's expressed intention to take the "Government-citizen relationship to the next level, one where citizens are actively engaged in the policy-making process", in part via an increased use of ICT (Singapore Government, 2010).

The three sections of this thesis each start from a particular element of this active policy agenda. Chapter 2 focuses on participatory democracy, specifically the use of citizens' juries as an alternative means of government consultation. Chapters 3 and 4 explore one aspect of local service provision: the use of local councils (and potentially also other, third sector, organizations) to deliver central government priorities. Finally, chapter 5 focuses on parish councils in the context of the broader drive to more localized and participatory control of, and responsibility for, public services.

Citizens' juries involve a small group of citizens spending several days learning about and discussing a specific issue, before producing a policy recommendation. Two sorts of claims are typically made in their favour. The first is that they engage the public with the policy process. The 2007 Green Paper "The Governance of Britain" lists citizens' juries as one of a number of "engagement methods to support a national conversation and debate" and a way to " enable people to become active citizens, empowered and fully engaged in local decision-making" (Secretary of State for Justice and Lord Chancellor, 2001).

The second claim, and the one on which I focus, is that on issues where public understanding of the policy options is poor, perhaps due to technical complexity, they give government (and other public bodies) access to "informed public opinion".[1] Clearly, public ignorance implies that there is a potential value to more in-depth political discussion. However, it also implies that engaging people in the policy process will take time—it is not enough simply to ask citizens for an immediate judgement on policy options. This kind of engagement is expensive for the government to organize. Moreover, many people may not enjoy sitting in committees debating policy at length.[2] We therefore have to worry about citizens' incentives to volunteer for participatory processes, exactly as we worry about incentives to turn out to vote.

In the chapter, I use a very simple binary model to contrast citizens juries with more traditional government consultation via a large opinion poll. In the model there are two groups of citizens, a left wing groups and a right wing group, and two possible policies—and the policy

[1] See, e.g., Maer (2007), Miliband (2007).

[2] Jordan (2007) makes an important related point that the "primacy of politics" assumed by many discussions of the value of participation is perhaps a "myth", reinforced by what Dahl (1961) describes as "the inescapable fact that those who write about politics are deeply concerned with political affairs and sometimes find it difficult to believe that most other people are not".

that is best for each group depends on the state of a technology variable. The government knows about technology, but doesn't know which group in the population is the majority, while citizens know whether they're in the majority, but only receive a noisy signal about technology. To make the right policy choice, then, the government and citizens need to "exchange" information about technology and preferences.

In this context, the choice between a jury and an opinion poll can be thought of as a choice between two imperfect communication technologies. An opinion poll takes information from a larger, and possibly also more representative sample so it is better for transmitting information about preferences. On the other hand, there is no opportunity for citizens to learn about technology before they respond to a poll, so their responses may be uninformed—and hence uninformative. Even ignoring the issue of incentives to volunteer, then, the government has to trade-off the informational advantage of a jury against the larger sample size of a poll.

I show that allowing for the fact that participation in a jury is costly does indeed bias the pool of citizens who volunteer because, echoing results in the costly voting literature, members of the minority have a greater incentive to volunteer. I also show, though, that because the number of participants in a jury is fixed at a small number in equilibrium the volunteer pool will still typically contain a majority of citizens from the population majority—so on average a jury should still allow the government to learn about preferences. Nevertheless, allowing for participation costs has a significant impact on the government's preferred consultation mechanism.

In the final part of the chapter, I extend the model in several directions. Organisers of actual citizens' juries commonly pay compensation to jurors, and almost always (attempt to) exclude members of special interest groups. I show that while both of these choices may be desirable under some circumstances, blanket recommendations are probably sub-optimal.

I also consider relaxing the assumption that the government has no information about the identity of the population majority. A small amount of additional information has no significant effect on the results. However, if the government has strong prior beliefs about the correct policy to implement, using a jury to Bayesian-update, rather than implementing the majority's choice, can substantially worsen the bias of the volunteer pool. As a result, there are circumstances under

which committing to implement the majority's preferred policy can, overall, be preferable to making ex post optimal use of the government's information. This links to a wider debate about the level of power it is appropriate to give to small scale "participatory processes". Many consultation mechanisms that have been described as participatory actually give participants very little power.[3] It can be hard to see why many citizens would choose to participate in these kinds of processes.

In chapters 3 and 4, I focus on local governance, and in particular the role of local councils in providing services on behalf of central government in a unitary state such as the UK. When deciding how to provide local public goods central government has a choice between three possible mechanisms. The bulk of spending is either "centralised"—channeled via agencies set-up and controlled by the centre—or distributed between local councils according to a needs-based formula. However, there is a third possibility, which I focus on in chapter 3: challenge funding.

Challenge funding is a competitive process whereby councils submit dossiers containing (non-binding) plans for how to spend government money on a particular central priority. As an approach, challenge funding has come in for criticism on the grounds that the process of producing dossiers is wasteful, and results in money going to those councils that produce the best dossiers rather than those where there is greatest need (which would be the outcome if a formula were used).

Much of the fiscal federalism literature analyses the decision to devolve provision of a particular service on the basis that there is a trade-off between the costs of failing to internalise any inter-regional spill-overs, and the benefits of having services designed locally to match local preferences; the central source of heterogeneity is differing regional preferences. In chapter 3, however, I argue that we need to consider the possibility of another source of variation: variation in *administrative capacity* between local councils.

I build a model motivated by evidence that not only are there differences in capacity between councils, but that for a large challenge funding programme these difference help to explain divergences between the amount of money different areas would have received under a needs-based formula, and their actual allocations: councils later assessed as more competent received more money.

[3] See, e.g., Rowe and Frewer (2004).

In the model, a benevolent central government has to decide whether to provide a local public good itself, allocate the money to local councils according to a formula, or hold a challenge funding process. Local councils have better local information than the centre, but may have less administrative capacity—and some councils may have less capacity than others. Crucially, I assume that if challenge funding is used councils with more capacity find it easier to produce good dossiers, so in equilibrium dossier quality may act as a signal of capacity.

As one would expect, once we allow for variations in capacity and for challenge funding to enable the centre to learn about these variations, there are situations under which challenge funding is preferable to formula funding even though the process of producing dossiers involves inherently unproductive, costly effort. The desirability of challenge funding depends partly on how efficiently dossiers discriminate between councils of different abilities. I show that increasing both the importance of ability relative to effort in producing good dossiers and the rate at which the marginal cost of effort rise both tend to make challenge funding more attractive. I also analyse the impact of an increase in the range of the ability distribution on the value of challenge funding. One would expect challenge funding to become more attractive, since the larger the ability gap between "high" and "low" capacity councils the more important it is to target money at the more able. However, the flip side of this is that the rewards to a council of being believed to be high ability also increase—so low ability councils will be willing to put more costly effort into dossier production. Whether this effect is sufficient to offset the increased "targeting benefit" depends, again, on how efficiently dossiers discriminate between councils of different abilities.

Underlying this section is a key feature of the relationship between central and local government in the UK—the ability of the centre to ring-fence money it gives to councils. Ring-fencing obliges the recipient to spend the money on a particular policy area or project. As a result, the centre can determine where its money goes without obliging councils to make the binding commitments (or allowing them the potential profits) associated with traditional procurement. This may be important in policy areas where the centre hopes to encourage innovation and there is uncertainty around the likely outcomes of a proposed policy.

In chapter 4, I move on from challenge funding to analyse the outcomes the centre might expect if

it used a (fixed budget) procurement auction to allocate ring-fenced budgets to local councils. Of particular interest here is whether an auction can induce councils to commit to provide more value to the government than they could produce simply using the budget on offer—i.e. to contribute their own funds to the government's policy. As one would expect, such contributions are more likely if council and government priorities are closely aligned, and if the distribution of abilities amongst councils is such that there is strong "competitive pressure" on councils to raise their bids. The main contribution of the chapter is to show that the ring-fencing constraint can have a striking effect on equilibrium bidding behaviour. Ring-fencing the budget, and so obliging councils to spend at least as much as they receive from central government on the centre's priority, in effect imposes ability-specific minimum bids. I show that there are situations in which in the absence of the constraint councils would bid strictly below it (and so make a profit if they win), but imposing the constraint induces councils to bid *strictly above* it, contributing to the government's priority.

The Lyons Inquiry into local government finance criticized much of the ring-fencing of local budgets on the grounds that it "has inhibited the ability of local government to respond to local needs and preferences and manage pressures on their budgets" (Lyons, 2007). In response, both major political parties have said they will give councils more flexibility in how they spend their main grants. At the same time though, the Labour government has continued to use, and the Conservative Party has explicitly ruled out abandoning the use of, ring-fencing for the type of departmental programmes for which challenge funding is commonly used.[4]

The Conservative Party, however, has said that it is "proposing that central government should either make block grants to local authorities and allow those authorities to decide how to spend the money, or set up frameworks within which other providers compete to manage or provide particular services" (Conservative Party, 2009). The Labour government, similarly, has expressed a desire to make more use of other, third sector providers (Hope, 2007). This is a potentially important future direction for public sector provision. In many accounts, the fundamental motivation for third sector service provision closely parallels that for using local councils: such organisations are thought to have a better understanding of local needs and resources. It is also reasonable to assume that variations in capacity are no less significant within the third sector than between local councils—and may well be considerably more pronounced. The analysis of chapters 3 and 4 sug-

[4] The Lyons Inquiry recognizes that the issue is one of scale rather than principle, and that "even in highly devolved countries specific grants play an important role in enabling the delivery of national priorities".

gest additional similarities between councils and the third sector—and differences between these organisations and the private sector—that may be important.

First, private sector companies pursue profits. In contrast, local councils and third sector organisations are, at least to some extent, interested in providing benefits for the populations they serve. In the case of councils, this may be due to a public service ethos, or it may be a means to attract votes. Challenge funding relies on the recipients exerting effort to spend the money they receive well, adapting their plans as circumstances change etc. As long as the government's policy priority is not too far divorced from their own priorities, and given that the budget is ring-fenced so cannot be diverted, it seems plausible that councils and third sector organisations will choose to do this. In contrast, it is hard to imagine why a profit-maximising private firm would do the same.

Second, local councils and many third sector providers have other, fungible funding streams. Councils levy the council tax while charities and social enterprises may receive donations, grants from other organisations and perhaps fees for services. This is critical to the conclusions on ring-fenced procurement auctions drawn in chapter 4. There is little reason to expect a (profit-maximising) private provider to bid more than it is able to provide with the budget offered by the government, since the spending itself has no value to the company. In contrast, councils and charities may find it optimal to divert their own resources away from higher priorities, i.e. make a "loss", to increase their chances of winning the government grant. Therefore, even in cases where it would be possible to auction off contracts for specific outputs, the government might prefer to "procure" from local government and/or third sector organisations rather than turning to the private sector.

In chapter 5, the third section of the thesis, I shift focus to an even more localised level of service provision to explore what has been described as the "neighbourhood governance agenda" (Steel, Jochum and Grieve, 2006), and in particular the role of parish councils.[5] In the 2008 white paper "Communities in Control", the Labour government expressed a desire for "democratic decision-making to be conducted as locally as possible" via "the creation of more local councils" as well as more use of consultation and "neighbourhood management" by bodies such as the police and principal local authorities. Similarly, the Conservative Party proposes to give much more freedom

[5] Confusingly, in discussions of town and parish councils the bodies usually referred to as "local councils"—borough, district, county and unitary councils—are called "principal local authorities" while parish councils and their equivalents are referred to collectively as "local councils".

to parish councils as well as local government, in an attempt to shift decision making "to the lowest possible level (i.e. ... the councils nearest to the citizens)" (Conservative Party, 2009).

The case made for this shift is two-fold. First, and echoing issues raised in chapter 2, it has been suggested that parish councils and similar, neighbourhood-level institutions can increase public interest and involvement in the political process. For example, in a speech to the National Association of Local Councils, Hazel Blears[6] described parish councils as "the most immediate and most local form of representation... acting as a focal point for local debate and identity... enormously effective at connecting with local people, stoking their enthusiasm for getting involved" (Blears, 2008). Second, it is commonly argued that by devolving decision making down to the very local level, services will be better tailored to suit local needs.[7]

Parish councils are the lowest tier of democratic government in those, mainly rural, parts of the UK in which they exist, and a long-standing example of neighbourhood governance. They have a wide range of spending powers and can levy taxes. Perhaps the most striking thing about them is the immense variation between councils in the extent to which they make use of these powers. Understanding why different communities choose very different levels of local activity is clearly important for assessing the implications of the neighbourhood governance agenda, especially if these variations reflect underlying differences in financial or other resources.

In chapter 5, I use data on parish councils' power to spend a limited amount on any policy with general benefit to assess the likely impact of a potentially significant recent policy change: the extension (in 2009) of the "general well-being power" from local authorities to town and parish councils. I find that larger parishes and those with a higher proportion of the population with a good level of education and a higher proportion of the population over 65 tend to make more use of the power. This suggests that (at least without intervention) the benefits of placing increased emphasis on neighbourhood governance are likely to be unevenly distributed, and a better understanding of the reasons for these results might help to inform policy.

A large literature on political participation, especially voter turnout, finds that age and (especially) education are strong predictors of participation. I suggest two possible explanations for the

[6] Then Secretary of State for Communities and Local Government.
[7] See, e.g., Winterton (2009), Conservative Party (2009).

greater use of the general spending power by parishes with a greater proportion of the population from these "politically active" demographics. It might be that because these groups tend to vote and campaign more, parish councillors who expect to face elections are more likely to exert effort on behalf of their parish (in order to avoid losing their seats) when they face a more active and informed electorate. Alternatively, it might be that more educated and older people are more likely to be willing and able to get involved in parish governance themselves.

I am able to test these hypotheses because, although parish councils are legally democratic, only a minority actually have competitive elections, whilst another (substantial) minority have exactly as many volunteers for the council as there are seats—and almost half fail to attract as many candidates as seats. The first, "electoral pressure" hypothesis assumes that politically active groups influence parish activity via elections. They should therefore only have an effect where there are (likely to be) competitive elections. I do not find support for this hypothesis. The second, "capacity", hypothesis, on the other hand, suggests that the proportion of old and educated people in a parish is essentially a proxy for the availability of willing, able volunteers. I find that if I include a variable for whether a parish had at least as many candidates as seats, the variable itself is somewhat significant, and the importance of the age and education variables also falls a bit. This is at least suggestive evidence for the capacity hypothesis, and I go on to consider possible ways policy could attempt to compensate for differences in capacity.

I also look more broadly at the many gaps in our understanding of neighbourhood governance. A particularly important point is that parish councillors are drawn from the population and the majority of parish councils operate in small communities, with minimal administrative support. In these circumstances, the distinction between "government" and "citizens" is far from clear-cut. Moreover, as I argue in section 5.7, conventional citizen-candidate models designed to help explain forces at work in national level politics may apply to larger parishes, but misinterpret the processes at work in smaller communities. In particular, the willingness and ability of citizens to participate in detailed policy making *and delivery*, rather than differences in policy preferences, might become the most significant determinant of the level of service provision. The analysis of the chapter therefore ties together to several of the themes from chapters 2- 4: participation, especially the role of incentives to participate, devolution, and the importance of allowing for variations in capacity when thinking about local governance.

2. INFORMATION VS. PARTICIPATION: CITIZENS' JURIES AND GOVERNMENT CONSULTATION

2.1 Introduction

Shortly after becoming Prime Minister in 2007, Gordon Brown expressed enthusiastic support for greater citizen participation in decision making, as part of a wider programme of proposed constitutional reforms. One of his specific proposals was for greater use of citizens' juries by government bodies. In a speech to the National Council of Voluntary Organisations, he said: "if we are to meet the challenge of engagement the old models of consultation need radical renewal... we will hold Citizens Juries round the country. The members of these juries will be chosen independently. Participants will be given facts and figures that are independently verified, they can look at real issues and solutions, just as a jury examines a case" (Brown, 2007). Since being introduced to the UK by the IPPR in 1996, citizens' juries have been held not only by central government departments but also by a number of NHS Trusts and many local authorities.

Political interest in more participatory forms of democracy is partly a response to, and is mirrored by, considerable academic interest, especially amongst political theorists. As I discuss in Section 2.2, much of this work is quite abstract. In this chapter, I start from an actual process—citizens' juries. A jury is a group of, usually, 11–25 ordinary members of the public who are selected from a pool of volunteers to spend several days discussing and learning about a particular policy issue, before producing a recommendation.[1] Given the fact that significant sums of public money are being spent on new (as well as less-new) forms of consultation, my object is to consider the circumstances under which citizens' juries might be a useful tool for policymakers.

One argument often advanced in favour of more participatory politics is that it can educate citizens about, and engage them in, the political process. However, in practice the fraction of the

[1] For more detail on the organisation of juries, see The Jefferson Centre (2004) and PeopleandParticipation.net.

population likely ever to be involved in citizens juries is too small for this to be an interesting proposition.[2] The cost of achieving a noticeable improvement in public education via citizens' juries (each costing around £30,000 (PeopleandParticipation.net) and involving about 15 people) would be astronomical. A second argument for participatory policy making, which I do not address at all, is the possibility that intensive face-to-face discussions on policy issues might result in "preference-shaping" (Miller (2003), Gutmann and Thompson (1996)). Philosophically, this raises some of the most interesting questions around small-scale deliberation; changes in *preferences* as a result of deliberation make the concept of representation in micro-forums unusually delicate.

Instead, I focus on the idea that citizens' juries give policy makers access to "informed public opinion." The essence of the argument is that intensive policy discussion may change people's policy preferences by educating them about the relationship between policy choices and outcomes.

The model in this chapter is motivated by three pieces of evidence. First, there is evidence to suggest that the public are ill-informed about many important policy issues. Caplan (2007) presents evidence for marked divergences between the views of academic economists and the general public on economic policy. Similarly, Taylor-Gooby, Hastie and Bromley (2003) find evidence from the 2001 British Social Attitudes Survey that while people have a reasonably good knowledge about some areas of concern for social policy, such as rates of car ownership and child poverty, they tend significantly to over-estimate other variables such as the level of violent crime and spending on unemployment benefits.[3] A review of further evidence for public ignorance is provided by Somin (1998).

There are, to my knowledge, no studies that look explicitly at the effect of participation in citizens' juries on jurors' knowledge. However, the second piece of evidence motivating this paper is work by Fishkin and Laslett (2003). They have organised a number of "deliberative polls", involving a combination of provision of information and deliberation over a number of days that is similar to the citizens' jury process. They find that participating in such a process improves individuals' information, and (arguably) makes their beliefs more consistent. This suggests that despite being very small, citizens' juries might have an advantage over opinion polls in areas where the possibil-

[2] Walzer (1999) sums up the practical problem: "deliberation is not an activity for the demos"—interaction in small groups is different to that in large groups, and beyond a certain size a a process can no longer be described as participatory.

[3] They also find that is some areas, the better educated are better informed, but that in others, there is little discernible difference in knowledge between socio-economic groups.

ity of public ignorance casts doubt on the reliability of opinion poll responses.

Third, there is evidence that people make cost-benefit calculations when considering whether to devote significant time and effort to small-scale political participation. There is considerable debate about the relevance of rational choice models to political participation in general (see Blais (2000)). However, the main focus of these studies is voting in large elections, where (arguably) both the probability of a participant being pivotal and the cost of participation may be very small. Citizens juries, in contrast are limited in size, so the probability of being pivotal may be significant. Bryan (2003) studies participation in the related context of New England town hall democracy, and finds evidence for the proposition that citizens are more willing to participate when they are more likely to have a significant influence on the outcome. In particular, he finds that the turnout rate is higher in smaller towns, and (controlling for town size) higher where more decisions are made in the meeting itself, rather than being voted on in a separate ballot.

In this chapter I present a theoretical model designed to capture the basic, intuitive trade-off between the "participation" advantage of a large opinion poll over a citizens' jury, and the "information" advantage of the intensive policy discussion involved in a jury over the "top-of-the-head" preferences collected by a poll. The model is a very simple binary set-up. The population is divided into two groups (e.g. a left wing group and a right wing group), one of which is a minority while the other is a majority. There are two possible policies and two possible states of technology. A "technology" determines how a policy choice translates into outcomes, so the best policy for a particular group depends on the state of technology. A benevolent government knows the true state of technology, but does not know which group is in the majority, and therefore does not know which policy would maximise welfare. Members of the population, on the other hand, know which group they belong to, and whether or not they are in the majority, but only receive a noisy signal about the state of technology. I discuss these assumptions further in Section 2.3.

The government has to decide whether to use an opinion poll or a citizens' jury to learn more about the preference distribution. Loosely, we can think of this as a choice between two imperfect communication technologies. In order to maximise social welfare, the government and citizens need to combine their information (about technology and preferences respectively). A citizens' jury is guaranteed to transmit information about technology but the sample size is very small,

and may also be biased, so it is a quite a poor method of obtaining information about preferences. Conversely, a large opinion poll is very likely to select a majority of respondents from the majority group in the population—but the more likely they are to be mis-informed about the state of technology, the less useful this is.

This paper has two main contributions. The first is that, in the context of the broader literature on costly political participation, I show that allowing for the fact that citizens' jurors must volunteer, and face a non-negligible participation cost, may have a striking effect on the composition of the volunteer pool—and hence on the expected composition of a jury.

Several recent papers focused on costly participation in large elections have found a "neutrality" result in strictly mixed strategies. Differential incentives to vote mean that, in equilibrium, the number of voters in favour of each of two policies is the same even though one has the support of a strict majority in the population at large. As a result there is a 50% chance the minority's preferred candidate or policy will be chosen. If this result carried over into the jury setting, it would imply that the participation advantage of an opinion poll would be overwhelming, and there would never be any point in holding a jury of volunteers. However, unlike in an election, a citizen can only decide to volunteer for a jury; the number of actual participants is a pre-set, exogenously determined number. In Section 2.4.2, I show that this difference is critical: for a citizens' jury, neutrality is a knife-edge result in the sense that it only arises if the participation cost takes a single, specific value. The trade-off between information and participation is therefore non-trivial.

A mixed strategy volunteering equilibrium for the citizens' jury does exist for a range of costs, and, as in the election models, it has the striking feature that the proportion of volunteers from the minority group depends on the cost of participation, but not on the relative sizes of the two groups. However, although the minority is over-represented, it still constitutes a strict minority of volunteers. A citizens' jury therefore suffers from "self-selection bias" but nevertheless has a better-than-50% chance of producing the right answer.

The second contribution of this chapter is to explore the policy choice facing the government: under what conditions is a citizens' jury a better way of learning which policy will be better for the majority than an opinion poll? I show that if jurors were a genuinely random sample from the

population, then the government's choice would be quite straightforward and intuitive—a jury is better if public information is poor and/or the minority is small relative to the majority. Allowing for the fact that jurors are in fact volunteers makes the choice more complex, and an understanding of the equilibrium of the volunteering game is crucial to making the right decision.

In Sections 2.5.3 and 2.5.4, I extend the analysis to consider two common features of real world juries: the payment of compensation to jurors; and the exclusion of members of "special interest groups". I show that, although there are circumstance under which compensation may be beneficial, there are also times when it will be wasteful. Similarly, though a ban on a very small special interest group will usually either make no difference, or a small positive difference, if a ban on "special interests" excludes a large number of citizens, the effect may well be negative. The general, blanket prescriptions offered by government guidelines and the policy literature therefore may well not be optimal. Lastly, in Section 2.6 I look at possible avenues for future research.

2.2 Related Literature

There is currently no literature which analyses citizens' juries from a game-theoretic perspective, or that draws formal comparisons between participatory decision-making mechanisms such as juries, and traditional consultation via opinion polls. The bulk of existing work on small scale participatory forums is in political theory, and is largely normative, though there are a number of relevant empirical papers which I discuss at the end of this section.[4] Aside from these, three main strands of literature relate to the issues addressed in this paper: analyses of meetings with costly participation; analyses of opinion polls; and a large literature on costly voting.

Osborne, Rosenthal and Turner (2000) model a committee with costly attendance. In their model, the committee is empowered to choose a policy, and members of the population have to decide whether to attend. Each individual has an ideal policy outcome and a payoff function that is decreasing in the difference between the committee's choice and her ideal. Their motivating ex-

[4] See, for example, Gutmann and Thompson (1996), Miller (2003), and Fung and Wright (2003). One problem with this literature, as Shapiro (1999), cited in Jordan (2007)) notes, is that "I did not detect any mention in their [Gutmann and Thompson's] discussion of any actual deliberative process that they did not insist falls significantly short of their deliberative ideal. Nor can I think of one". Barabas (2004) offers further criticisms. In a recent article Landa and Meirowitz (2009) argue for a more fruitful interaction between game theorists and deliberative democratic theorists, in which axioms proposed in normative, theoretical research into deliberative democracy would be tested for consistency using game-theoretic techniques, together with empirical results from social psychology, behavioral economics, and cognitive science about how people in fact behave in various collective decision making environments. If, as seems likely, it turned out that not all axioms are mutually consistent, it would then be the role of normative theorists to debate the relative desirability of different feasible combinations.

amples relate to environmental regulatory procedure in the US. They therefore interpret Nash equilibrium as a steady state in which individual preferences are common knowledge amongst the participants.[5] They have three principal conclusions: a block of individuals holding "moderate" views will not participate; even in a large population, the number of participants is small; and, if the committee's decision is assumed to be the median preference and individuals are prevented from attending with small probability, the outcome varies randomly and is often extreme (because of non-participation of the "moderates").

Turner and Weninger (2005) test these conclusions using fishing industry data. They find that more extreme fishing firms, larger firms, and firms located closer to the meeting are all more likely to attend—which is consistent with the idea that what matters is the difference between costs and benefits. Bulkley, Myles and Pearson (2001) construct a similar (but one-dimensional) model to Osborne et al (2000), and test it using data on the British House of Lords. They show that "cross-bench" (non-aligned) members participate less often than peers from the Labour and Conservative parties, and argue that this is evidence for "non-participation of the moderates".[6]

The treatment of opinion polling in this chapter is very simple, and individuals can do no better than to report truthfully which policy they believe would be best for them. However, opinion polls have been studied in a variety of contexts. Morgan and Stocken (2008) consider an informational environment diametrically opposite to the one in this paper. In their model, the government knows the location of the median voter, but information about technology is dispersed amongst the population in the form of a binary signal the expected value of which is the value of the technology variable. They show that there cannot be truthful revelation in equilibrium in a large poll because the impact of an individual's report on the government's choice is small so individuals with preferences far from the median will attempt to "distort" the government's choice toward their preference. However, there will be a range of "centrists" who report truthfully. They go on to show that as the poll becomes infinitely large, the fraction of centrists tends to zero, but the number of centrists grows without bound, so information aggregates. Kawamura (2008) presents a similar model with a richer message space. He shows that in large polls, a message space restricted to a binary high/low choice is "robust" in the sense that it eliminates incentives to exaggerate.

[5] since it is reasonable to suppose that various local interest groups (such as sports and commercial fishermen) interact frequently enough to acquire this kind of information

[6] Of course, it is not necessarily true that cross-benchers are more moderate than party members and, as Turner and Weninger (2005) note, one purpose of party groupings may be to "get out the vote".

The literature on costly voting is also closely related to my analysis of voluntary participation in a citizens' jury. Costly voting models assume that each individual make a rational choice to vote on the basis of a comparison between the cost of participation on the one hand, and her expected benefit on the other. This benefit is simply the product of the probability that she is pivotal, and the increase in her payoff if she votes, given that her vote will be pivotal.[7]

This literature originated with work by Palfrey and Rosenthal (1983, 1985) and Ledyard (1984). Palfrey and Rosenthal (1983) show that in a model with two groups of voters of known sizes and the same voting cost for all individuals, there are a large number of possible equilibria, including some with substantial turnout levels, and some in which the minority group is more likely to win than the majority. Their later paper (1985) assumes individuals face heterogenous voting costs. In this case, there is an equilibrium cost level for each group such that an individual votes iff her cost is at or below this level. As the size of the electorate tends to infinity, the cut-off tends to 0, so only individuals with negative "costs" of voting participate. Ledyard (1984) takes a similar model, and proves the existence of an equilibrium with positive participation if there are two distinct policy platforms. He goes on to endogenise the policy options as optimal choices of vote-maximising politicians, and shows that they converge. This eliminates the incentive to vote, so turnout goes to zero.

Most closely related to my analysis are two recent papers, Goeree and Großer (2007) and Yildirim and Talor (2010), both of which model a situation with 2 groups of voters, all of whom face the same voting cost. Goeree and Großer show that if an individual's preference is private information, but preferences are correlated, increasing this correlation depresses turnout. They go on to show that if citizens learn which group is in fact the majority, turnout rises but welfare falls. They focus on strictly mixed strategy equilibria, so within each group all the members vote with the same, positive probability, and this probability (which may differ between groups) is strictly less than one. They show that such an equilibrium exists for a non-degenerate range of costs, and that with full information it is characterised by "neutrality"—the expected number of voters is the same for

[7] There is a somewhat separate literature which explores whether this is in fact a valid model of the decision to vote. A key concern is that in large elections, the probability of being pivotal may be very small, and therefore the expected benefit, at least as defined above, cannot account for observed turnout levels (Blais, 2000). Various alternatives have been proposed, including: voting as a "duty" (Riker and Ordeshook, 1968); minimax preferences (Ferejohn and Fiorina, 1974); the role of parties in motivating their supporters; the possibility that votes operate as signals to politicians which will affect their future policy platforms (Meirowtiz and Shotts, 2009).

both policies, even though in the population as a whole one policy has majority support. Hence the policy preferred by only a minority of voters wins half of the time, and expected welfare is lower. Yildirim and Taylor (2010) also find neutrality in large elections.

There are several other costly voting papers with related concerns. Krasa and Polborn (2009) have a similar model, but assume voters have personal attendance costs drawn from a common distribution. They show that if voting is voluntary, a larger proportion of the minority than the majority will vote. They then show that at least in large elections, paying subsidies to voters is welfare improving, because those induced to vote by the subsidy will come predominantly from the majority.

Increasing the number of voters also has a negative effect, because it reduces the probability that an individual is pivotal, and therefore reduces the expected payoff to those already voting. In small elections, where almost everyone votes anyway, this may outweigh the positive effect. This insight comes from Börgers (2004). In his model, an individual is equally likely to support each of two policies. As a result, voluntary voting is preferable to mandatory/subsidised voting, because increasing turnout is costly for those who vote, and only has a negative external effect on other citizens.

Ghosal and Lockwood (2009) extend Borgers' (2004) model to allow for an additional common value element in voters preferences. Information about the correct common choice is dispersed in the population in the form of a noisy signal. They show that if voters place sufficient weight on the common element of their preferences, they will vote according to their signal. In this case, higher turnout raises the probability that the correct collective choice is made. Voting therefore has a positive externality and turnout can be inefficiently low.

Lastly, Campbell (1999) is motivated by the observation that often the policies chosen by democracies are actually those with the support of a small number of enthusiastic citizens, rather than necessarily reflecting the will of the majority. Allowing the distribution of costs/benefits to differ between the supporters of two policies, he shows that in a large election there is a high probability that the policy with the largest number of "zealous" (low cost/high benefit) supporters will win, even if the majority are opposed to it.

There is a small amount of empirical work on participatory processes. List et al (2000) provide evidence from "deliberative polls", in which citizens engage in small group learning about, and discussion of, a particular policy issue for several days. They find that "deliberation" results in participants becoming better informed, and changing their opinions—and sometimes developing more "highly structured preferences".[8]

A number of papers present case studies of individual citizens' juries, including Aldred and Jacobs (2000), Lezaun and Soneryd (2007), Font and Blanco (2007), Paul at al (2008), Pickard (2002), Kuper (1997), Lenaghan et al (1996) and Parkinson (2004). These papers vary considerably in focus, but two concerns addressed in almost all of them are the "representativeness" of juries, and the capacity of ordinary citizens to deal with complex, technical issues—both of which are relevant to the modeling assumptions I make in this paper. Response rates to appeals for volunteers are low. Nevertheless, in most cases, organisers aimed, and more-or-less managed, to recruit juries that were demographically diverse, if not demographically representative, although the precise theoretical justification for this approach tends to be unclear.[9] All the juries studied banned members of "special interest" groups from participating as jurors. However, none of the studies make any systematic attempt to examine whether attendees' political attitudes , or attitudes to the issue under discussion, were typical.[10]

These studies of citizens' juries mostly conclude that citizens appear to be capable of dealing with complex policy issues. For example Kuper claims that the "quality and depth" of the final report by a Hertfordshire jury on waste management proves that fears ordinary people would not be able to deal with complex, technical information are unfounded. Lenaghan et al, similarly, conclude that their pilot jury showed that "given enough time and information, the public is willing and able to contribute to the debate about priority setting in health care". Aldred and Jacobs'

[8] "in the sense that more of them are single-peaked so that the collectivity can avoid voting cycles" (Fishkin and Laslett, 2003).

[9] Two exceptions are the Ely wetlands jury studied by Aldred and Jacobs, and the New Zealand breast cancer screening jury studied by Paul et al. The organisers of the wetland jury aimed instead for "fair representation of all relevant perspectives", by selecting people on the basis of criteria such as the amount of time they had lived in the area, and whether they were in agricultural employment. These criteria were chosen by the organisers. No attempt appears to have been made to test in advance whether these factors influence people's attitudes to wetland management. The breast cancer screening jury recruited only women from the age group in question (age 40-49).

[10] A partial exception is Font and Blanco, who consider evidence from a number of juries conducted by local authorities in Spain. and speculate that a jury focused on urban policy might have attracted more young people because these issues are particularly important to this group. Paul et al also note that the jury they study had a disproportionate number of women with a family history of breast cancer.

evidence is more mixed. While jurors took the process seriously, and were able, for example, to pick up on inconsistencies in evidence presented, their final recommendation was inside the budget frontier and therefore, arguably, irrational.

2.3 Model

The underlying picture of the world that this model seeks to capture is one in which a benevolent government wishes to implement the policy that maximises social welfare (or is best for the average voter), but is confronted by two sources of randomness. First, there is idiosyncratic noise because voters' preferences differ, so the government can never be certain of the preference of the average voter on the basis of the information provided by a finite sample of voters. Second, there is a common shock; voters share a common perception of the state of technology, but this perception is not necessarily accurate. As a result, the policy preference a citizen reports may not coincide with the policy that would actually maximise her welfare. The accuracy of an individual citizens' belief about technology can be improved via a (costly) participatory process. However, this participatory process (a citizens' jury) is limited by exogenous factors to a small number of citizens.

The basic policy question is whether expected welfare is higher if the government chooses a citizens' jury over an opinion poll. In the simplest case, the outcome clearly hinges on whether the smaller idiosyncratic component of the variance associated with the outcome of a poll (compared to a jury) outweighs the larger common component. However, the main concern of this paper is the effect of allowing for the fact that attendance at a citizens' jury is voluntary, and that incentives to volunteer vary across the population, and hence that the sample may be biased. I use a simple, binary model in order to make this problem tractable.

The players in the game are a benevolent, utilitarian government, and a continuum of citizens (approximating a very large electorate). The citizens are divided into two groups, which I refer to as a "left-wing" group and a "right wing" group. One of the groups is in a minority, and constitutes a fraction $\lambda < \frac{1}{2}$ of the population, while the other is the majority. Ex ante, it is equally likely that the left wing is the minority and the right the majority, and vice versa.[11]

[11] It follows that, as long as the poll sample/jury is drawn from a pool containing a majority from the majority group in the population, the government cannot do better than implement the policy preferred by the majority of the sample. If the prior put more weight on one group than the other, then clearly the government might want to use a more complex Bayesian updating process. This has potentially important implications for incentives to attend a jury, and the distinction between consultation and participatory government. I explore these briefly in Sections 2.5.2 and 2.6.1.

Members of the population know λ and the group to which they belong, and if necessary, any number of individuals in each group can be ordered/labelled. The assumption that there is a continuum of citizens means that if citizens use strictly mixed strategies when deciding whether to volunteer for a jury, there will always be more than enough volunteers to make up a jury. The government knows λ, but not which group is which.

The division of the population into just two groups is a common approach in the costly voting literature. It is obviously a simplification, and in a world with a continuous distribution of preferences it is arguably more plausible that the government would not know which group was in the majority. However, even with only two groups, people's opinions on the sort of complex policy issues addressed by some juries (nano technology, climate change, health service provision etc) may well depend heavily on other-regarding preferences, so the population need not divide along obvious cleavages.

I also limit the policy space to a choice between just two policies, A and B. Again, this is largely for simplicity. However, a possible theoretical justification for restricting the government to a binary policy space, at least for an opinion poll, is suggested by Kawamura's (Kawamura, 2008) result, discussed in Section 2.2, that a binary message space is robust when citizens have incentives to exaggerate.

Third, I assume that there are two possible states of technology, $s1$ and $s2$, which are ex ante equally likely. In $s1$, the left-wing prefer policy A and the right policy B, while in $s2$ the left prefers B and the right A i.e. a change in technology "flips" preferences. The (positive) effect on the payoff to an individual of having her preferred policy, rather than the alternative, implemented, is assumed to be the same across groups and states of the world, and is normalised to 1. The government learns the true state of technology, whilst citizens receive a common signal, which is correct with probability $p > \frac{1}{2}$.

The assumption that a change in technology "flips" preferences is clearly quite unintuitive, and will not directly reflect many real-world policy scenarios.[12] A more appealing model might have

[12] There may nevertheless be circumstances where it is a reasonable representation of reality, for instance where the decision is zero-sum.

both citizens' ideal outcomes and the available policy options arranged along a line, with changes in technology shifting each citizen's ideal policy either "left" or "right". Unfortunately, in this kind of more realistic environment the analysis quickly becomes uninformatively complex. To keep the model tractable, therefore, I employ the very simple binary set-up described.

The government has to choose between holding an opinion poll and a citizens' jury. If a poll is held, a random sample of M citizens are asked whether they think policy A or policy B should be implemented. If a jury is held, the government invites all citizens to volunteer, citizens decide whether to volunteer, and the government selects m jurors at random from the pool of volunteers. The jurors then learn the true state of technology and choose a policy by majority vote. $m < M$, and (without loss of generality) both are assumed to be odd. I assume that if no one volunteers for a jury, or if the jury is tied (which can only occur if the number of volunteers is fewer than m and even) then the government chooses by tossing a fair coin.

The assumption that each individual juror learns the true state of technology for certain is quite strong (even allowing for the fact, discussed below, that they incur a cost). In particular, together with the assumption that citizens all know the opinion distribution it implies that jurors have better information than the government. In this chapter, the assumption is maintained for simplicity but in future it might be interesting to relax it in favour of a model in which jurors received a better, but still noisy, signal about the state of technology. It might also be worth exploring the implications of a model in which the precision of jurors' signals could be improved in return for a higher attendance cost.

I assume that the basic cost to the government of holding a poll (c_{OP}) and a jury (c_{CJ}) are the same. If anything, this probably overstates the cost of an opinion poll of the type I am considering, but it is not unreasonable, and makes the analysis much cleaner. In Appendix A I briefly assess the importance of this assumption.[13]

[13] The cost of holding a citizens' juries varies widely. In 1997, the IPPR estimated the cost of a citizens' jury to be in the region £16,000-20,000 (Coote and Lenaghan, 1997). According to PeopleandParticipation.net, the cost of a jury is usually in the range £20,000-40,000. Wolverhampton City Council budgeted £25,000 for a jury on the Lyons inquiry. Costs of opinion polling vary even more. DFID spent £5940 and £7400 to add questions (on concern about global poverty and interest in ethical shopping respectively) to omnibus surveys of around 2,000 people. A bespoke survey of 1000 people (looking at young people's attitudes to global poverty and development) cost £23,745 (written answer to parliament, Hansard 2 Jun 2008 : Column 660W). The Department for Transport spent £35,384 on an ONS survey of public attitudes towards buses and concessionary fares, with a sample of 729.

Turning to the costs faced by citizens, whilst the cost of responding to a poll is negligible (I assume it is actually 0), the same is not true of a jury. The process takes $3 - -4$ days, and jurors have to exert effort to learn the details of the policy question. I therefore assume they face an attendance cost, c. For the main part of the paper, I assume that c is the same for all citizens. I relax this assumption in Section 2.5.1, while in Section 2.5.3 I also consider the possibility of the government offering to pay compensation to jurors.

2.4 Analysis

2.4.1 Compulsory (or Costless) Citizens' Jury Attendance

As discussed in the introduction, this paper has two main aims: to use a simple model to begin to analyse incentives to participate in these new forums and, in light of this, to characterise circumstances under which a benevolent policy maker might prefer to use them instead of the more traditional approach of opinion polling. In this section I briefly analyse a simplified scenario, in which attendance at a citizens' jury is either costless or compulsory. Establishing the most basic information/participation trade-off faced by the government helps to clarify the exact role of jurors' participation incentives in the full analysis in sections 2.4.2 and 2.4.3.

The assumption of no participation costs implies that the sample for a jury, like that for a poll, will be unbiased. Clearly, though, since $m < M$ the probability that the sample will be "minority-dominated"—contain a majority of members from the minority group in the population—is higher for a jury than a poll.[14] This is the first of the two "participation" advantages of opinion polls over citizens' juries mentioned in the introduction. I will refer to it as the **sample-size advantage**.

However, the existence of the sample-size advantage does not guarantee that a poll will be better. Citizens' juries involve intensive engagement with a particular policy problem by a small number of members of the public, so at the end of the process they offer "informed opinions". Citizens' juries therefore have an **information advantage** over opinion polls.

In deciding between an opinion poll and a jury, then, the government is comparing the potential for inaccuracy arising from a small but well-informed sample with the combined potential for

[14] i.e., in general terms, although the variance of of the preference of an individual selected to participate is the same for the two mechanisms, the variance of the sample average is decreasing in the sample size.

inaccuracy of a much larger, but still finite sample, where those questioned might also be misinformed. Clearly, which mechanism is more likely to produce the right result depends on both the variance of individual preferences (relative size of the minority), which interacts with the scale of the sample-size advantage of an opinion poll, and the probability that the public are mis-informed about technology.

The expected outcome of a citizens' jury is independent of the quality of public information, p, because attendees learn the true state of the world before they vote. The probability that a citizens' jury arrives at the "wrong" decision (i.e. votes in favour of the policy preferred by the population minority) is simply the probability of selecting a minority-dominated jury:

$$\begin{aligned} &Prob(\text{wrong result, CJ}|\lambda, m) = Prob(\text{minority-dominated}|\lambda, m) \\ &\quad = \sum_{i=0} \frac{m-1}{2} \binom{m-1}{\frac{m-1}{2}} \lambda^{m-i}(1-\lambda)^i = Prob(i \leq \frac{m-1}{2}) \quad i \sim Binomial[m, 1-\lambda] \end{aligned} \tag{2.1}$$

The probability of an opinion poll going wrong, however, is a function of p as well as λ and M:

$$\begin{aligned} &Prob(\text{wrong result, OP}|\lambda, p, M) = \\ &\quad pProb(\text{minority-dominated}|\lambda, M) + (1-p)(1 - Prob(\text{minority-dominated}|\lambda, M)) \\ &\quad pProb(i \leq \frac{M-1}{2}) + (1-p)(1 - Prob(i \leq \frac{M-1}{2})) \quad i \sim Binomial[M, 1-\lambda] \end{aligned} \tag{2.2}$$

I define a function[15] $\underline{\lambda}(p, M, comp)$. It is the value of λ at which, for given values of p and M, the government is indifferent between using an opinion poll and a citizens' jury with compulsory attendance. If $\lambda < \underline{\lambda}(p, M, comp)$, the government prefers a citizens' jury, and if $\lambda > \underline{\lambda}(p, M, comp)$ it prefers an opinion poll. Figure 2.1 illustrates for a range of values of M.

The simplest case is where $M \to \infty$, so an opinion poll is guaranteed to have a representative sample, and the comparison is simply between the probability the public have false information and the probability the jury is minority dominated. As one would expect, $\underline{\lambda}(p, M, comp)$ is downward sloping—when the minority group is smaller, it is less likely that the jury will be minority-dominated, so public information must be better for the government to prefer an opinion poll.

[15] I assume m is exogenously fixed; all the examples take $m = 15$.

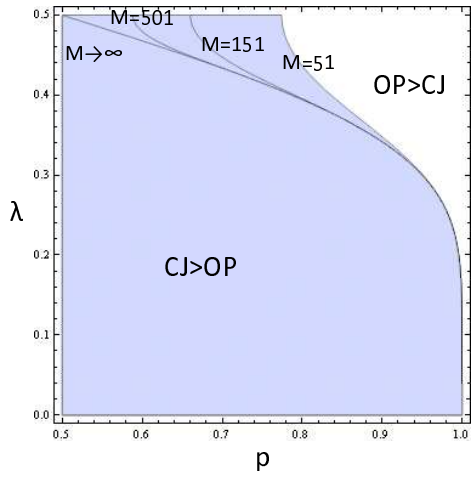

Fig. 2.1: Plot of $\underline{\lambda}(p, M, comp)$—the level of λ at which, given p, the government is just indifferent between an opinion poll of size M and a citizens' jury

Allowing for the fact that M is finite makes the trade-off somewhat more complicated, since variations in λ also affect the probability that a poll is minority dominated. Although a poll always has a sample size advantage, the size of this advantage varies with λ, as does the rate at which the size of the advantage changes. For example, for λ very close to $\frac{1}{2}$, a small fall in λ increases the sample-size advantage significantly, whereas for λ around 0.4, a fall in λ has a negative effect on the advantage. This helps explain why $\underline{\lambda}$ is steep for λ close to $\frac{1}{2}$, but relatively flat around $\lambda = 0.4$. Close to $\frac{1}{2}$, to offset an increase in p, λ has to fall sufficiently for the sample-size advantage of a poll to fall. Conversely, around $\lambda = 0.4$, a small fall in λ is sufficient to offset a small fall in the information advantage of a jury.

The overall impact of a change in λ on the government's preferred mechanism also depends on p. If p is close to $\frac{1}{2}$, so the public are almost as likely to be wrong as right, it makes very little difference to an opinion poll whether the sample is minority dominated or not, whereas if p is close to 1, the risk of a minority-dominated sample is critical. Lastly, as one would expect, the smaller M is the smaller the sample size advantage will be for a given λ, and hence the less likely the government is to prefer a poll.

2.4.2 Voluntary Attendance at a Citizens' Jury

In this section, I allow for the fact that attendance at citizens' juries is voluntary and that, as discussed in section 2.3, individuals have to incur a cost to attend a jury. This creates a "volunteering game" in which all the citizens decide simultaneously whether to volunteer to participate in a jury. For the most part I focus on symmetric equilibria—those in which all the members of each group follow the same, possibly mixed, strategy.

This game is closely related to the problem of costly voting. As discussed in Section 2.2, in models similar to the one in this chapter, Goeree and Großer (2007), and Yildirim and Taylor (2010) show that in a large election, for a range of participation costs[16] the outcome of the vote will be a "toss-up"—the policy preferred by the minority is as likely to win as that preferred by the majority. The intuition behind this result is explained below. It is important to note that if it carried over into the citizens' jury context, it would imply that the participation disadvantage of a jury was decisive.

In any standard model of voting over 2 alternatives, an individual's incentive to participate does not depend directly on the probability that her preferred alternative wins. Rather, what matters is the probability that by participating she makes a difference to the outcome.[17] The crucial difference between the volunteering sub-game in my model and costly voting in elections is that although any number of citizens can volunteer to be jurors, the number of citizens who actually get to participate in a jury (and so incur the participation cost) is capped at m. In contrast, any number of citizens can choose to pay the cost and vote in an election. This has two important consequences. First, an increase in the number of volunteers does not directly influence the probability that an individual, if selected to attend, will be pivotal. For a jury, it is the proportion of the volunteer pool from each group that matters. Second, the probability that an individual makes a difference is not the same as for an election. Since the number of jurors is fixed, if an individual decides not to participate, she will be replaced.

Goeree and Großer, and Yildirim and Taylor both restrict attention to perfect Bayesian equi-

[16] As the size of the population $rightarrow\infty$, this range of costs extends to cover the range $(0, \frac{1}{2})$, while if the cost is $> \frac{1}{2}$ no-one votes. Amongst other things, this implies that in the current set-up the government could never want to use a referendum in place of a poll or a jury. In Section 2.6.2 I discuss briefly how changing the framework might allow a referendum to be an interesting possibility.

[17] An exception is Meirowitz and Shotts (2009), in which citizens have an additional incentive to vote because the size of the winning alternative's majority provides information to politicians about the populations' preferences.

libria in strictly mixed strategies. I begin by doing the same for the volunteering sub-game. Let members of the minority volunteer with probability $q_{min} \in (0,1)$, and members of the majority volunteer with probability $q_{maj} \in (0,1)$. Then, for an individual from the minority, the difference between the probability that her preferred option is chosen if she attends, and the probability that it is chosen if she does not, is readily simplified to

$$\underbrace{\binom{m-1}{\frac{m-1}{2}} \frac{(q_{min}\lambda)^{\frac{m-1}{2}}(q_{maj}(1-\lambda))^{\frac{m-1}{2}}}{(q_{min}\lambda + q_{maj}(1-\lambda))^{m-1}}}_{\text{Prob. other } m-1 \text{ jurors evenly split}} \underbrace{\frac{q_{maj}(1-\lambda)}{q_{min}\lambda + q_{maj}(1-\lambda)}}_{\text{Prob. replaced by opponent}} \tag{2.3}$$

and it is straightforward to see that:

$$\binom{m-1}{\frac{m-1}{2}} \frac{(q_{min}\lambda)^{\frac{m+1}{2}}(q_{maj}(1-\lambda))^{\frac{m-1}{2}}}{(q_{min}\lambda + q_{maj}(1-\lambda))^{m}} \tag{2.4}$$

is the analogous expression for a member of the majority. In order for a pair $\{q_{min}, q_{maj}\}$ to constitute an equilibrium in strictly mixed strategies, individuals must be indifferent between attending and not attending when the rest of the population mixes with these probabilities i.e.:

$$c = \binom{m-1}{\frac{m-1}{2}} \frac{(q_{min}\lambda^{\frac{m-1}{2}}(q_{maj}(1-\lambda))^{\frac{m+1}{2}}}{(q_{min}\lambda + q_{maj}(1-\lambda))^{m}} = \binom{m-1}{\frac{m-1}{2}} \frac{(q_{min}\lambda^{\frac{m+1}{2}}(q_{maj}(1-\lambda))^{\frac{m-1}{2}}}{(q_{min}\lambda + q_{maj}(1-\lambda))^{m}} \tag{2.5}$$

Equation 2.5 implies that $\frac{q_{min}}{q_{maj}} = \frac{1-\lambda}{\lambda}$, which mirrors the neutrality result found for elections—the mixing probabilities exactly offset the underlying differences in group size, so that half of the volunteer pool comes from each group. To see why, note that for both groups to be using strictly mixed strategies, their expected benefit must be exactly offset by their attendance cost. I have assumed that all citizens face the same attendance cost, so they must have the same expected benefit. Moreover, the probability of the remaining $(m-1)$ jurors being evenly split between the two groups is the same for a potential juror from the minority as for one from the majority. Therefore, equilibrium in strictly mixed strategies is only possible if the volunteer pool is equally split between the two groups, so the probability of being replaced by someone from the opposition is the same for all citizens. It is useful to define $\hat{c}$ as the expected benefit to a juror when half the volunteer pool come from each group: $\hat{c} = \binom{m-1}{\frac{m-1}{2}}(\frac{1}{2})^m$.

This is the point at which this paper departs from the existing literature. In an election, it is possible to have (in expectation) equal numbers of voters from the two sides in equilibrium for a non-degenerate range of costs. The probability of being pivotal depends on the expected total

number of participants as well as the expected ratio of participants from the two groups, and in an election the number of participants is endogenous. When the cost of participating is higher, the probability with which an individual votes is simply lower.

In contrast, the number of participants in a jury is fixed at m. As a result, in the volunteering sub-game for a citizens' jury neutrality with strictly mixed strategies is a knife-edge result. There is an equilibrium in which both groups use strictly mixed strategies and the ratio of volunteers from the two sides is $1:1$ iff $c = \hat{c}$. In order to analyse the problem thoroughly, therefore, it is necessary to look at the equilibrium (or equilibria) when the attendance cost will not support an equilibrium in strictly mixed strategies.

We find that the equilibrium, and therefore the composition of the volunteer pool, depends on which of four ranges c falls into. These are illustrated in figure 2.2, and discussed below.

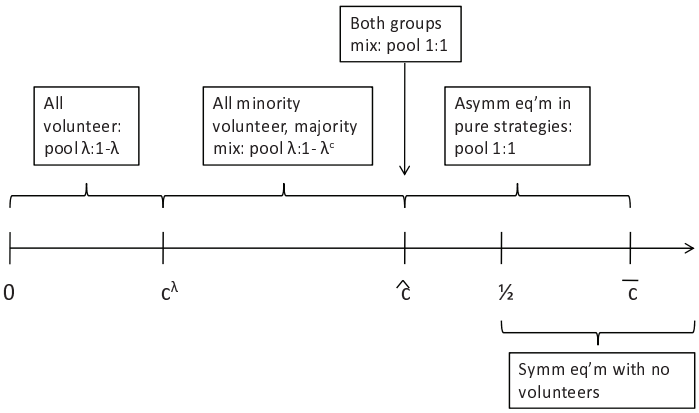

Fig. 2.2: Variation of the composition of the volunteer pool with the attendance cost, c, when the minority comprises a fraction λ of the population

If c is not equal to $\hat{c}$, then the only possible symmetric equilibria are: no-one volunteers; everyone volunteers; and all of the minority, but only a fraction $q > \frac{\lambda}{1-\lambda}$ of the majority, volunteer. The first case is simple. If one considers a proposed equilibrium in which no-one volunteers, then by assumption the government implements each policy with probability $\frac{1}{2}$. An individual who deviated and volunteered would be the only juror, and so would be sure to get her preferred policy, increasing her expected payoff by $\frac{1}{2}$. Hence, if $c > \frac{1}{2}$, there is an equilibrium in which no-one volunteers.

The conditions for an equilibrium in which everyone volunteers are also straightforward. If everyone volunteers, the probability that an individual who refuses an invitation would be replaced by someone from the opposite group is lower for members of the majority, while the probability that the remaining jurors $(m-1)$ jurors are evenly split is the same for the two groups. The expected benefit from attending is therefore lower for a member of the majority so the cost of attendance must be less than the expected benefit to a member of the majority in such an equilibrium i.e:

$$c \leq \binom{m-1}{\frac{m-1}{2}} \lambda^{\frac{m-1}{2}} (1-\lambda)^{\frac{m-1}{2}} \lambda \tag{2.6}$$

It will be useful for what follows to define two function, c^{λ} and λ^{c}. For a given value of c, let λ^{c} be the value of λ at which equation 2.6 holds with equality $c = \binom{m-1}{\frac{m-1}{2}} (\lambda^{c})^{\frac{m+1}{2}} (1-\lambda^{c})^{\frac{m-1}{2}}$ and, conversely, for a given value of λ, let $c^{\lambda} = \binom{m-1}{\frac{m-1}{2}} \lambda^{\frac{m-1}{2}} (1-\lambda)^{\frac{m-1}{2}} \lambda$. Since the right hand side of 2.6 is increasing in λ, we know that everyone will volunteer in equilibrium if $\lambda > \lambda^{c}$, or $c < c^{\lambda}$.

I now turn to equilibria in which the two groups adopt different strategies. We can rule out both equilibria in which the majority all attend and the minority attend with probability less than one, and equilibria in which the minority all volunteer and the majority volunteer with probability $q < \frac{\lambda}{1-\lambda}$. In the first case, the fact that only the minority are using a mixed strategy implies that they have a lower expected benefit from volunteering than the majority (who must strictly prefer attending to not attending). But clearly, if only the minority mix then an individual who refuses an invitation is more likely to be replaced my a member of the majority than of the minority. The expected benefit from attending is therefore higher for a member of the minority than the majority—which is a contradiction. This rules out the possibility that the minority might be under-represented in the volunteer pool.

Similarly, in the second case, for the majority to be using a strictly mixed strategy while all of the minority volunteer, it must be that the majority have a lower expected benefit than the minority. However, if $q < \frac{\lambda}{1-\lambda}$, the majority of the volunteer pool will consist of members of the minority, so an individual who refuses an invitation is more likely to be replaced my a member of the minority than of the majority.[18] This guarantees that although (for all but small values of c) the minority will be over-represented in the volunteer pool, it is impossible for the minority to constitute a strict majority of volunteers.

This leaves equilibria in which the minority all volunteer and the majority volunteer with probability $q \in [\frac{\lambda}{1-\lambda}, 1]$ so a majority of the volunteer pool are from the majority group in the population. Since the payoff to a member of the majority is decreasing in q, equilibria of this type exist for values of $c \in [c^{\lambda}, \hat{c}]$.

This range is important to understanding the government's choice between mechanisms. Crucially, q must be such that the proportion of volunteers from the minority remains at λ^c even though $\lambda < \lambda^c$. In order for the majority to use a strictly mixed strategy in equilibrium, they must be indifferent between attending and not attending. This is true (by definition) when everyone volunteers at $\lambda = \lambda^c$. The probability that an individual from the majority will alter the final policy choice must therefore be the same as when everyone volunteers at $\lambda = \lambda^c$ i.e.

$$\binom{m-1}{\frac{m-1}{2}} \frac{(\lambda)^{\frac{m+1}{2}}(q(1-\lambda))^{\frac{m-1}{2}}}{(\lambda + q(1-\lambda))^m} = \binom{m-1}{\frac{m-1}{2}} (\lambda^c)^{\frac{m+1}{2}}(1-\lambda^c)^{\frac{m-1}{2}}$$

In fact this is only possible if $\lambda^c = \frac{\lambda}{\lambda + q(1-\lambda)}$. For a given c, then, the proportion of volunteers from the minority as a function of λ is kinked. Above λ^c, it is equal to λ, but once λ falls below λ^c, the proportion remains at λ^c.

The minority is therefore over-represented in the volunteer pool if $\lambda < \lambda^c$, (or, if we are considering variations in c, if $c > c^{\lambda}$). This creates a second participation advantage of opinion polls over citizens' juries, because juries suffer from **self-selection bias**. Not only is the sample size of a poll larger, and therefore less likely to be minority-dominated, but an opinion poll sample is a genuinely random sample of the entire population, whereas with costly, voluntary attendance, a jury is drawn from a sub group of the population which (unless c is low) contains a dispropor-

[18] Recall that if $q = \frac{\lambda}{1-\lambda}$ the volunteer pool is evenly split.

tionate number of citizens from the population minority.

I have now considered all possible symmetric equilibria. It follows that if $c \in (\hat{c}, \frac{1}{2}]$ there cannot be a symmetric equilibrium. However, there is an asymmetric pure strategy equilibrium with more than m volunteers for all $c \in [\hat{c}, \bar{c}]$, where $\bar{c}$ is the maximum possible expected benefit to an individual from attending a jury. In this range, equilibrium is characterised by neutrality so the details are irrelevant to the government's problem. Appendix B.1 provides further details. Proposition 1 brings together the results of this section:

Proposition 1. *In equilibrium, the minority group in the population are never under-represented, but also never constitute a strict majority of volunteers. The exact proportion of volunteers from each group in equilibrium depends on which of three ranges the attendance cost lies in. If $c \in [\hat{c}, \bar{c}]$, then there will be an equilibrium with an equal number of volunteers from each group, so the proportions in the volunteer pool will bear no relation to those in the population (and if $c > \frac{1}{2}$ there will (also) be an equilibrium with no volunteers). If $c \in [0, c^{\lambda}]$, then the entire population will volunteer, so the volunteer pool will be exactly representative. If $c \in (c^{\lambda}, \hat{c})$, then a proportion λ^c of volunteers will be from the minority, so the minority will be over-represented, but still form a strict minority of volunteers.*

Proof in Appendix B.1

2.4.3 The Government's Choice when Jury Attendance is Voluntary

In this section, I show that once we allow for the fact that participants in citizens' juries must be volunteers, and therefore that a jury may suffer from self-selection bias, the government's choice of mechanism becomes more complex. The results of this section flow principally from the results of Proposition 1. If the attendance cost is low enough for there to be a symmetric equilibrium of the volunteering sub-game ($c < \hat{c}$), then the performance of a citizens' jury depends critically on whether λ is above or below λ^c. If $\lambda > \lambda^c$ an individual is quite likely to be decisive, so in equilibrium the entire population volunteers—and the probability that a jury makes the wrong decision declines as λ declines as under compulsion. If, on the other hand, $\lambda < \lambda^c$, then in the unique equilibrium the proportion of volunteers from the minority is fixed at λ^c regardless of the true value of λ. The probability that the jury makes the wrong decision is therefore also fixed. This radically alters the regions in which the government prefers an opinion poll to a jury and vice verse. The first result is:

Lemma 1. *If individuals must pay a cost $c \in (0, \hat{c})$ to attend a citizens' jury , as $\lambda \to 0$, the minimum value of p at which the government is indifferent between a citizens' jury and an opinion poll does not converge to 1, but rather to some value $\underline{p} < 1$.*

Proof in Appendix B.2

If jury attendance is compulsory, the pool of potential jurors is the same as the entire population. As the relative size of the minority gets very small, the probability of drawing a minority-dominated sample of jurors shrinks to almost 0 so the government prefers a jury for all but the highest values of p. If, however, jurors must be volunteers, then the probability of a minority dominated sample from a jury is the same for all $\lambda < \lambda^c$—i.e. it does not converge to 0 as λ does. As a result, the government will prefer a poll to a jury for small values of λ for a less-than-perfectly reliable technology signal. The minimum value of p at which the government prefers a poll to a jury as $\lambda \to 0$ is $\underline{p} = 1 - Prob(\text{minority-dominated}|\lambda^c, m) < 1 \quad if \quad \lambda^c > 0$

The second result of this section says that with voluntary jurors, there will be a level of p beyond which the government will prefer to use a poll regardless of the relative sizes of the two groups:

Lemma 2. *Under compulsion, for any $p \in [0.5, 1)$ there is a non-degenerate range of values of λ for which the government prefers a citizens' jury to an opinion poll. If individuals must volunteer and then pay a cost $c \in (0, \hat{c})$ to attend a citizens' jury, however, there is a value of p, $\bar{p} < 1$, above which the government always prefers an opinion poll.*

Proof in Appendix B.3

If the entire population volunteers, then the probability that a jury will be minority-dominated is smaller for smaller values of λ. It follows that with voluntary jurors, the minimum probability of a minority-dominated sample is $Prob(\text{minority-dominated}|\lambda^c, m)$. Since $\lambda^c \in (0, \frac{1}{2})$, there must be some value of p, $\bar{p}$, such that $\lambda^c = \underline{\lambda}(\bar{p}, M, comp)$.

Referring back to Figure 2.1, it should be clear that if $p > \bar{p}$, the government must prefer an opinion poll for all values of λ. First, if $\lambda \geq \lambda^c$, then a citizens jury is the same as under compulsion—so at $p \geq \bar{p}$, the government will prefer an opinion poll. Second, if $\lambda < \lambda^c$, then the probability that a citizens' jury is minority dominated is the same as if $\lambda = \lambda^c$. In contrast, in absolute terms an opinion poll performs better the smaller λ is—so if the government prefers a poll at λ^c, it must also prefer one at $\lambda < \lambda^c$.

Lemma 1 says that with voluntary jurors the government does better by using an opinion poll when the minority is very small, even when the public's signal is quite unreliable. In light of the intuition from Section 2.4.1, one might expect that the government will in fact do better with an opinion poll for all values of λ if $p > \underline{p}$. However, in fact $\bar{p}$ is larger than $\underline{p}$—so there is a region over which the government's choice is non-monotonic in λ. We have:

Proposition 2. *If individuals must pay a cost $c > \hat{c}$ to attend a citizens' jury, the government will always prefer to use an opinion poll. If the cost is $c \in (0, \hat{c})$, then the government's choice of consultation mechanism is non-monotonic in λ. If $p < \underline{p}$, the government prefers an opinion poll iff $\lambda > \underline{\lambda}(p, M, comp)$. If $p > \bar{p}$, the government always prefers an opinion poll. If $p \in [\underline{p}, \bar{p}]$, the government prefers an opinion poll if $\lambda > \underline{\lambda}(p, M, comp)$ or if $\lambda < \bar{\lambda}(p, M, c)$, while it prefers a jury if $\lambda \in [\bar{\lambda}, \underline{\lambda}]$.*

Proof in Appendix B.4

Figures 2.3 and 2.4 illustrate for different values of c and M. If attendance at a jury is costly, and the prospective organiser is unable (or unwilling) to compel citizens to attend, then the decision as to whether it is better to hold a jury, or use an opinion poll instead, may not be a simple one. Unsurprisingly, once we allow for the fact that jurors must volunteer, and that this will skew the volunteer pool in favour of the minority for at least some values of λ, the regions of the parameter space in which a jury is better shrinks.

More strikingly, the gradual, monotonic relationship found in Section 2.4.1 disappears. For a relatively narrow, but critical, range of values of p, a jury is better when the minority is mid-sized, while a poll is better for small as well as large values. For $p < \bar{p}$, $\underline{\lambda}(p, M, comp) > \lambda^c$, so if $\lambda > \underline{\lambda}(p, M, comp)$, the government still prefers an opinion poll. However, for $\lambda < \lambda^c$, as λ falls the range of values of p for which the government prefers a poll increases. Whereas the probability of a minority-dominated jury is fixed by λ^c, the probability of a minority dominated opinion poll declines as λ declines. The probability of an opinion poll producing the wrong result therefore also declines, so for the government to remain indifferent between a poll and a jury, a fall in λ must be accompanied by a fall in the quality of public information.

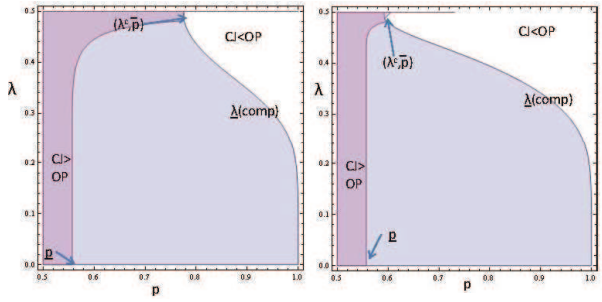

Fig. 2.3: Comparison of the government's preferred consultation mechanism under compulsion ($\underline{\lambda}(comp)$) and with voluntary attendance for $c = 0.05$ and $M = 51$ (left hand diagram) and $M = 501$ (right hand diagram)

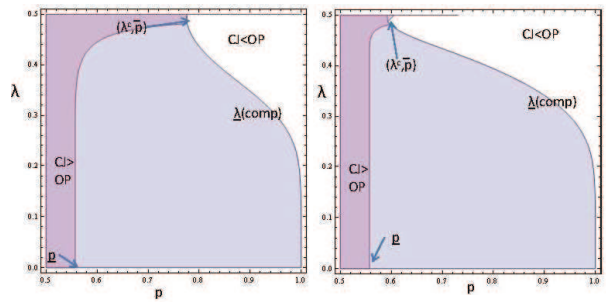

Fig. 2.4: Comparison of the government's preferred consultation mechanism under compulsion ($\underline{\lambda}(comp)$) and with voluntary attendance for $c = 0.1$ and $M = 51$ (left hand diagram) and $M = 501$ (right hand diagram)

The final important point to note is that a relatively small difference in the reliability of public information (between $\underline{p}$ and $\bar{p}$) makes the difference between a situation in which a jury is better for a wide range of of values of λ, and one in which a poll is always better. The selection of the best consultation method can therefore be highly sensitive to all three of the key variables: the quality of public information; the size of the minority; and the participation cost faced by citizens.

2.4.4 Discussion

The decision to volunteer for a citizens' jury is crucially different to the decision to turn out to vote. Although from the perspective of a citizen, her "participation" decision is whether to volunteer, she only has to incur the cost if she is selected as one of a small, pre-determined number of participants. As discussed in section 2.4.2, it follows that the probability a particular citizen will be able to influence the policy outcome if she pays the participation cost differs between the two scenarios. In an election, a citizen has to weigh up the probability that adding her vote will either create or break a tie against her participation cost. By volunteering for a jury, however, a citizen does not "add" a vote for her side. Rather, it means that she might be selected as one of the m jurors, and her calculation is based not only on the probability that the remaining $m-1$ jurors are evenly divided but also on the probability that in her absence her "replacement" would be from the opposing side.

The first important implication of the difference between a jury and an election is that it is quite possible for the entire population to be willing to volunteer for a jury (with probability 1) even when the attendance cost is non-negligible. In an election with a large population, if everyone participates the probability of being pivotal—and therefore of influencing the outcome—shrinks to zero and so there cannot be an equilibrium with full participation unless the cost of participation is also zero (or negative). The fixed size of a jury eliminates this effect.

The second theoretical implication of the fixed number of jurors is that the neutrality result for elections found in Goeree and Großer (2007) is a knife-edge result for juries. Unless the attendance cost happens to take a single, specific value ($\hat{c}$), there will not be a symmetric equilibrium in which the pool of volunteers for a jury contains equal numbers of citizens from the majority and minority. Rather, if $c < \hat{c}$, but is not low enough for the entire population to be willing to

volunteer (i.e. $c > c^{\lambda}$), all the members of the minority group will volunteer, while members of the majority will volunteer with some probability such that they constitute a majority of volunteers.

This type of equilibrium (where the minority all volunteer and the majority use a strictly mixed strategy) has a similar flavour to the neutrality result. Within the relevant range of parameter values ($\lambda < \lambda^{c}$) variations in the distribution of preferences does not affect the expected outcome of the jury. However, the policy implications are importantly different. If the neutrality result held, the government would never want to use a jury. In fact, though, if $c < \hat{c}$, a jury is more likely to produce the right result than not, so if public information is poor the government may do better by holding a jury, and getting access to "informed public opinion", rather than a large opinion poll.

Of course, unless $c < c^{\lambda}$, a jury will suffer from self-selection bias as well as a sample-size disadvantage. Moreover, the nature of the mixed strategy equilibrium means that the self-selection bias is larger at smaller values of λ—and this wholly offsets the reduction in sample-size we saw in Section 2.4.1. It is this that generates both the non-monotonicity in the government's choice of mechanism, and the possibility that, for a substantial range of values of $p < 1$, the government will never want to use a jury even if the minority group in the population is very small.

2.5 Extensions

In this section I consider four extensions to the model. The first two are robustness checks. I first relax the assumption that all citizens incur the same cost if they attend a jury, and then the assumption that the government has no prior information about which group is more likely to be the majority. The remaining two extensions are motivated by variations in the conduct of actual citizens' juries; some organisers offer compensation to participants, and some ban members of relevant "special interest groups" from participating.

2.5.1 Heterogenous Costs

An obvious question raised by the analysis in Sections 2.4.2 and 2.4.3 is the extent to which the results rely on the fact that all individuals share the same cost, so that for $\lambda < \lambda^{c}$ the equilibrium is in mixed strategies. In this section I briefly consider the effect of allowing for heterogenous attendance costs:

Assumption 1. *Each individual, i, has a cost $c_i \in [\underline{c}, \bar{c}] \in \Re^+$ drawn from a continuous distribution $F(\frac{c-\underline{c}}{\bar{c}-\underline{c}})$ which is strictly increasing on $[\underline{c}, \bar{c}]$, where $\underline{c} < \hat{c}$, $F(0) = 0$ and $F(1) = 1$. An individual's cost is independent of her policy preference.*

In equilibrium, the expected benefit from attending is the same for all the members of a group, so equilibrium must be characterised by a cut-off cost level for each group: c_{min} for the minority and c_{maj} for the majority. An individual from the majority with $c_i = c_{maj}$ will be just indifferent between attending and not attending, so those in the majority with c_i greater than c_{maj} must strictly prefer to attend, and vice versa. We have:

Proposition 3. *Suppose individual costs satisfy assumption 1. Then an equilibrium of the attendance sub-game is characterised by a cut-off values for each of the two groups. Members of the population minority volunteer iff $c_i \leq c_{min}$, while members of the majority volunteer iff $c_i \leq c_{maj}$. These are such that $F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}}) \geq F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})$ but $\lambda F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}}) < (1-\lambda)F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})$ i.e. the minority are over-represented in the volunteer pool, but the majority of volunteers still come from the majority group in the population. As $\bar{c}, \underline{c} \to c' \in (0, \hat{c})$ the equilibrium ratio of volunteers from the minority to those from the majority converges to that which would arise if all citizens had the same cost c'.*

Proof in Appendix B.5

The cut-off cost levels for the two groups must satisfy:

$$\binom{m-1}{\frac{m-1}{2}} \frac{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)^{\frac{m-1}{2}} (F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^{\frac{m+1}{2}}}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda + F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^m} = c_{min} \tag{2.7}$$

and

$$\binom{m-1}{\frac{m-1}{2}} \frac{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)^{\frac{m+1}{2}} (F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^{\frac{m-1}{2}}}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda + F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^m} = c_{maj} \tag{2.8}$$

As in Section 2.4.2, the probability that the remaining $(m-1)$ jurors are evenly split between the two groups is the same for a member of the minority as the majority. However, the probability that, if an individual declines an invitation, she will be replaced by someone who shares her preference is higher for a member of the group that contributes a majority of volunteers. Thus a member of this group has less incentive to incur the cost of attendance.

It follows that members of the population majority must constitute a majority of volunteers. Suppose that they did not. In order for a majority of volunteers to come from the minority group,

a larger fraction of the minority than the majority must volunteer. This would imply (given iid costs) that the highest cost volunteer from the minority had a higher cost than the highest cost volunteer from the majority. But if the population minority form a majority of volunteers an individual is more likely to be replaced by a member of the minority than the majority. The incentive for a member of the population minority to attend is then be smaller than that for a member of the majority. This is inconsistent with the highest attendance costs being incurred by members of the minority.

The final point in Proposition 3 is that as the range of costs converges to a point $c'(< \hat{c})$, the equilibrium converges to that which would occur if all citizens had the same cost c'.[19] This is important—the results of the earlier analysis are indeed robust to small amounts of cost heterogeneity. It is also quite straightforward. Recall that in the model with a single common cost, c^{λ} was the maximum attendance cost at which the entire population would volunteer for a given size of the minority, λ. Clearly if $c' < c^{\lambda}$, the entire population will be willing to volunteer under heterogenous costs too. If $c' > c^{\lambda}$, on the other hand, the fact that $c_{maj}, c_{min} \to c'$ implies that the equilibrium expected payoff to a volunteer from the majority[20] must also $\to c'$. As we saw above, any given cost is associated with a unique ratio of volunteers from the two groups. Hence as $c_{maj} \to c'$, it must be that $\frac{F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda)}{F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda+F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda)} \to (1-\lambda^{c'})$.

2.5.2 Uneven priors

I assumed in the main model (Section 2.3) that the policy maker was committed to implementing the choice of the jury's majority. In fact, though, since the policy maker attached equal probabilities to the majority being on the left and on the right, this commitment was unimportant. I now consider the effect of allowing for the possibility that the government might have some prior information about the identity of the majority.

Without loss of generality, suppose the government knows that with probability $\pi \geq \frac{1}{2}$, the majority of the population is left-wing. Since the government learns whether the state of technology is $s1$ or $s2$, it can use this to infer that the majority would prefer a particular policy with probability π (specifically, policy A if the state is $s1$ and policy B if the state is $s2$). The main

[19] Recall that if citizens share a common attendance cost, $\hat{c}$ is the level of this cost at which an equilibrium in strictly mixed strategies exists.

[20] how narrow the cost range must be before the entire minority is willing to volunteer i.e. before $c_{min} = \bar{c}$, will depend on the distribution function—so we cannot say for certain if the minority will all volunteer.

purpose of this section is to establish that as $\pi \to \frac{1}{2}$, the equilibrium of this game almost always converges to that in Section 2.4.2, and hence that the results derived above are robust to small improvements in the government's information.

With $\pi > \frac{1}{2}$, the government will use the results of a jury for non-trivial Bayesian updating. If, for example, the state is $s1$ (so with probability π the majority prefer policy A), then if policy A gets κ of the m votes in a citizens' jury, and the government believes that a fraction $(1-\theta)$ of the volunteer pool come from the population majority group, the updated probability that the majority really does prefer policy A is:

$$Prob(A|\kappa,\theta,\pi) = \frac{\binom{m}{\kappa}\pi\theta^{m-\kappa}(1-\theta)^{\kappa}\pi}{\binom{m}{\kappa}(\pi\theta^{m-\kappa}(1-\theta)^{\kappa}+(1-\pi)\theta^{\kappa}(1-\theta)^{m-\kappa})} \tag{2.9}$$

The government will choose policy A if $Prob(A|\kappa,\theta,\pi) \geq \frac{1}{2}$ i.e.:

$$\frac{\pi}{1-\pi} > (\frac{(1-\theta)}{\theta})^{m-2\kappa} \tag{2.10}$$

Since $\pi \geq \frac{1}{2}$, as long as the population majority comprise a majority of volunteers ($\theta < \frac{1}{2}$) this is always true if $\kappa > \frac{m}{2}$—so the government will certainly want to choose policy A if it has a majority of votes. If π is large (so the government attaches less weight to the outcome of the jury relative to its prior), or $(1-\theta)$ is small (so the probability of minority-dominated jury is high), the government may also want to choose policy A if it gets only a minority of votes. I therefore define k as the value of κ such that the government chooses policy A iff it gets at least k votes.

It is useful to rearrange condition 2.10 to give an expression in terms of θ We can then define the value of θ at which it holds with equality for given k and π as:

$$\underline{\theta}^{k,\pi} = \frac{(1-\pi)^{\frac{1}{m-2k}}}{(1-\pi)^{\frac{1}{m-2k}}+(\pi)^{\frac{1}{m-2k}}} \quad \forall k \in 0, \frac{m-1}{2} \tag{2.11}$$

and define the value of θ at which it holds with equality for $k-1$ as:

$$\bar{\theta}^{k,\pi} = \frac{(1-\pi)^{\frac{1}{m-2(k-1)}}}{(1-\pi)^{\frac{1}{m-2(k-1)}}+(\pi)^{\frac{1}{m-2(k-1}}} \forall k \in 0, \frac{m+1}{2} \tag{2.12}$$

Using these, we can say that the government will want to choose policy A iff it gets at least k votes as long as $\theta \in [\underline{\theta}^{k,\pi}, \bar{\theta}^{k,\pi}]$.[21] If $\theta > \bar{\theta}$, it will select A even if it only gets $k-1$ votes (or possibly fewer). If $\theta < \underline{\theta}$, the government will not select A if it only gets k votes.

As one would expect, participation incentives for citizens may be affected. If the government uses a cut-off value k for the policy it thinks the majority will prefer, and the rest of the population are using strategies that generate a volunteer pool $\theta : 1-\theta$, then the expected gains from attending a jury to a member of the majority and the minority respectively are:

$$G(maj, \theta, k, \pi) = \binom{m-1}{k-1}\left(\pi\theta^{m-k+1}(1-\theta)^{k-1} + (1-\pi)\theta^{k}(1-\theta)^{m-k}\right) \tag{2.13}$$

$$G(min, \theta, k, \pi) = \binom{m-1}{k-1}\left(\pi\theta^{m-k}(1-\theta)^{k} + (1-\pi)\theta^{k-1}(1-\theta)^{m-k+1}\right) \tag{2.14}$$

By the reasoning in Section 2.4.2, members of the minority will all volunteer while members of the majority will volunteer with probability $q \leq 1$, where q is large enough to ensure that a majority of volunteers come from the population majority. Proposition 4 gives the key results of this section:

Proposition 4. *Suppose that the government receives an informative signal about the identity of the majority, which is correct with probability $\pi > \frac{1}{2}$. If it holds a citizens' jury, there is an equilibrium in which it uses a cut-off value k for the policy it believes is more likely to be preferred by the majority if*

- *$\exists\theta \in [\underline{\theta}^{k,\pi}, \bar{\theta}^{k,\pi}]$ and $\theta > \lambda$, such that $G(maj, \theta, k, \pi) = c$*
- *or $\lambda \in [\underline{\theta}^{k,\pi}, \bar{\theta}^{k,\pi}]$ and $G(maj, \lambda, k, \pi) \geq c$*

If neither condition is satisfied for any $k \in \{0, \frac{m+1}{2}\}$, there is no equilibrium with a positive number of volunteers.
Under the assumption that $\lambda, \lambda^c \ll \frac{1}{2}$ as $\pi \to \frac{1}{2}$, there will almost always be a unique equilibrium with positive volunteering. This equilibrium converges to that in Proposition 1.

Proof in Appendix B.6

The conditions for equilibrium in Proposition 4 follow from the preceding discusion. In general, with uneven priors there may be multiple equilibria of the citizens' jury game.[22] However, for

[21] if $k = \frac{m+1}{2}$, $\underline{\theta} = 0$

[22] In Section 2.4.2, if the expected benefit from volunteering for a member of the majority when the entire population volunteered was less than the attendance cost, then in equilibrium members of the majority would volunteer with a probability less than one, so the probability of being pivotal was higher. While this effect is

values of π close to $\frac{1}{2}$, as long as $\lambda < 1 - \pi$ there is almost always only one equilibrium. In this "principal" equilibrium, the government sets $k = \frac{m+1}{2}$ and the population behave as in Proposition 1.

For there to be an alternative equilibrium (i.e. one with $k < \frac{m+1}{2}$), there must be a value of λ such that not only is k the government's best response to a volunteer pool with a ratio $\lambda : 1 - \lambda$ (i.e. $\lambda \in [\underline{\theta}^{k,\pi}, \bar{\theta}^{k,\pi}]$) but member of the majority are strictly indifferent between volunteering and not volunteering ($G(maj, \theta, k, \pi) = c$). However, as $\pi \to \frac{1}{2}$, $\underline{\theta}^{k,\pi} \to \bar{\theta}^{k,\pi}$ $\forall k < \frac{m+1}{2}$, so the range of values of c for which such an equilibrium is possible shrinks to a point.

2.5.3 Compensation

In Section 2.4.2 I assumed that the attendance cost faced by the public was outside the government's control. However, in reality some public bodies pay compensation to participants in citizens' juries. Allowing the government to choose to pay compensation introduces a theoretical problem. The government faces a trade-off between (possibly) improving the representativeness of the jury by increasing compensation, and keeping the cost of consultation low. The optimal level of compensation therefore depends critically on the weight the government attaches to expenditure relative to improved policy decisions. Broadly, any compensation costs paid to jurors by the government need to be weighted to take account of two considerations.

First, compensation is paid to at most a small number of individuals, while the policy choice may affect large populations—ranging from a few thousand members of a local community (or community of interest) to the entire UK population. Second, the marginal cost of public funds is probably greater than 1. The upper end of most estimates[23] of the SMCPF is around 1.5, but if we consider a policy maker in a local council facing highly geared council tax rates (and media criticism of excessive spending on consultation exercises), it is possible that costs would be weighted more heavily.[24] I combine these into a single coefficient, τ, and look at values of τ up to 0.1. I show that the optimal level of compensation is higher when the two groups are more dif-

present here for given k, an increase in the proportion of volunteers from the minority makes it more likely that the government will want to use a lower value of k. Multiple equilibria exists if π and c are such that at progressively smaller values of k, there are progressively higher minority proportions consistent both with k being the optimal cut-off for the government, and the payoff to the majority being exactly c. Conversely, there will be no equilibrium if, for any k, the change in the proportion of volunteers necessary for the payoff to the majority to cover its attendance cost shifts the government to a lower value of k.

[23] See, e.g., Ruggeri (1999), Klevena and Kreinerb (2006).

[24] A similar argument probably applies at national level to individual spending departments.

ferent in size, and that allowing the government to offer compensation to prospective jurors may, depending on τ, introduce a second non-monotonicity into the function defining the government's preferred consultation mechanism.

Optimal compensation

For simplicity, I restrict the analysis of the government's optimal compensation problem to $c \leq \hat{c}$.[25] I denote the amount of compensation paid to each juror by the government ν, and the solution to the government's optimisation problem ν^*. Also, let ω be the effective attendance cost faced by individuals: $\omega \equiv c - \nu$. We can define λ^ω analogously to λ^c:

$$\omega = \binom{m-1}{\frac{m-1}{2}} (\lambda^\omega)^{\frac{m+1}{2}} (1-\lambda^\omega)^{\frac{m-1}{2}} \tag{2.15}$$

It is also necessary to define two cut-off values of τ (the weighting applied by the government to compensation costs). $\bar{\tau}$ is the level of τ at which, for a given size of the minority group and value of c (and hence λ^c), the marginal benefit from increasing the representativeness of the volunteer pool by offering compensation is exactly offset by the (weighted) cost of compensation at $\nu = 0$:

$$\bar{\tau}(\lambda, c) = \frac{2(1-2\lambda)(1-\lambda^c)}{m(m+1-2m\lambda^c)Beta[\frac{m+1}{2}, \frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}} \tag{2.16}$$

At the other extreme, $\underline{\tau}$ is the level of τ at which the the marginal benefit from increasing the representativeness of the volunteer pool by offering compensation is exactly offset by the (weighted) cost of compensation when ν is large enough to induce the entire population to attend:

$$\underline{\tau}(\lambda, c) = \frac{2(1-2\lambda)(1-\lambda)}{m(m+1-2m\lambda)Beta[\frac{m+1}{2}, \frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}} \tag{2.17}$$

Lastly, let

$$\lambda^{\omega^*}(\lambda, \tau) = \frac{2(1-2\lambda) - \tau m(1+m)Beta[\frac{m+1}{2}, \frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}}{2(1-2\lambda) - 2\tau m^2 Beta[\frac{m+1}{2}, \frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}} \quad if \quad \tau \in [\underline{\tau}, \bar{\tau}] \tag{2.18}$$

The results of this section are set out in Lemma 3:

Lemma 3. *If $\lambda > \lambda^c$, $\nu^* = 0$. If $\lambda < \lambda^c$ the optimal level of compensation depends on λ, c and τ.*

[25] If $c > \hat{c}$, the government has to compare not paying compensation and getting the policy right with probability $\frac{1}{2}$ (in which case it will actually prefer an opinion poll), or paying a "lump sum" of $c - \hat{c}$, then (because τ is constant, so this lump sum does not affect the comparison of marginal costs/benefits), solving the optimal compensation problem outlined in this section with $\lambda^c = \frac{1}{2}$.

If $\tau > \bar{\tau}(\lambda, c)$, it is not worth paying any compensation. Conversely, if $\tau < \underline{\tau}(\lambda, c)$, it is optimal to pay enough to induce the entire population to volunteer. Lastly, if $\tau \in [\underline{\tau}, \bar{\tau}]$ then it is optimal to pay an intermediate amount that results in a volunteer pool with a proportion λ^{ω^*} of volunteers from the minority.

The optimal level of compensation is weakly decreasing in λ. In particular, if it is worth paying enough to induce the entire population to volunteer at λ', it is worth it $\forall\ \lambda < \lambda'$.

Proof in Appendix B.7

If $\lambda > \lambda^c$, we know from Proposition 1 that in equilibrium the entire population volunteers even without compensation—so offering compensation cannot improve the representativeness of the volunteer pool. If we consider a decline in λ from λ^c, the incentive to offer compensation is affected by three forces. Obviously, the higher the marginal cost of compensation (τ) the less likely it is that the government will want to pay jurors. Second, at lower levels of λ, because the two groups are more different in size the cost to the government of making the wrong decision (implementing the policy that benefits the minority rather than the majority) is higher. This increases the incentive to offer compensation. Third, however, it costs more to induce the entire population to attend when the two groups are very different in size.

In principle, therefore, it is not clear whether the incentive to pay compensation, and the amount of compensation it is optimal to pay, would be higher or lower a lower values of λ. However, it turns out that optimal compensation is strictly decreasing in λ. The key driver of the result is the nature of the volunteering equilibrium when all citizens share the same attendance cost.

When the net attendance cost is ω, for any $\lambda < \lambda^\omega$, a fraction λ^ω of the volunteer pool is from the minority. A marginal increase in ν decreases ω and hence λ^ω and so improves the (expected) performance of the jury by the same amount for all $\lambda < \lambda^\omega$. However, the benefit to the government from a given increase in the probability of a jury selecting the right policy is larger when the majority is larger (i.e. λ is smaller). Hence, if an increase in ν is worthwhile at some λ' it is worthwhile for all $\lambda < \lambda'$, and if there is some λ'' such that $\nu^*(\lambda'') > 0$ then $\nu^*(\lambda)$ is strictly decreasing in λ for all $\lambda < \lambda''$. Figure 2.5 illustrates for $c = 0.1$ and τ from $0 - 0.1$.

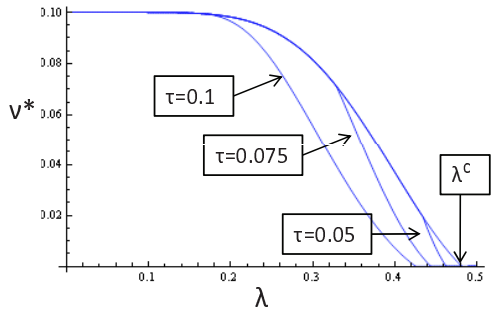

Fig. 2.5: Optimal compensation for $c = 0.1$, for different values of τ

The government's choice with optimal compensation

In light of Lemma 3, it is not surprising that the effect of allowing the government to compensate jurors on its preferred consultation method depends heavily on τ and c. Clearly, as $\tau \to 0$, the problem converges to that analysed in Section 2.4.1, while if τ is so large that it is never worth paying compensation, then the results of Section 2.4.3 apply. As noted in the previous section, optimal compensation is higher when the groups are more different in size (λ is smaller). For intermediate values of τ, therefore, compensation may eliminate the non-monotonicity established in Proposition 2. On the other hand, it may instead introduce additional complexity. We have:

Proposition 5. *If individuals must volunteer for a jury, but the government is able to pay compensation, then the government's choice of mechanism will depend on the weighting factor τ. If $\tau > \bar{\tau}(\lambda = 0)$, then $\nu^* = 0$ so the government's choice is non-monotonic in λ. At the other extreme, there is some value $\tau' \leq \underline{\tau}(\lambda^c)$ such that if $\tau \leq \tau'$, the government's choice is monotonic in λ. If $\tau \in [\tau', \bar{\tau}(\lambda = 0)]$, then allowing the government to pay optimal compensation introduces a second non-monotonicity—there is a range of values of p over which as λ increases from 0 the government prefers first a jury, then a poll, then a jury, and then (unless $\underline{\lambda}(p, M, comp) = \frac{1}{2}$) a poll again.*

Proof in Appendix B.8

Figure 2.6 illustrates. It is useful to divide the effect of optimal compensation on the government's choice into two elements. The first is the change in $Prob(\text{minority-dominated}|\lambda, m, \omega)$. For exam-

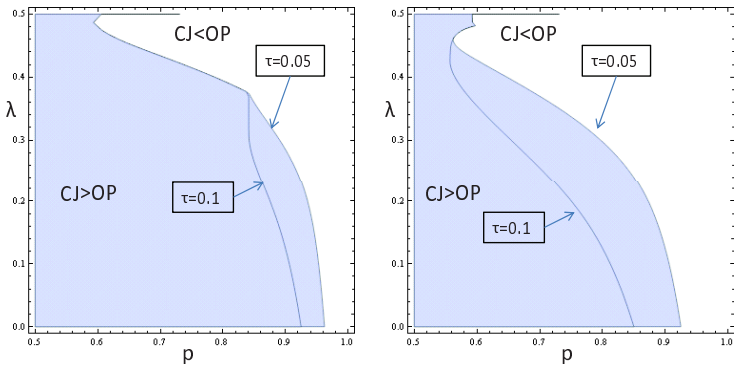

Fig. 2.6: The government's preferred consultation mechanism for $M = 501$, $m = 15$ and $c = 0.05$ (left hand figure) and $c = 0.1$ (right hand figure)

ple, if $\tau \leq \underline{\tau}(\lambda = \lambda^c)$ then it is optimal to pay enough compensation to get the entire population to volunteer for all $\lambda < \lambda^c$. The probability of a jury producing the wrong result is therefore exactly the same as under compulsion.

However, on its own this may not be enough to eliminate the non-monotonicity in the government's choice. The second element is the reduction in the payoff from a citizens' jury due to compensation payments of $(\tau \times m \times \nu^*)$. This explains why, even if it is worth paying enough to induce the entire population to volunteer for all values of λ, a fall in λ will not necessarily increase the payoff from a jury by more than that from an opinion poll i.e. why it may be that $\tau' < \underline{\tau}(\lambda = \lambda^c)$.

On the other hand, allowing the government to pay compensation to jurors clearly must (weakly) increase the amount of the parameter space in which a jury is preferable to a poll. From a policy perspective, perhaps the most interesting result from Proposition 5 is the potential for a second non-monotonicity in the choice of mechanism.

This is illustrated in the second example from Figure 2.6, where $c = 0.1$ and $\tau = 0.1$ or $\tau = 0.05$. For $c = 0.1$, $\bar{\tau}(\lambda = \lambda^c) = 0.024$, so there is a range of values of $\lambda < \lambda^c$ for which it is not worth paying any compensation. This explains the first non-monotonicity close to λ^c. On the other hand, it is clear from Figure 2.5 that both these values of k are low enough for it to be worth paying full compensation for smaller values of λ.

It is also clear from Figure 2.5 that the level of compensation required to get everyone to attend does not vary very much at low values of λ. Since in the region of interest $p << 1$, the effect of a fall in λ on $Prob(\text{minority-dominated}|\lambda, m, comp)$ is considerably larger than that on $Prob(\text{wrong result, OP}|\lambda, M, p)$. Combined, these two facts mean that for lower values of λ, an increase in λ increases the payoff from a jury by more than that from a poll—so the cut-off value of λ at which the government is indifferent is decreasing in p. Allowing the government to pay compensation may therefore make the optimal consultation mechanism even more sensitive to the exact values of p and λ.

2.5.4 Special Interests

Government guidance describes citizens' juries as being "made up of a small panel of 12–15 lay people who are not experts on the topic under discussion, nor members of interest groups or other key stakeholder organisations" (Maer, 2007). Organisers of actual juries have taken steps to exclude members of special interest groups (see, e.g., Aldred and Jacobs (2000) and Lezaun and Soneryd (2007)). To consider the effects of these restrictions, I extend the model of Section 2.3 to include a fraction γ of the population who have a "special interest" in the policy decision. I assume that members of this group faces the same attendance cost, but increase their payoff by $\beta > 1$ if the policy changes to their preferred choice. I make a further assumption to simplify the analysis, and also capture the idea that the "special interests" I am interested in represent only a small fraction of the population:

Assumption 2. $\lambda < 1 - \lambda - \gamma$ *and* $(\lambda - \gamma) + \beta\gamma < 1 - \lambda$

Clearly, if $\beta < 2$, the first of these implies the second, while if $\beta > 2$, the second implies the first. The first says that if the special interest group is part of the majority and is excluded, the remainder of the majority is still larger than the minority. This rules out situations where the two groups are very close in size—but in these situations, choosing the "right" policy is less important anyway. The second says that if the special interest group is part of the minority, the government

still prefers to choose the policy that benefits the majority.[26]

In this section, I show that, depending on c, γ and λ, banning members of a special interest group from volunteering may have no effect, a positive effect or a negative effect on the likelihood of a citizens' jury choosing the policy that's best for the majority. I begin by defining analogues to λ^c (and c^λ) as defined in Section 2.4.2. Recall that λ^c is the minimum size of the minority group such that for a given cost, c, the entire population is willing to volunteer. Let $\lambda^{c,\gamma,maj}$ be the value of λ such that a member of the majority is just indifferent about attending a jury given c and γ, and assuming that the special interest group shares the preferences of the majority group and is banned from volunteering. It satisfies:

$$c = \binom{m-1}{\frac{m-1}{2}} \frac{(\lambda^{c,\gamma,maj})^{\frac{m+1}{2}}(1-\lambda^{c,\gamma,maj}-\gamma)^{\frac{m-1}{2}}}{(1-\gamma)^m} \tag{2.19}$$

If, on the other hand, the special interest group shares the preferences of the minority, then, if the special interest group is banned, the cut-off value of λ is $\lambda^{c,\gamma,min}$ such that:[27]

$$c = \binom{m-1}{\frac{m-1}{2}} \frac{(\lambda^{c,\gamma,min}-\gamma)^{\frac{m+1}{2}}(1-\lambda^{c,\gamma,min})^{\frac{m-1}{2}}}{(1-\gamma)^m} \tag{2.20}$$

Note that $\lambda^{c,\gamma,min}$ must be larger than λ^c, while $\lambda^{c,\gamma,maj}$ is smaller. We have:

Lemma 4. *If $c \leq \hat{c}$, and a fraction γ of the population constitute a "special interest" group, with a payoff of $\beta > 1$, banning them for volunteering for a citizens' jury has no impact on the expected policy outcome as long as $\lambda < \lambda^{c,\gamma,maj}$. If $\lambda \in [\lambda^{c,\gamma,maj}, \lambda^c]$, a ban increases the probability of a minority-dominated jury. If $\lambda \in [\lambda^c, \lambda^{c,\gamma,min}]$, the effect of a ban is ambiguous. Finally, if $\lambda > \lambda^{c,\gamma,min}$, the effect of a ban is ambiguous in general, but it strictly decreases the probability of a minority-dominated jury if γ is very small.*

Proof in Appendix B.9

The central result in roposition 4 is that if $\lambda < \lambda^{c,\gamma,maj}$, banning the special interest group from attending has no effect on the expected outcome. By construction, in this range c and λ are such that ordinary members of the majority will not volunteer with probability 1 in equilibrium. They

[26] This might be true even if the second inequality did not hold. The government might be interested in maximising votes or it might under-weight the preferences of special interests relative to "ordinary" citizens.

[27] Conversely, if we fix λ we can define cut-off values of c: $c^{\lambda,\gamma,maj} = \binom{m-1}{\frac{m-1}{2}} \frac{\lambda^{\frac{m+1}{2}}(1-\lambda-\gamma)^{\frac{m-1}{2}}}{(1-\gamma)^m}$ if the special interest group shares the majority's preference, and $c^{\lambda,\gamma,min} = \binom{m-1}{\frac{m-1}{2}} \frac{(\lambda-\gamma)^{\frac{m+1}{2}}(1-\lambda)^{\frac{m-1}{2}}}{(1-\gamma)^m}$ if it shares the minority's.

therefore must have an expected payoff of exactly c. Since all ordinary members of the minority and (if they are not banned) all the members of the special interest group will volunteer, in equilibrium members of the majority must volunteer with the appropriate probability to generate a volunteer poll with a ratio of $\lambda^c : 1 - \lambda^c$.

The remainder of the proposition deals with the cases in which the entire (eligible) population may volunteer. If $\lambda \in [\lambda^{c,\gamma,maj}, \lambda^c]$, everyone volunteers if the special interest group shares the majority's preference and is banned. Otherwise, ordinary members of the majority mix with some probability less than 1 and, once again, a proportion λ^c of the volunteer pool will be from the minority. A ban therefore only has an effect if the special interest group shares the preferences of the majority. If it is not excluded, the pool will be $\lambda^c : 1 - \lambda^c$. If it is excluded, the entire eligible population will volunteer, so the pool will be $\lambda : 1 - \lambda - \gamma$. The fact that ordinary members of the majority strictly prefer to volunteer in this case implies that $\frac{\lambda}{1-\gamma} > \lambda^c$ so overall the government does better by allowing the special interest group to volunteer.

If $\lambda \in [\lambda^c, \lambda^{c,\gamma,min}]$, then the entire eligible population volunteers either if there is no ban, or if there is a ban but the special interest group shares the preference of the majority. If the special interest group is banned and shares the preference of the minority, then the proportion of volunteers from the minority is still λ^c in this range. If, on the other hand, $\lambda > \lambda^{c,\gamma,min}$, then the entire eligible population will always volunteer.

If the group shares the majority' preference, banning it reduces the proportion of volunteers from the majority and therefore increases the probability of a minority dominated jury. On the other hand, banning it when it shares the minority's preference reduces the proportion of volunteers from the minority, and decreases the probability of a minority dominated jury. The net effect depends on λ and γ (and c).

The closer λ is to λ^c, the more likely it is that a ban will have a negative overall effect on expected welfare, because the benefit from a ban when the special interest group is in the minority is very small. The effect of a ban is also more likely to be negative if γ is large. For a given value of γ, a ban on volunteers from special interest groups has more effect on the proportion of volunteers from the minority if the special interest group is part of the minority than if it is part of the

majority. However, the nature of the binomial distribution means that the effect of a change in the proportion of volunteers from the minority on the probability of a minority dominated jury is larger when the minority is larger. At larger values of γ, therefore, the gain from excluding special interests from the minority is less likely to outweigh the loss from excluding them when they are part of the majority.

2.6 Future Work

2.6.1 Commitment with Uneven Priors

In Section 2.5.2, I noted that if the government has prior information about the identity of the majority, there may be multiple equilibria, in which citizens volunteer in different proportions and the government uses correspondingly different cut-off values, k. Crucially, lower values of k are associated with volunteer pools in which the minority is more heavily over-represented . A natural question that arises is whether, therefore, the government might prefer to commit to implement whichever policy received a majority of votes in the jury[28]—even if no equilibrium with $k = \frac{m+1}{2}$ actually exists. If citizens expect the government to use a larger value of k, the volunteer pool may be more representative, so even if this value of k is sub-optimal for the government ex post the improvement in the volunteer pool may be large enough for the commitment to benefit the government overall.

Clearly, such a commitment will only ever be desirable if the equilibrium without commitment involves over-representation of the minority in the volunteer pool i.e. if it has $k < \frac{m+1}{2}$ and a proportion $\lambda^{c,\pi,k} > \lambda$ of the volunteer pool come from the minority. Since as π gets large the equilibrium of the citizens' jury game may become quite complicated, an exhaustive analysis is left for future work. However, I present a numerical example here to demonstrate that there are circumstances under which the government may indeed wish to handover decision making power to a jury.

Suppose $m = 15$, $p = 0.75$, $c = 0.39$ and $\lambda < 0.35$. These imply two possible equilibria without commitment, one with $k = \frac{m-1}{2}$ and one with $k = \frac{m-3}{2}$. The second column of table 2.1 details the values of $\lambda^{c,\pi,k}$ that occur in each of these equilibria, as well as λ^{c}—i.e. the proportion of volunteers there would be from the minority if the government were to commit to using $k = \frac{m+1}{2}$.

[28] In principle one could imagine the government being able to choose any value of k to commit to. However, $k = \frac{m+1}{2}$ is particularly interesting, because such a commitment is equivalent to transferring democratic decision making power to the jury.

k	$\lambda^{c,\pi,k}$	$Prob$(correct policy)
$\frac{m-3}{2}$	0.427	0.79
$\frac{m-1}{2}$	0.378	0.87
$\frac{m+1}{2}$	0.352	0.88

Tab. 2.1: The probability of the government selecting the correct policy following a citizens' jury if $m = 15$, $p = 0.75$, $c = 0.39$ and $\lambda < 0.35$, for various cut-off values, k.

The third column gives the probability that the government will choose the correct policy. Clearly, the government would need to be able credibly to commit to $\frac{m+1}{2}$, since $\lambda^c \in [1-\pi, \frac{(1-\pi)^{\frac{1}{3}}}{(1-\pi)^{\frac{1}{3}}+\pi^{\frac{1}{3}}}]$ so ex post it would rather use $k = \frac{m-1}{2}$. However, as long as it is possible, the government would indeed wish to make the commitment. Moving from $k = \frac{m-1}{2}$ to $k = \frac{m+1}{2}$ reduces the proportion of volunteers from the minority by so much that, even using a sub-optimal cut-off value, the probability of making the right choice is higher.[29]

2.6.2 Other Open Questions

There are a number of other possible avenues for future work. These fall in to two groups: further extensions to the model; and broader questions about participatory democracy. In the first group, it would be interesting to explore other sources of heterogeneity. It has been suggested that policy/preference cleavages may map quite closely on to the sort of differences that might affect individuals' willingness to participate in citizens' juries and other "mini-publics". Participation not only takes time, but also, it is often argued, requires confidence and articulacy. If this is true, we might expect more educated citizens to be more willing to participate. If differences in wealth and education also predict relevant policy preferences then it would be interesting to extend the model to allow for correlation between preferences and participation costs.

It might also be interesting to relax the assumption that the benefit to an individual from altering the policy decision to her favoured policy is always the same, regardless of the state of the world or her preference. This would allow for a slight move away from the idea that a change in the state of the world literally "flips" the policies. Instead, we could think of there being a status quo policy, and an alternative which, depending on the state of the world, might lie to the "left" or "right" of the status quo.

[29] Of course, this will not always be the case. If $\lambda = 0.37$, the equilibrium is unaffected in the first two cases, but if $k = \frac{m+1}{2}$, the entire population will be willing to volunteer. The volunteer pool is consequently only slightly better under commitment than in the equilibrium with $k = \frac{m-1}{2}$. The probability of the right decision under commitment therefore falls too—to 0.85—and the government would actually prefer to make use of its information and play the equilibrium with $k = \frac{m-1}{2}$.

Last, as noted in Section 2.4.2 it would never be worth the government putting the question to a vote in a referendum in this model; over-representation by the minority would be sufficiently severe to generate neutrality over the entire relevant cost range. However, moving to a model in which members of the public had less good information about the distribution of preferences would weaken this result.[30] In terms of participation, the cost of voting in a referendum is likely to be non-negligible but significantly smaller than that of being a juror. On the other hand, the lack of a fixed cap on the number of participants will tend to reduce the incentive to participate in a referendum and perhaps accentuate selection bias. Referendum campaigning might also mean that the reliability of referendum voters' information would lie between that of jurors and that of poll respondents.

Moving away from the particular assumptions made in this paper, there are clearly many open questions of the sort posed by Landa and Meirowitz (2009). For example, Miller (2003) attempts to differentiate "liberal" and "deliberative" democracy on the grounds that while both start from the premise that political preferences conflict, and that the purpose of democratic institutions is to resolve these conflicts, liberal democracy treats preferences as "sacrosanct" and looks to aggregate individual preferences fairly whereas under deliberation "the process of reaching a decision will also be a process whereby initial preferences are transformed to take account of the views of others". It is not completely clear from this exactly what deliberative democratic agents would look like but as a first pass we might try to extend the model of this chapter to one in which citizens have altruistic concerns and noisy information about others' preferences.

Various potentially interesting questions also arise if we drop the assumption of a purely benevolent government. Canes-Wrone, Herron and Shotts (2001) have a model in which the executive knows for sure whether or not the policy is in the majority interest from the outset. The executive is motivated by re-election, and the outcome of the policy choice may not be realised until after the election—so it has to choose whether to provide "leadership" by selecting an unpopular policy. They show that it is possible for an executive to choose not only leadership but also "fake-leadership" in equilibrium—selecting an unpopular policy which is bad for the majority in order to look like leaders. Citizens juries offer the government the possibility of educating a small

[30] Though holding a referendum is very considerably more expensive than either a jury or an opinion poll.

number of citizens about technology—and therefore perhaps a mechanism to convince the general public that its chosen policy is in fact in the public interest.[31]

2.7 Conclusions

In the introduction, I set out two questions for this chapter: first, from a theoretical perspective, whether, and if so how, a model of costly participation in a citizens' jury setting might produce different results to those found in work on costly voting in large elections; and, second, what this implied for the conditions under which a policy maker might in fact want to use a citizens' jury, rather than a more traditional opinion poll, to help in setting policy when citizens' have imperfect information about the technical environment.

The main theoretical contributions have been discussed in some detail in Section 2.4.4. To recap, if attendance at a citizens jury is costless (or compulsory) then the comparison between a citizens' jury and an opinion poll simply depends on whether the information advantage of the jury outweighs the sample-size advantage of the opinion poll. Of course, jury attendance is (almost certainly) not costless. This introduces a self-selection bias, though the fixed number of jurors means it is less severe than the existing costly voting literature would suggest: neutrality is a knife-edge result. For sufficiently small, but nevertheless non-negligible, costs the entire population may be willing to participate—something which is impossible in an election with a large population. If the cost is too high for everyone to volunteer, but below $\hat{c}$, then the the minority is always over-represented in the volunteer pool, but never contributes a majority of volunteers—and the proportions of the two groups in the equilibrium volunteer pool are *independent* of the proportions in the population.

In terms of policy, a key implication of the equilibrium of the volunteering sub-game (Proposition 1) is that the attendance cost faced by citizens and the government's assessment of the quality of public information (the value of p) are central to its choice of mechanism—arguably more so than the relative sizes of the two groups.

Making allowance for the possibility that the attendance cost of a jury will result in self-selection

[31] This links to broader political theory questions about the credibility and legitimacy of citizens juries, given that the members are not elected, and non-participating members of the public have no direct way of knowing whether the jury went against their wishes because a majority of jurors came from the opposing group, or because the jurors had better information.

bias will inevitably affect the sort of policy areas for which it might be worth replacing traditional consultation via opinion polling with a jury. In the absence of self-selection, a jury would seem to be a good idea for any issue where a reasonably large majority of the population agree on what would constitute a desirable outcome. Examples might include health and safety standards (for things like water supplies), many environmental issues (not least because almost 80% of the UK population live in urban areas) and the regulation of minority behaviours. However, if potential volunteers weigh up the cost of participation against their likely impact on the policy outcome, we should expect the pool of actual volunteers to contain a disproportionate number of volunteers from the minority. As a result, the government will only actually be better off using a jury if it thinks the population are quite likely to be misinformed about the effects of the policy alternatives.

The format of the citizens' jury analysed in Section 2.4.2 is very simple. Section 2.5 considered two additional features that we sometimes observe in real world juries: the payment of compensation to jurors; and the exclusion of individuals with a "special interest" in the policy area being considered. An important, if straightforward, immediate conclusion from the analysis of compensation payments is that it is unlikely to be optimal to have a blanket policy of paying compensation, even if the cost of compensation is quite low (τ is small). As long as the policy under discussion is reasonable important to citizens, if the minority and majority groups are quite similar in size then the opportunity to influence policy should be sufficient incentive. This conclusion is reinforced by two further considerations. First, if the groups are similar in size, the loss to the government from selecting the wrong policy is small. Second, even if paying compensation will improve the representativeness of the jury sample, unless public information is very poor, an opinion poll is still likely to be superior when the minority group is large. On the other hand, if the two groups are very different in size then both the self-selection problem and the costs of choosing the wrong policy may be severe, so is quite likely that the government should pay compensation.

It is UK government policy to exclude "experts", members of "interest groups" and other "key stakeholders" from participation in citizens' juries. The analysis of Section 2.5.4 suggests that whether this is a good idea may depend heavily on how broadly these terms are interpreted. Members of a special interest group are willing to incur the cost of jury attendance in return for a lower probability of influencing the outcome than ordinary members of the public. As a result, if they belong to the minority group in the population they may exacerbate the self-selection prob-

lem, and vice versa.

Note first that they only "may" have an effect. If citizens all share the same cost, and the minority is quite small relative to the majority, then in equilibrium ordinary citizens will simply adjust their behaviour to fully offset the presence of the special interest groups, and a ban will have no impact at all. However, if the minority group is reasonably large, the decision whether to allow special interests to participate may be important. Section 2.5.4 indicates that if the number of people who would be excluded by a ban on special interest groups is very small, then any positive impact of a ban when the special interest group belong to the minority will usually outweigh any negative impact when it belongs to the majority— and the government's approach is probably a good one.[32] If, however, a large number of people are encompassed by the definition of a "special interest", it is quite possible for the net effect of a ban to be negative.

Overall, then, it may be possible to make a case for the use of citizens' juries as an alternative means of public consultation. In some ways they resemble more traditional, and more widely studied, forms of costly political participation. However, their fixed, small size makes them importantly different and opens up the possibility that they might provide at least some useful information on the distribution of preferences. If we accept that the public often lack important information about public policy choices, it may be enough to make a citizens' jury a better option than an opinion poll—under some circumstances.

[32] The exception to this is if $\{\lambda, c\}$ are such that a ban only has an impact when the special interest group is in the majority

3. CHALLENGE FUNDING AND STATIC EFFICIENCY

3.1 Introduction

The 388 elected local councils in England were responsible for spending over £102bn in 2009/2010 (CLG, 2009). Their current responsibilities cover a broad range of services including environmental health, housing, recreation, social services, transport and waste disposal. However, compared to sub-national governments elsewhere in the EU and USA, their decision making powers are limited and their constitutional position weak. Councils in the UK are "creatures of statute" (Leigh, 2000); Parliament can—and frequently does—unilaterally alter local councils' powers.[1] Central government also exercises considerable power over council budgets. Only £25.6bn of councils' 2009/10 expenditure was financed by the council tax (CLG, 2009). The rest came from centrally set and collected taxes, often with restrictions on how recipient councils may spend it.

To better understand a situation that to a local council may at times seem suffocatingly restrictive, it is useful also to consider the perspective of central government. Many of the goods and services it funds with public money are essentially local in their impact. National ministries can choose to provide these things directly, or they can give the resources to local government together with a statutory obligation to spend them on the centre's objectives. Two main features mark local councils out from government agencies. First, they have their own democratic legitimacy and employ their own staff. This limits government's control over exactly what they do. Second, they are long-term, multi-functional organisations. This gives them superior information on local needs and opportunities. From the point of view of the centre, then, local councils offer a distinctive alternative delivery mechanism.

[1] Wilson and Game (2002) remark that "the Conservative governments from 1979 to 1997 produced well over 210 Acts of Parliament affecting local government, at least a third of them in major and far-reaching ways".

Local Public Goods in a Unitary State

Central government in the UK uses public money to buy local public goods in three different ways. First, much of what central government does is essentially local in its impact. Examples include NHS hospitals and the Environment Agency's flood defences. I will describe the provision of these goods as "centralized". Second, local councils provide services using centrally collected revenue that is distributed between councils according to a needs-based formula. This makes up the bulk of expenditure on things like schools and social services and is the largest component of councils' incomes.[2] Finally, central government departments sometimes invite local councils to submit dossiers making their case for shares of the budget allocated to particular central priorities.

The amount of money distributed to councils via this third, "challenge funding" process is small relative to that channeled via formulae.[3] Nevertheless, some individual programmes have been quite large. One that has attracted particular attention is the Single Regeneration Budget (SRB), which distributed £5.7billion in regeneration funding over 6 rounds between 1994 and 2001.

A central government that wants a particular good to be provided, then, faces a choice between three possibilities: centralisation, formula funding and challenge funding. The literature on decentralisation and fiscal federalism highlights several key influences on both the optimal and the actual distribution of responsibility for various goods between tiers of government. These are discussed in more detail in Section 3.3.2, but none of them include all the key features of the context in which the decision between the funding mechanisms outlined above is made. These features, which I discuss in more detail below, are:

- the state is unitary (like the UK) and *central government decides* which funding mechanism is to be used for the provision of a particular good
- the good to be provided is a strictly local public good for which regional preferences and/or technology are *heterogeneous*
- local councils have *better information* than central government on these differences
- there may be *differences in ability* between councils, and between councils and the centre

[2] In 2009/10, approximately £71bn, including the Dedicated Schools Grant, was distributed between English councils (CLG, 2009).

[3] In 2000 the Department for Transport, Local Government and the Regions, which had responsibility for local government at the time, published a Green Paper with proposals to expand the use of challenge funding but these were dropped following objections from local councils.

Much of the literature focuses on decentralisation in federal states. Compared to a federal system, the relationship between the national and sub-national tiers of government in the UK is both complex and fluid. The centre can unilaterally alter councils' powers. It also has considerable control over councils' budgets, and in some policy areas local government officials are used to implement central decisions. An important intermediate level of central direction is "ring-fencing". Councils are obliged to spend ring-fenced budgets on the policy area specified by the centre, but the fine details of expenditure are not specified.

Despite the centre's considerable legal and financial powers, though, it would be misleading to suppose that councils are essentially executive agencies of central government. The centre has much less power over councillors and local government officers than over the bureaucrats in its executive agencies. Councillors are accountable to local voters and are responsible for the officers who implement both local policy decisions and those aspects of central government policy for which provision is decentralized. Thus, while central government can control, more or less broadly, what councils spend their money on, it cannot directly control the quality of the outcomes.

Though there is a literature that examines the provision of public goods in unitary states[4] it is motivated by the question of subsidiarity in the EU and so focuses on the role of elections and strategic delegation. Whereas subsidiarity is a key issue in European elections, opinion polls indicate that by far the most important issues in UK national elections are crime, health and immigration.[5] These papers therefore do not shed much light on the allocation of responsibilities between national and sub-national governments.

In contrast to the nature of central-local relations in a unitary state, inter-regional heterogeneity in preferences and informational asymmetries between tiers of government have been extensively analysed in the fiscal federalism literature following the seminal contribution of Oates (1972). However, this literature does not address a potentially important source of variation. This is the fourth element listed: variation in ability between tiers of government and between different local councils, which I will refer to as variation in *administrative competence*. In 2002 the Audit Commission began a programme of evaluation of local councils called Comprehensive Performance

[4] I discuss papers by Lorz and Willman (2005) and Redoano and Scharf (2004) in Section 3.3.2

[5] In a Mori (2005) poll prior to the 2005 general election, less than 1% of respondents gave "local government/council tax" as the most important issue facing Britain, and only 3% considered it one of the "other important issues facing Britain".

Assessment (CPA). The variation in CPA scores indicates that the quality of service provision varies between councils. Of course, this might be due to differences in effort rather than intrinsic ability. To support the latter interpretation I present Local Government Association data on recruitment and retention in Section 3.2.1. This suggests that there are significant differences in the ease with which councils are able to hire and retain skilled staff.

Challenge Funding and Inter-Regional Heterogeneity

Ministers claimed that the challenge funding approach used to allocate the SRB, under which councils have to submit dossiers setting out their case for funding, forces councils to raise their game.[6] There have been investigations into the use of challenge funding, including several empirical analyses of the Single Regeneration Budget. In a theoretical paper, Ward (2002) assumes councils have heterogeneous preferences but identical abilities and argues that if the only gains from the challenge funding process arise from competitive pressure, it is unlikely to be worthwhile because in equilibrium only a small number of marginal councils are actually subject to any pressure. Ward and John (2005) apply Ward's model to data on bid documents submitted for the SRB. They argue that the model is supported empirically and that even assuming improvements in bid documents translated into improved delivery the gains were small enough to be outweighed by even very small transaction costs. They conclude that challenge funding is socially sub-optimal.

However, preference heterogeneity need not be the only relevant source of variation. The alternative I wish to explore is that areas differ in two dimensions. First, preferences/technology may not be uniform, so the socially optimal policy may differ between regions. Second, there may be variations in *administrative competence* between bureaucrats in different tiers of government and, within the local tier, between officers in different councils.

In Section 3.2.2 I show that, controlling for deprivation, councils the Audit Commission judged to be more competent won larger shares of the Single Regeneration Budget. Thus, compared with what a formula funding process would have produced, the allocation resulting from the challenge funding process was skewed in favour of more able councils. Since the Audit Commission's assessment regime only began in 2002, while the final round of the SRB was held in 2001, the natural interpretation of this relationship is that central government was able to infer something about

[6] The Treasury's (HM Treasury, 1996) handbook claims that "[the process] offers opportunities to enhance value for money... driving up performance and securing better outputs at lower cost to the taxpayer".

councils' abilities from the dossiers they submitted.

Summary of model and results

After presenting this evidence in Section 3.2, in Section 3.4 I develop a model designed to capture key features of policy problems such as that addressed by the SRB. Central government is able to decide whether to decentralise policies on a case by case basis, and we can think of there being two relevant dimensions to efficiency: "allocative" and "productive". By virtue of their superior local information, councils have an advantage in allocative efficiency. On the other hand, administrative competence, or "productive efficiency", varies across local councils. I make two further assumptions. First, central government officials are assumed to be at least as competent as those in the best councils, so centralisation will ensure greater "productive efficiency".[7] Second, I assume the administrative competence of a council is positively correlated with its ability to produce good dossiers. I am interested in whether, and if so when, such variation in ability between councils can make the use of challenge funding socially desirable.

In the model (Section 3.4), a benevolent central government faces two local councils. The centre has a fixed budget and has to decide first how to allocate the money, and second how much should be spent in each area, given that there are diminishing returns to spending in an area. The two dimensions of efficiency—productive and allocative—identified above are combined into one "ability" parameter which determines the probability that a project is "good" (high social returns) rather than "bad". Central government's ability is common knowledge, while each local council's is a privately observed draw from a commonly known distribution. Central government's overall ability may therefore be higher or lower than expected council ability. The final feature of the model is the technology involved in production of the dossiers submitted if challenge funding is chosen. Any council can produce a slicker dossier by exerting more (costly, and increasingly costly) effort, but the returns to effort are higher for more able councils.

The first, natural, implication of the model is that the more important local knowledge is, and hence the more likely the centre is to make poor choices, the more desirable it is to have councils spend the budget. The choice between decentralisation via challenge or formula funding is rather more complex. By choosing challenge funding, central government may learn the ability of each

[7] Though I do not present data to support this assumption, it seems quite reasonable since central government both recruits from the national labour market and has more prestige as an employer (Times Graduate Employers, www.timesonline.co.uk/top100grad).

local council it is dealing with (there is always a fully separating equilibrium, though there may also be semi-separating and pooling equilibria). This allows the centre to target money at those who are less likely to waste it on badly managed projects. This "targeting benefit" is increasing in both the range of competence levels.

This benefit has to be weighed against the cost to councils of producing their dossiers. This cost is largest precisely when the gross benefits from discriminating between more and less competent councils are largest. This can be described as an "envy" effect. When discrimination is important, the difference between the optimal allocations to more and less competent councils is large, so being perceived to be competent is more valuable. Less competent councils are therefore willing to exert more effort if doing so will lead the centre to over-estimate their competence, so in a separating equilibrium more competent councils must produce better dossiers.

"Envy" is not the only influence on dossier-production costs, however. Depending on the dossier quality and cost-of-effort functions, bids may discriminate more or less efficiently between councils. We can describe dossiers as more *efficient discriminators* if competence, or talent, is more important than effort in determining dossier quality. If this is true, competent councils only have to exert a small amount of effort to produce dossiers of a quality that less competent councils will not be willing to imitate. Dossiers are also more efficient if the marginal cost of effort increases more steeply. The cost of effort a less competent council is willing to incur is fixed by its prospective gains. In turn this determines the quality of bid more competent councils will produce in a (semi-)separating equilibrium. Holding the importance of talent relative to effort fixed, the overall cost of effort to high ability councils will be lower the more steeply effort costs rise with effort.

To summarise, then, the government will want to use challenge funding if the "targeting benefit" is sufficiently high (due to large differences in competence) and dossiers are sufficiently "efficient discriminators" (with talent being more important than effort in producing dossier quality, and a rapidly rising marginal cost of effort).

An alternative mechanism: bidding with commitment

In an economic environment in which a number of agents compete for shares of a budget, it seems natural to consider using a form of procurement auction in which, rather than producing dossiers,

councils (costlessly) submit binding offers to provide specific projects of value to central government in return for a certain amount of funding. How appropriate this would be seems likely to depend on the policy area under consideration. If the aim is to encourage innovative solutions to intractable social problems, good projects will likely have uncertain outcomes, and allowing councils to change their plans during implementation may be efficient.

If commitment is not (too) problematic, an auction might be worthwhile. It only really makes sense to use a first price auction in this context. In order for an auction to be a plausible proposition at all we must assume that

a the centre is fully able to compare (Thiel, 1988) multi-dimensional projects

b the way the centre evaluates any given proposal is common knowledge amongst all the players

However, in order to be able to run a second price auction we would have to assume further that

c this "conversion formula" could be stated formally and enforced contractually

d councils could costlessly switch from the project that they had proposed to one providing precisely the value offered by the second highest bidder.

(a) and (b) are debatable, but (d), and in particular (c), seem really quite unlikely.

In Section 3.5.2 I consider a very simple kind of auction for shares of the government's budget. Specifically, I assume that councils cannot transfer resources from their own budget to increase their bids. Combined with the ring-fencing constraint this means that councils will simply bid the maximum amount it is able to produce with each share. I also assume that the government has to fix a division of the budget prior to the auction. In this context a "bid" is a project proposal. While we might expect councils to be able to produce 2 or 3 proposals corresponding to different possible allocations, a procedure that required councils to submit a continuum of possible projects corresponding to every possible budget split does not seem practical.

This allows for a direct comparison between challenge funding and this "bidding with commitment" process. I show that the government faces a trade-off. On the one hand, bidding with commitment eliminates socially wasteful dossier production. On the other hand, the practicalities of the auction format imposes a "rigidity cost"—the government must decide the budget split

before it knows the realisations of councils' abilities. In Chapter 4 I develop a richer model of a procurement auction with transferable resources.

3.2 Data

3.2.1 Human Capital Differences

Since 2002 all local councils have received a Comprehensive Performance Assessment (CPA) from the Audit Commission. Under CPA, each council is awarded an overall rating on a 5 point scale: poor; weak; fair; good; excellent. The results from the first round of CPA are given in Table 3.1.In

CPA rating	Number of councils
Poor	21
Weak	51
Fair	121
Good	139
Excellent	56

Tab. 3.1: Number of councils in each CPA category

modelling, I assume that it is differences in intrinsic ability between councils that result in differences in performance. In theory, observed variations in performance could be due solely to variations in officers' effort. However, data on local government employment suggests that there are in fact intrinsic differences.

In 2003 ODPM[8] published the results of an investigation into capacity building in local government. The report provides anecdotal and survey evidence that creating and maintaining effective workforces is easier for some kinds of council than others. Examples include the suggestion that

> District councils ... have the advantage of being smaller, so managers inevitably have wider portfolios and are more likely to be engaged in interesting strategic work outside of their own specialism. The downside... is that the size of their portfolios makes it difficult to find time for team development activities, and vacancies can cause significant capacity issues.

and that

> particularly outside major conurbations, turnover at the heads of service/assistant director level is very low. This presents a number of difficulties in building capacity,

[8] Office of the Deputy Prime Minister, the government department responsible for local government prior to the creation of the Department for Communities and Local Government in May 2006.

> particularly when a fundamental change is needed in the culture of the organisation. (ODPM, 2003)

To investigate these claims more rigourously, I have obtained the results of the Local Government Association's 2005 Recruitment and Retention survey. This survey was sent to all 410 English and Welsh councils, and 193 were returned. The number of responses from each council type/region pair is given in Appendix D.[9] For each professional/managerial occupation represented in their council, respondents were asked to rate the difficulty they had recruiting and (separately) retaining staff at each of 4 levels of seniority on a 0–4 scale (with 0 being "no difficulty" and 4 "extremely difficult"). These reported difficulties are averaged first across occupations for recruitment and retention at each level, then across levels, and finally across recruitment/retention to create a set of "scores" for each council.

The data is anonymous, but includes each council's type and region. The results of regressing the various score variables on type and region are reported in Appendix D.2. Compared to shire counties, shire districts report significantly (at 1%) less trouble both overall and for recruitment specifically, while London Boroughs, have significantly more problems. Across regions, London and Yorkshire and Humberside (and to a lesser extent Wales and the North West) report significantly more difficulties than councils in the rest of England. The fact that the scores are self-reported means they must be treated with some caution. Some councils may perceive a given "objective" level of difficulty as more severe than others, and how difficult it is for an employer to recruit staff will depend in part on how demanding it is. Subject to these caveats, though, this data supports the claim that some councils will find it easier to recruit and retain good staff.

3.2.2 The Challenge Funding Process

As described in Section 3.1, the Single Regeneration Budget was launched in 1994 and allocated a total of £5.7billion over six rounds, administered first by Conservative, then Labour, ministers. Though in theory any organisation could apply for funds, the vast majority of applications were submitted by local councils (or partnerships including local councils alongside community groups, businesses, local police and health councils) and Training and Enterprise Councils.

[9] Very little data is available on actual skill levels/qualifications of local government officers and (as far as I can find out) none at all is collected on variation in qualifications between councils. Direct statistical support for claims that capacity varies across councils is therefore not available.

As well as several studies commissioned by ministers and carried out by researchers at the Department of Land Economy at Cambridge (Tyler, Brennan and Rhodes, 1998), the size of its budget and the controversial nature of urban regeneration policy have meant the SRB has attracted considerable academic attention. Most relevant to my concerns are the papers by Ward (2002), John and Ward (2005) and John, Ward and Dowding (2004). These are discussed in more detail in Section 3.3.1.

I use Communities and Local Government data on SRB allocations. For applications for which the project details listed on the CLG website do not identify the local council areas covered, searches of agencies' (mainly councils, TECs and local partnerships) documentation were undertaken. I divide the country into local council areas [10] both for reasons of data availability and because I am interested in whether challenge funding results in different allocations from formula funding, which necessarily uses LA area level statistics. Following Tyler, Brennan and Rhodes (1998) I amalgamate each council's allocations from the six rounds.[11]

The allocation of the SRB was not only based on the dossiers submitted; total regional allocations were set in advance according to statistical needs indicators. I use the 1998 Indices of Multiple Deprivation (IMD) for each LA area to measure need. I check that this is reasonably close to that used for the SRB by regressing per capita SRB allocation on IMD and region. The results are in Appendix D. Controlling for deprivation the regional dummies are insignificant.

Tyler, Brennan and Rhodes (1998) find that per capita SRB allocations were correlated with need over rounds 1–3. It is not immediately obvious that this holds if the sample is extended to include the final three rounds as well (Figure 3.1). The main outlier is the Isle of Wight. It seems reasonable to omit it on the grounds that it is *sui generis*. Once this is done (first panel of Figure 3.2), the positive correlation is clear, and the explanatory power of deprivation in relation to SRB allocation is confirmed by the regression reported with the graph.[12] However,

[10] i.e. those defined by the boundaries of London boroughs, shire districts, and unitary and metropolitan councils. Where a project affected more than one area, I attribute to each council a share equal to its share of the total population in the affected areas. This is obviously an approximation since not all projects affect everyone in an area. However, given the variations in population between some adjacent councils, it is preferable to taking the total allocation and simply dividing by the number of affected areas.

[11] I also do not distinguish between dossiers submitted by different bodies. Local councils were involved in some capacity in most projects, and to the extent that local factors (e.g. the pool of available labour) influence the success of applications, one would expect these to apply in much the same way to the council and to other local agencies.

[12] There is a lower bound of £0 on a council's share of the SRB so if any area had actually received £0, it would have been necessary to treat the data as censored. However (due to a few quite low budget projects covering very

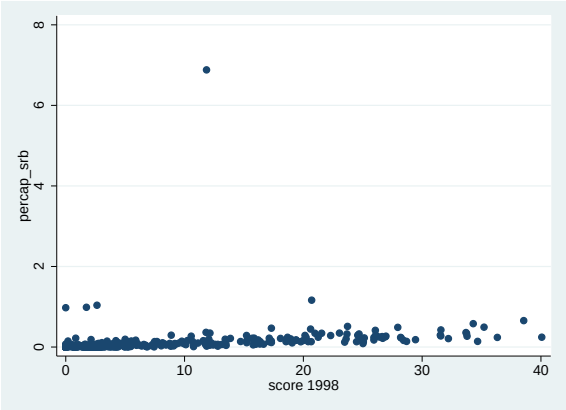

Fig. 3.1: Correlation of IMD score 1998 and per capita SRB (all local councils)

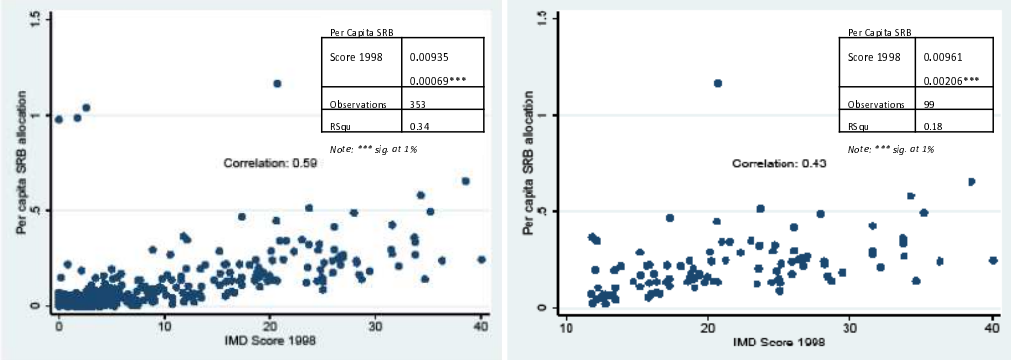

Fig. 3.2: Correlation of IMD score in 1998 and per capita SRB (all local councils & 100 most deprived (omitting IoW)

this correlation partly reflects the rough division of councils into two groups—a set of essentially non-deprived areas which all received quite small amounts of money, and a much more dispersed group of deprived areas. If we take only the 100 most deprived areas and omit the Isle of Wight (number 99), the correlation between need and per capita SRB is much less obvious (righthand panel of Figure 3.2) and, though it is still highly significant, the standard error of the coefficient on IMD in the regression reported in the second panel of Figure 3.2 is higher than that in the first. Evidently, need was an important factor in determining the geographical distribution of SRB expenditure. However, it does not explain all the variation in allocations. John, Ward and Dowding (2004) scored dossiers from rounds 1-4 on various presentational aspects. They found that an applicant's chances of success were increased not only by coming from an area of greater need but also by submitting a better presented dossier, for example including a diagram of the organizational structure of the proposed project, or using desktop publishing software. They con-

large areas) the allocation is strictly positive for every area so standard regression analysis can be used.

clude that the use of challenge funding rather than formulaic allocation resulted in "the triumph of packaging over substance".

In the light of the differences in administrative competence discussed in Section 3.2.1, though, an alternative interpretation of these results is that submitting a well "packaged" dossier is indicative of council ability. I therefore regress allocations on local council Comprehensive Performance Assessment (CPA) scores as well as need. Though it has been criticised (see, e.g., McLean (2005), and Andrews, Boyne, Law and Walker (2005)) CPA has the advantage of offering a direct assessment of council ability. Since the Audit Commission only began the CPA process in 2002 SRB assessors cannot have used CPA scores in making their decisions. However, it is possible that the challenge funding application process allowed central government to identify more competent councils. Comprehensive Performance Assessment rates each council on a 5 point scale (poor, weak, fair, good, excellent). Table 3.2 presents the results from the regression:

$$S_i = \alpha D_i + \eta PW_i(+\rho Linc_i) + \varepsilon_i \tag{3.1}$$

where those councils the Audit Commission found to be sub-standard (i.e. "poor" or "weak") are grouped together in the dummy variable PW_i. Lincoln is the apparent outlier in the right hand graph of Figure 3.2. There is nothing obviously unusual about Lincoln, so it is not excluded from the data, but the second specification in the table does include a dummy variable which is equal to one for Lincoln, and zero otherwise. Whether or not this dummy is included, the coefficient on PW_i is negative and significant at 5%. As one would hope, need was an important factor in determining

per capita SRB spend (99 neediest councils excl. IoW)		
score 1998	0.01032 (0.00203)***	0.01035 (0.00152)***
Poor/weak CPA	-0.06523 (0.03259)**	-0.05254 (0.02442)**
Linc		0.94549 (0.10447)***
Observations	99	99
R-squared	0.22	0.58

*Note: *** significant at 1%; ** significant at 5%;*

Tab. 3.2: Results of regression of per capita SRB for 99 neediest areas (excl.IoW) on IMD & CPA

the share of the Single Regeneration Budget that went to each area. However, different councils

with the same level of need did not always receive the same amount. In particular, challenge funding appears to have favoured needy areas which (by 2002) had more competent councils over equally impoverished areas with poorly performing local councils. Thus what John et al (2004) viewed as "the triumph of packaging over substance" may in fact have reflected a link between the ability to produce a good dossier and more important service delivery skills. In Section 3.4 I develop a model that incorporates this possibility.

3.3 Literature Review

3.3.1 Policy Literature

Relevant existing literature relevant falls into two broad groups: a theoretical literature on fiscal federalism; and a smaller, more applied literature on the workings of formula funding and challenge funding, and of the Single Regeneration Budget specifically.

The two policy studies most relevant to the comparison of challenge funding with formula funding are those by Tyler et al (1998) and Ward and co-authors (Ward (2002), John and Ward (2005), John, Ward and Dowding (2004)). Tyler et al look at the correlation of per capita spend to IMD. They find that on average more was spent per capita in more deprived districts, but that there was a "wide range of spending per head in Districts within the groups". They argue that focusing on the 99 most deprived districts "may be more meaningful because it cuts off the long tail of less deprived and non-deprived Districts", in which case the correlation is 0.51 (compared to 0.75 for the entire sample).

John et al (2004) also look at the correlation of SRB spending with measured deprivation. They consider three (not mutually exclusive) hypotheses about challenge funding processes: that (like formulae) they result in allocations proportional to need; that competitive pressures lead to higher effort; and/or that political considerations skew the results. They find only very weak evidence for political considerations. However, while their deprivation variable was significant for national allocation, so were several variables relating to the quality of the presentation of dossiers. John et al describe these differences from the allocation that would have resulted from a purely mechanical, needs-based allocation as "the triumph of packaging over substance".

The hypothesis that challenge funding induces councils to try harder is examined in more de-

tail in John and Ward (2005). They collect and rate the dossiers submitted in rounds 1–4 of the SRB to test the model of challenge funding set out in Ward (2002).[13] In this, any local council is able to produce any outcome at any cost and dossiers take the form of a (cost, outcome) pair. However, the councils have different bliss points in this space, and these all differ from the government's (a particular outcome, and 0 cost). Given these assumptions, Ward shows that challenge funding only affects a subset of councils. Those close enough to the government to guarantee funding for their ideal (cost, outcome) pair, or too far to make an acceptable application worthwhile are unaffected, but an intermediate group submit applications slightly closer to the government's optimum than their ideal in order to get funding.

John and Ward look at changes in the quality of the dossiers submitted over several rounds.[14] They find a small increase in average quality, accounted for largely by improvements at the bottom end of the initial quality spectrum. Although they also note that "the substantial increases at the 5th and 95th percentiles from the third to the fourth round do tell against our interpretation" they conclude that "overall the evidence is consistent with the prediction".

Clearly, improvements in dossiers don't necessarily imply improved delivery. However, supposing that they do, Ward and John go on to make some (necessarily rather heroic) assumptions in order to calculate a measure of central government's willingness to pay for improved quality. They calculate "that quality improvements over the 4 rounds were worth around £42.22m"—i.e., would have been wiped out by transaction costs of £40k per bid.

Formula funding has also been studied, and in fact faces various difficulties that I abstract from. Ideally, formulae should give the representative individual the same utility regardless of where she lives (Smith, 2003) or at least ensure comparable agencies can offer a "standard" level of service. However, there is a tension between the desire for accuracy on equity and efficiency grounds, and the benefits of simplicity for comprehensibility and accountability. Moreover, McLean (2005) argues that there is a more fundamental problem: "in local government, the only evidence as to the cost of providing a service is often the vector of costs which local councils have actually incurred". The situation is further complicated because not only are needs an "essentially contested concept"

[13] The dimensions they assessed included the number of partners listed, overall presentation, the number of the government's stated objectives the dossier claimed to meet and the number of mentions of government policy.

[14] Although, since Ward's model is one shot, it is not totally clear that looking for improvements in dossier quality over time is a legitimate test of the model's predictions.

but outcomes (as opposed to outputs) in local government are hard to measure. This absence of an obviously "right" answer, combined with the fact that local and national party politics are closely linked, makes the process highly politicised. For example, Ward and John (1999) find that, controlling for needs and population, formula allocations to local councils in 1994/95 were higher if the area had been a Conservative flagship council in 1990, or contained marginal parliamentary seats.

3.3.2 Theoretical Literature

Turning to the theoretical literature, what Lockwood (2006) describes as the "standard theory" of fiscal federalism looks at (de)centralisation from a welfare economics perspective. The benefits of centralisation arise from the internalisation of inter-regional externalities of various kinds. These co-ordination benefits of centralisation have to be balanced against efficiency concerns arising from inter-regional heterogeneity. If regional preferences vary and there are constraints on central government's ability to vary provision between areas there are advantages to local government being responsible for goods and services that are at least partially local. These constraints can take various forms; informational asymmetries are the most obvious reason for decentralisation, but the centre may also face political constraints on how differently it can treat different areas.

My model shares with Oates (1999) the feature that lower tier governments, because they are closer to the ground, have superior local information. With purely local goods, this would usually imply local provision is preferable. However, I also allow for the possibility that productive efficiency will vary between tiers of government—a form of heterogeneity neglected by the literature.

Other influences on the causes and effects of (de)centralisation have also been explored. From a welfare economics perspective, Strumpf (2002) considers learning-by-doing in the public sector: regional governments multiply the number of policy "laboratories", but regions devote sub-optimally little effort to innovation because successful experiments have positive spill-overs. It has been suggested that challenge funding might encourage councils to innovate. In order to focus on the role of human capital differences, I do not examine the support for this claim. It is worth noting, though, that whilst innovations by large state or regional government may be close substitutes for those by central government, this claim is much less persuasive for English local councils. It was hoped that the competitive element of the Single Regeneration Budget would encourage councils

to adopt innovative approaches to things such as partnership working. This kind of learning would appear to be *qualitatively* different to any lessons central government might draw from nationwide regeneration policies.

In this chapter I restrict attention to the case of a benevolent central government, but the literature has also considered some political economy aspects of decentralisation. The allocation of responsibilities between tiers of government can affect electoral incentives where elections act as disciplining devices on self-interested politicians. Rewards to re-election, and hence incentives for "good behaviour", are larger for a central policy maker than a regional one. On the other hand, since re-election requires only a majority of votes some regions may be neglected under centralisation (e.g. Seabright (1996), Hindricks and Lockwood (2009)).

Decentralisation may also create inter-regional competition for mobile resources. Particular attention has been paid to the likely effects of tax competition. However, though important for broader questions surrounding local government finance, it is not directly relevant here since my concern is with the tier of government that provides policies that are to be funded from centrally collected revenues.

Another significant financial concern in the federalism literature is the "fly-paper" effect; even when local government has substantial fiscal autonomy, grants from federal to local governments tend to raise local expenditure by more than can be explained by a pure income effect (Wilde (1968), Hines and Thaler (1995)).[15] Again, however, because local councils are so dependent on central finance and funds are often tightly ring-fenced these issues are less relevant to the UK.

In federal systems transferring responsibilities between tiers of government requires the consent of both tiers. In a unitary state, the decision is made by the centre alone. Redoano and Scharf (2004) and Lorz and Willman (2005) address the political economy of centralisation in unitary states. Their central policy question is the level of local public goods with inter-regional spillovers and (in Lorz and Willman) who is to pay for them. Lorz and Willman assume the centralisation decision is made by regional representatives in a central legislature. They show citizens vote strategically for representatives who place low valuations on public goods to improve their bargaining position,

[15] Numerous theoretical explanations of the flypaper effect have been advanced, including "fiscal illusion" on the part of voters who believe grants must be spent on public goods (Oates, 1979), and the agenda-setting power of budget maximizing local governments (Filimon, Romer and Rosenthal, 1982).

resulting in too little centralization. Redoano and Scharf compare the effect of making the centralization decision via a referendum rather than delegating it to a central legislature. They find centralised provision is more likely if the decision is delegated; electing low-preference representatives commits voters not to be too demanding, so voters who place a high value on public goods can ensure *some* central provision. However, these models are most relevant to the EU, primarily because they assume voters choose their representatives for the central legislature on the basis of their views on the desirable degree of centralisation. As discussed in Section 3.1, this is not a plausible interpretation of voting behaviour in national UK elections.

3.4 Model

To model the central government's problem, I suppose that a country is composed of 2 localities (labeled 1 and 2). There are three players: central government (G) and 2 local councils (L_1, L_2). G has a fixed amount, £X, to divide between the two areas. To capture the variation in ability between the players discussed above, I assume that each player has an ability parameter $\theta \in [0, 1]$.

Assumption 3. *The government's ability, $\theta_G \in [0, 1]$ is common knowledge. Each council's ability θ_i is equally likely to take one of two values, "high" (θ_h) or "low" (θ_l) where $\theta_l < \theta_h$ and $\theta_l + \theta_h = 1$. The realisations of θ_1 and θ_2 are independent, and each one is private information to the relevant council.*

Note that these ability parameters combine the "allocative" and "productive" elements of efficiency identified in Section 3.1. I therefore do not place any restrictions on the size of θ_G relative to θ_l or θ_h. One would expect that in a policy area where local knowledge was very important relative to administrative capacity, θ_G would be relatively small, and vice versa.

I assume that the marginal returns to spending (in terms of social benefit) in an area are always positive, but diminishing. While in practice this may not hold at very low levels of spending, in general it is probably a more realistic assumption than either constant or increasing returns for two reasons. First, it is usually assumed that marginal utility is diminishing. Second, at least in the short-to-medium term the size and structure of a council or government agency will be effectively fixed, so extra resources are unlikely to be spent as efficiently as infra-marginal ones. I use:

Assumption 4. *If a council or agency of ability θ spends £x, the social benefit is $\theta f(x)$ where*

$f(x)$ is smooth and twice continuously differentiable, with $f'(x) > 0$ and $f''(x) < 0$.

One can either interpret this deterministically, or treat θ as the probability that the player chooses a project that will succeed—and $f(x)$ as the social benefit of a successful project that cost £x.[16]

I assume that neither G nor local councils have incentives to act in socially undesirable ways when choosing and implementing projects, so we can ignore effort considerations in policy implementation. For central government, this follows from the assumption of benevolence. For local councils, the money received from central government is ring-fenced, so councils cannot divert it to other activities. Given this, as long as councils wish to maximise service provision in their areas, they will spend money from government to the best of their ability.

The other key features of the basic model are: the connection between councils' true ability and the quality of the dossiers they submit if G decides to use challenge funding; and the problem that preparing dossiers can be costly. I assume G knows that a council i's (observable) dossier quality, q_i, is an increasing function of both its intrinsic ability and the effort it chooses to exert in preparing its dossier, e_i. However, if a council exerts no effort at all, its dossier will be of minimum quality regardless of the council's ability.

Assumption 5. *$q_i = q(\theta_i, e_i)$ is continuous in both arguments with $\frac{\partial q}{\partial e} > 0, \frac{\partial q}{\partial \theta} > 0 \ \forall e > 0$ and $q(\theta, 0) = 0 \ \forall \theta$*

Though effort it is exerted by council officials, because it diverts time and resources from other activities the cost of effort is to be interpreted as a social cost (and hence of concern to a benevolent G). I assume:

Assumption 6. *$C_i = C(e_i)$ is continuous in e with $C(0) = 0, C' > 0, C'' > 0$*

The conditions I impose on $q(\theta, e)$ and $C(e)$ imply that single-crossing (Edlin and Shannon, 1998) always holds in $(C(e), q)$ space: except at $q_i = 0$ it will always be less costly for a higher ability council to achieve a given quality level. However, I do not require the Spence-Mirrlees condition to hold; increasing quality need not increase a low ability council's costs by more than a

[16] I make this approach explicit in Hunt (2007), where I use the somewhat richer specification: $\theta f(x) + (1-\theta) f(\frac{x}{\alpha})$ with $\alpha > 1$—so if a project fails it has a lower, but still positive, social value. The simpler assumption 4 gives the same key results with less algebra, and a more straightforward alternative interpretation as a deterministic production function.

high ability council's. This is for realism. It is not hard to produce "stories" in which it wouldn't. For example suppose that councils can achieve some improvements in their dossiers via extra "in-house" effort, but that there is a limit to this, and beyond this limit improvements require the help of outside consultants. In terms of the predictions of the model, not assuming Spence-Mirrlees holds opens up the possibility of semi-separating equilibria in the signalling game that is played if the government chooses to use challenge funding.

Timing

The timing of the game is as follows. First, nature determines the abilities of the two councils, then the government decides which allocation method to use. In Section 3.5.1, this choice is between centralization (**CZ**), formula funding (**F**) and challenge funding (**CF**). In Section 3.5.2 it is between **CF** and bidding with commitment (**BC**).

If the government chooses **F** or **CZ**, it then sets the amount to be spent in area 1, $x_1 \in [0, X]$, which also fixes $x_2 = X - x_1$. If it chooses **CF**, each council i chooses an effort level to exert in preparing its dossier, e_i. G observes $q_i = q(\theta_i, e_i)$ for $i = 1, 2$ and chooses $x_1 \in [0, X]$.

If, in Section 3.5.2, the government chooses **BC**, it then sets $x > X - x$. Councils submit bids for the smaller share $b_i(X - x)$ and for the larger share $t_i(x)$. The government gives the larger share to the council that submits the highest $t_i(x)$, and the smaller share to the other council.

Payoffs

Central government, G, is benevolent and risk neutral throughout so it maximises the sum of social welfare in the two regions net of any effort costs incurred by local councils i.e. if the budget is given to councils its expected payoff is:

$$V_G = E(\theta_1 f(x_1) + \theta_2 f(x_2) - C(e_1) - C(e_2)) \tag{3.2}$$

while if it spends it itself it gets:

$$V_G = \theta_G(f(x_1) + f(x_2)) \tag{3.3}$$

Councils' payoffs are assumed to be simpler. The payoff to a council in area i is modelled as:

$$V_{L_i} = \begin{cases} x_i & \text{if F} \\ x_i - C(e_i) & \text{if CF} \end{cases}$$

i.e. councils seek to maximise the resources available for public spending in their area. This might be interpreted as a kind of budget maximisation, but need not be.[17] Unlike government, an benevolent individual council doesn't need to trade off spending in different areas - it is interested only in local welfare. The (relative) ability parameter is therefore not relevant to the council's decisions, and it can simply be assumed to try to get as much money spent in its area as possible.

3.5 Analysis

If it chooses CF, G has the opportunity to update its beliefs about L_1 and L_2's abilities on the basis of the qualities of their dossiers. I therefore look for perfect Bayesian equilibria, and begin by calculating equilibrium strategies for each of the subgames following G's mechanism choice.

3.5.1 Comparison of Centralisation, Formula Funding and Challenge Funding

Equilibria of the sub-games

Local councils have no moves if centralisation or formula funding is chosen. Under formula funding the councils are responsible for implementation, but this can be ignored since it is purely mechanical—once a council has been given money, its project succeeds with a probability that depends only on its intrinsic ability. Central government's problem is therefore simply to divide the budget to maximise expected social welfare. We have:

Lemma 5. *If central government (G) chooses to provide the good centrally (CZ), it is optimal for it to spend half the budget in each area so $x = X - x = \frac{X}{2}$.*

Proof. Under CZ, the government sets x_1 to maximise $V_G^{CZ} = \theta_G(f(x_1) + f(X - x_1))$, while under F it maximises $V_G^F = E(\theta_1)f(x_1) + E(\theta_2)f(X - x_1) = \frac{1}{2}(f(x_1) + f(X - x_1)$. The optimality of $x_1 = \frac{X}{2}$ follows immediately $f'(x) > 0$ and $f''(x) < 0$. □

[17] The combination of a welfare maximising central government and a budget maximising local council may seem odd, but isn't entirely implausible. Challenge funding budgets are typically not huge, and in the case of some regeneration funding streams only a relatively small number of highly deprived councils may be eligible. The government minister's motive in providing the scheme, therefore, may be either "mission-oriented", or to win votes from altruistic voters in other areas. Locally, on the other hand, a challenge fund award may be substantial in comparison to the budget for the receiving department (giving it status value). Short local electoral cycles may also make headline "award won" figures useful campaign material.

Since in expectation there is no difference in the effective resources the two areas will derive from a given level of actual resources it is efficient to divide the budget equally between them. This is the implicit assumption in the analyses of the SRB that try to test whether the observed distribution can be explained purely by variations in need. If only need varied between areas, with diminishing returns two areas with the same level of need should have received identical allocations.

The challenge funding subgame may have multiple equilibria. For plausibility, and to keep the number of equilibria manageable, I impose Cho and Kreps' (1987) intuitive criterion throughout.

If the Spence-Mirrlees condition holds, there can be no pooling equilibria that satisfy the intuitive criterion—but if the condition does not hold then there may be. Denote the dossier quality chosen by both types of councils on the equilibrium path of a pooling equilibrium as q^p, and the effort levels that have to be exerted to achieve this by high and low ability councils respectively as[18] e^{ph} and e^{pl}. We have that:

Lemma 6. *If G chooses CF and the equilibrium of the subgame following this choice involves both types of council setting $q_i = q^p$, it is optimal for G to set $x_1 = \frac{X}{2}$*

Proof. In a pooling equilibrium G cannot update its beliefs about councils' abilities, $Prob(\theta_i = \theta_h | q_i = q^p) = \frac{1}{2}$. Hence the government's problem is the same as in Lemma 5. □

Conditions under which such an equilibrium will in fact exist are set out in Lemma 7

Lemma 7. *For there to be a pooling equilibrium in which both types of council always set $q_i = q^p$ that satisfies the intuitive criterion, there must exist no $\tilde{q}_p = q(\theta^l, \tilde{e}_p^l) = q(\theta^h, \tilde{e}_p^h)$ such that:*

$$\big(\tilde{x}_p - \frac{X}{2}\big) - \big(C(\tilde{e}_p^h) - C(e^{ph})\big) > 0 \text{ and } \quad \big(\tilde{x}_p - \frac{X}{2}\big) - \big(C(\tilde{e}_p^l) - C(e^{pl})\big) \leq 0$$

where $\tilde{x}_p$ satisfies $\theta^h f'(\tilde{x}_p) = \frac{1}{2} f'(X - \tilde{x}_p)$.

See Appendix C for proof

It is easy to see that if we were to impose the Spence-Mirrlees condition, so the cost of increasing quality from q_p to $\tilde{q}_p$ was always higher for a low ability type, then such a deviation would always exist—and therefore there could be no pooling equilibrium. However, there will always be a fully separating equilibrium of the challenge funding subgame. We have:

[18] So $q^p = q(\theta_l, e^{pl}) = q(\theta_h, e^{ph})$.

Lemma 8. *In the sub-game following G's choice of CF there is always a unique separating equilibrium outcome that satisfies the intuitive criterion. In this equilibrium low ability councils set $q_i = 0$ while high ability councils set $q_i = q^s$ at a cost $C(e^{hs})$. G believes:*

- $Prob(\theta_i = \theta^h \mid q_i < q^s) = 0$
- $Prob(\theta_i = \theta^h \mid q_i = q^s) = 1$
- $Prob(\theta_i = \theta^h \mid q_i > q^s) \in [0, 1]$

The government sets $x_i = x_j = \frac{X}{2}$ if $q_i, q_j < q^s$ or $q_i, q_j \geq q^s$. It sets $x_i = x^s$ and $x_j = X - x^s$ if $q_i \geq q^s$ and $q_j < q^s$, where the budget share x^s satisfies $\theta^h f'(x^s) = \theta_l f'(X - x^s)$ and the cut-off quality level, q^s is such that $C(e^{sl}) = x^s - \frac{X}{2}$ where $q^s = q(\theta_l, e^{sl})$.

See Appendix C for proof

The assumption that the cost of bid quality is strictly increasing in bid quality and decreasing in ability means there is a unique level of bid quality, q^s, at which a low ability council is just indifferent between producing a bid at q^s and being believed to be high ability, and exerting 0 effort but revealing itself to be low ability. The intuitive criterion further implies that in equilibrium high ability councils won't set the quality of their bids any higher than q^s, since they're believed to be high ability for certain at $q_i = q^s$.

However, in the absence of the Spence-Mirrlees condition, it is possible for their to be semi-separating equilibria too, in which at least one council uses a mixed strategy. I show in Appendix C that in fact we can rule out all semi-separating equilibria except those in which high ability councils always set $q_i = q^{sem}$ and low ability councils set $q_i = 0$ with probability $p \in [0, 1]$ and $q_i = q^{sem}$ with probability $(1 - p)$. Analogous to Lemma 7, Lemma 9 gives conditions under which a proposed semi-separating equilibrium will satisfy the intuitive criterion.

Lemma 9. *For a semi-separating equilibrium in which high ability authorities always exert effort $e^{h,sem}$, producing a bid of quality $q_i = q^{sem}$, while low ability authorities set $e_i = q_i = 0$ with probability p, and $e_i = e^{l,sem}$ and $q_i = q^{sem}$ with probability $1 - p$ to satisfy the intuitive criterion, it must be that there exists no $\tilde{q} = q(\theta_l, \tilde{e}^l) = q(\theta_h, \tilde{e}^h)$ such that:*

$$\left(\frac{p}{2}(x^s - x^{sem}) + \frac{2-p}{2}(\tilde{x} - \frac{X}{2})\right) - (C(\tilde{e}^h) - C(e^{h,sem})) > 0$$
$$\text{and } \left(\frac{p}{2}(x^s - x^{sem}) + \frac{2-p}{2}(\tilde{x} - \frac{X}{2})\right) - (C(\tilde{e}^l) - C(e^{l,sem})) < 0$$

where $e^{l,sem}$ *is such that* $x^{sem} - \frac{X}{2} = C(e^{l,sem})$ *while* $\tilde{x}$ *satisfies* $\theta_h f'(\tilde{x}) = \frac{\theta_h+(1-p)\theta_l}{2-p} f'(X-\tilde{x})$ *and* x^{sem} *satisfies* $\frac{\theta_h+\theta_l(1-p)}{2-p} f'(x^{sem}) = \theta_l f'(X-x^{sem})$.

Beginning from a semi-separating equilibrium at q^{sem}, there will be some range of dossier qualities a high ability council will be prepared to deviate to if as a result it is treated as high ability with probability 1. There will be a corresponding range for low ability councils. If the Spence-Mirrlees condition does not hold, it is possible that these ranges will be such that there is no level of q to which only high types are willing to deviate.

For example, it might be that in order just to achieve q^{sem} low ability councils have to send staff on training courses in presentational skills, but that once this training expense has been incurred raising quality to levels within some broad range only entails quite low costs of additional staff time. High ability councils, on the other hand, might be able to produce dossiers at q^{sem} relatively easily but need to train their staff or make other investments to go beyond it. If a semi-separating equilibrium does exist, it takes the form set out in Lemma 10.

Lemma 10. *For every value of* $p \in (0,1)$ *for which the conditions of Lemma 9 are satisfied, there is a semi-separating equilibrium satisfying the intuitive criterion in which high ability councils always set* $q_i = q^{sem}$ *while low ability councils set* $q_i = 0$ *with probability* p *and* $q_i = q^{sem}$ *with probability* $(1-p)$.
The government believes $Prob(\theta_i = \theta_h | q_i \geq q^{sem}) = \frac{1}{2-p}$ *and* $Prob(\theta_i = \theta_h | q_i < q^{sem}) = 0$ *and sets* $x_i = x^{sem}$ *and* $x_j = X - x^{sem}$ *if* $q_i \geq q^{sem}$ *and* $q_j < q^{sem}$, *and* $x_i = x_j = \frac{X}{2}$ *otherwise.*

See Appendix C for proof

Note that as $p \to 1$, $x^{sem} \to x^s$ and at $p = 1$, $x^{sem} = x^s$. Moreover, once the intuitive criterion is imposed there is at most one possible equilibrium outcome of the subgame following CF for each value of p. Each non-pooling equilibria can therefore be identified by a value of $p \in (0,1]$ and has the payoffs set out in Lemma 9.

There is always a fully separating equilibrium. However, if for a particular set of functional forms and values of the other parameters there is also one or more values of $p \in (0,1)$ at which there is an intuitive semi-separating equilibrium, the question of how mixed strategies are to be interpreted arises. One possibility is to allow "low" (and "high") ability councils' ability to be distributed over some small interval around θ^l (θ^h), and to view the low ability councils' strategy as the result of Harsanyian purification. The idea that some, but not all, low ability councils

will find it just worthwhile to exert the effort to pool with high ability councils is of itself quite appealing—and this interpretation means p is fixed by the distribution of θ^l.

The government's choice of mechanism

From Lemma 5 it is straightforward to see that the government will prefer centralization to formula funding if and only if $\theta_G > \frac{1}{2}$ i.e. if the expected ability of government agencies is greater than that of local councils, taking into account both allocative and productive efficiency considerations.

It is also immediately obvious that if a pooling equilibrium of the challenge funding subgame is played, the government will never choose challenge funding: dossiers are uninformative and socially costly. A (semi-)separating equilibrium is therefore a necessary condition for challenge funding to be chosen over formula funding. Since there will always be at least one such equilibrium (with $p = 1$) for the remainder of the analysis I focus on this case.

Central government's expected payoff from a semi-separating equilibrium in which low ability councils set $q_i = 0$ with probability p is:

$$V_G^{CF}(p) = \frac{p(1-p)\theta_l}{2}(f(x^{sem}) + f(X - x^{sem})) + \frac{p}{2}(\theta_h f(x^{sem}) + \theta_l f(X - x^{sem})) + \big(\frac{\theta_h + (p^2 + (1-p)^2)\theta_l + 2(1-p)(\theta_h + \theta_l)}{2}\big) f(\frac{X}{2}) - C(e^{h,sem}) - (1-p)C(e^{l,sem})$$

It is possible to construct examples under which CF is preferred to CZ and/or F and vice versa. The centre's preferred mechanism will depend on: θ_G, θ_h, $q(\theta, e)$, $C(e)$, $f(y)$ and, if there are multiple possible equilibria, p. A full comparative statics analysis would require more specific functional forms. Nevertheless, several informative general conclusions can be drawn.

Comparative statics

The first two results relate to the dossier-production technology. First, we have that:

Proposition 6. *The effect of an increase in* $\frac{\frac{\partial q(\theta,e)}{\partial \theta}}{\frac{\partial q(\theta,e)}{\partial e}}$ *is to make challenge funding unambiguously more attractive relative to formula funding and centralization.*

Proof. Effort costs to low ability councils are fixed by $C(e^{l,sem}) = x^{sem} - \frac{X}{2}$. In turn this fixes $q^{sem}(= q(\theta^l, e^{l,sem}))$. Increasing $\frac{\partial q(\theta,e)}{\partial \theta}$ relative to $\frac{\partial q(\theta,e)}{\partial e}$ lowers the level of $e^{h,sem}$ that satisfies $q(\theta^l, e^{l,sem}) = q(\theta^h, e^{h,sem})$ and hence $C(e^{h,sem})$. □

If they exert positive effort (which occurs with probability $(1-p)$ in a semi-separating equilibrium), low ability councils always exert the same amount of effort—that at which they are just indifferent between producing good dossiers and being grouped with high ability councils, and being recognised as low ability but putting minimal effort into their dossiers. This level is therefore pinned down by the cost of effort function $C(e)$ and the value of additional resources won by sending a high signal, (x^{sem}). With $\{\theta^h, \theta_l\}$ also fixed, this effort level determines the quality of dossiers high ability councils will produce in a (semi-)separating equilibrium. However, the effort cost to high ability councils will also depend on how rapidly dossier quality increases with ability. When dossier quality is more sensitive to ability, high ability councils are able to achieve any quality level at lower cost. Dossiers can then be described as more *efficient discriminators.*

The next result looks at the other aspect of dossier production, the effort cost function:

Proposition 7. *An increase in $C''(e)$ makes challenge funding unambiguously more attractive.*

Proof. In equilibrium the cost of effort for low ability councils is fixed at $C(e^{l,sem}) = x^{sem} - \frac{X}{2}$. Since $\frac{dq}{d\theta} > 0$, higher ability councils exert strictly less effort. Increasing the rate at which the marginal cost of effort rises therefore lowers $C(e^{h,sem})$ without affecting the incentive compatibility conditions. □

Given the fixed effort cost for low ability councils, a steeper marginal cost of effort function makes dossiers more efficient discriminators.

The final result in this section looks at the ability distribution. Since if $\theta^h = \theta^l = \frac{1}{2}$ CF cannot possibly be preferred to F, it seems at least superficially likely that an increase in θ^h and hence in the ability range will increase the expected payoff from CF; the more different councils' abilities may be, the more useful it would seem to be to be able to treat them differently. In fact the situation is less clear-cut.

Proposition 8. *The effect of an increase in the ability range on the desirability of using challenge funding instead of formula funding (or centralisation) is ambiguous. It is more likely to make CF more attractive if $\mid f''(y) \mid$ is small. It is also more likely to favour CF if $C''(e)$ and $\frac{\frac{\partial q(\theta,e)}{\partial \theta}}{\frac{\partial q(\theta,e)}{\partial e}}$ are larger*

See Appendix C for proof

Given the assumption that $\theta_l + \theta_h = 1$, an increase in the ability range increases the optimal dif-

ference between the amounts paid to low and high ability councils. There is therefore an increase in the gross benefit of challenge funding over formula funding. This "targeting benefit" will be larger the more slowly marginal productivity declines i.e. the smaller $f''(y)$ is.

However, as well as the targeting effect, a change in θ^h affects the effort exerted by the types in equilibrium. In a semi-separating equilibrium a low ability council is indifferent between exerting 0 effort and being believed to be low ability, and exerting $e^{l,sem}$ and being believed to be high ability with positive probability. The rewards to being believed to be high rather than low ability increase with θ^h so the effort costs for low ability councils must rise. The effect on the effort costs for high ability councils $C(e^{h,sem})$, on the other hand, is ambiguous. In equilibrium they exert just enough effort to produce dossiers of quality $q^{sem} = q(\theta^l, e^{l,sem})$. An increase in θ^h affects the expected cost of this effort through three channels.

envy effect on q First, an increase in θ^h raises the rewards to a council of appearing to be of high ability. Holding abilities constant, this raises the level of dossier quality at which separation occurs, and hence the effort high ability councils have to expend.

ability effect on q However, holding x^{sem} constant, a mean-preserving spread of the ability range makes it more expensive for a low ability council to achieve any given level of dossier quality, lowering the quality level at which separation occurs in equilibrium.

ability effect on C Last, an increase in θ^h makes it cheaper for a high ability council to reach a given q^{sem}.

The net impact of the envy and ability effects on the quality of dossiers produced by high ability councils in equilibrium is ambiguous. If an increase in the range of abilities lowers q^{sem}, then it will unambiguously lower the expected cost of effort for high ability councils. As noted in Propositions 6 and 7, this requires marginal costs to rise steeply and/or ability to be very important in determining bid quality. A higher q^{sem} might, but need not, raise expected effort cost; the high ability council's costs may fall more than enough to offset the rise. Again, this is more likely if the marginal cost schedule is steep and ability matters a lot to dossier quality.

Overall, then, a greater ability range may, but need not, strengthen the case for challenge funding. The greater disparity between the resources received by high and low ability councils is desirable ex post, but it increases the rewards to being perceived to be high ability. It therefore increases the amount of effort exerted by low ability councils in a semi-separating equilibrium which *may*

in turn increase the effort costs for high ability councils.

3.5.2 Comparison of Challenge Funding and Bidding with Commitment

As discussed in Section 3.1, it is natural to consider what might happen if, instead of inviting councils to submit dossiers setting out proposed projects, government simply asked councils to submit (one or more) binding commitments to produce a particular outcome in return for a pre-specified amount of money. The analysis of a proper auction in this context is quite complex and I pursue it in Chapter 4.

Here, I consider a very simple version in which councils are unable to contribute resources to the government's project, so they are able to bid at most $\theta_i f(x)$ for a share of £x. The ring-fencing constraint means that they will never want to bid less than this, so councils' bids are non-strategic. It is then straightforward to analyse the value of this "bidding with commitment" (**BC**) mechanism to the government in the same theoretical setting used in the rest of this chapter.

I look at the determinants of the government's optimal budget split, and then compare its expected payoff from BC with that from challenge funding, focusing on the fully separating equilibrium for clarity.[19] Recall from Section 3.4 that the government decides a budget split $\{x^{bc}, X - x^{bc}\}$ where $x^{bc} \geq X - x^{bc}$, and councils submit a bid of $t(\theta, x^{bc}) = \theta f(x^{bc})$ for the larger share, and $b(\theta, x^{bc}) = \theta f(X - x^{bc})$ for the smaller share. The government then gives x^{bc} to the council that submits the (weakly) largest $t(\theta, x^{bc})$, and $X - x^{bc}$ to the other council. We have:

Lemma 11. *If the government chooses bidding with commitment, it sets x^{bc}, the larger of the budget shares, to satisfy $(2\theta_h + 1)f'(x^{bc}) = (2\theta_l + 1)f'(X - x^{bc})$. As long as $\theta_h \neq \theta_l$, it will always be the case that $x^s > x^{bc} > \frac{X}{2}$.*

See Appendix C for proof

Although the government has to set the value of x^{bc} before councils submit their bids, the problem differs importantly from formula funding, because which council receives which share is only decided *after* the government learns their abilities. Setting $x^{bc} > \frac{X}{2}$, ensures that when one council is low ability and one is high ability, the more able council receives a larger share.

[19] The arguments if the CF equilibrium is only semi-separating are qualitatively the same, though the exact value of the expected payoff from CF will obviously vary with the separation probability, p.

However, because the split must be set in advance there is a *rigidity cost* to bidding with commitment that is absent under challenge funding. In setting x^{bc}, the government trades-off the benefit of targeting resources when councils differ in ability against the cost of an uneven split when they are of the same ability. It therefore sets x^{bc} at a compromise level below x^s (but above $\frac{X}{2}$).

Given this, it is clear that eliminating socially wasteful dossiers is not unambiguously desirable. Rather, the government has to compare the rigidity cost of bidding with commitment to the social cost of the effort councils devote to producing dossiers under challenge funding.

Proposition 9. *In expectation, the government does better by using bidding with commitment rather than challenge funding as long as the expected cost of the effort high ability councils expend on dossier production, $C(e^{h,s})$, is larger than the rigidity cost:*

$$\frac{1}{2}\big((\theta_h f(x^s)+\theta_l f(X-x^s))-(\theta_h f(x^{bc})+\theta_l f(X-x^{bc}))\big)+\frac{\theta_h+\theta_l}{4}\big(2f(\frac{X}{2})-(f(x^{bc})+f(X-x^{bc}))\big)$$

Proof. The proposition follows directly from a comparison of G's expected payoffs. □

As one would expect, the rigidity cost is increasing in θ_h. When the gap between high and low ability councils is larger, the difference between the optimal budget division when councils are of the same ability ($\{\frac{X}{2},\frac{X}{2}\}$) and that when they're of different abilities ($\{x^s, X-x^s\}$) is larger—so the obligation to compromise when setting x^{bc} is more costly.

The shape of $f(.)$ has a similar effect. When $\mid f''(.) \mid$ is smaller, so marginal returns to spending diminish less rapidly, it is efficient to give more of the budget to a high ability rather than a low ability council. Again, then, the rigidity cost is higher.

However, both these effects on the rigidity cost operate via the fact that an increase in θ_h or decrease in $\mid f''(.) \mid$ increases the optimal x^s. As a result, they will also affect $C(e^{h,s})$. As discussed in Proposition 8, the effect of an increase in θ_h on $C(e^{h,s})$ is ambiguous. However, a decrease in $\mid f''(.) \mid$ will unambiguously increase $C(e^{h,s})$, since only the "envy" effect is present.

3.6 Discussion and Conclusions

I have shown that, empirically, the use of a challenge funding process to allocate centrally collected regeneration funds to local councils favoured councils later assessed as more competent. In

practice, if central government is going to pay for a local public good to be provided in the public sector, it has to decide between providing it itself, delegating a ring-fenced budget to local councils according to a purely needs-based formula, and delegating provision but obliging councils to apply for funding by submitting dossiers. As one would expect, incorporating differences in ability, or *administrative competence*, both between central government and an "average" local council, and between individual local councils, affects the socially optimal method of provision. In particular, increased variation between local councils increases the benefits of targeting resources to more competent councils. This can make a challenge funding process, which may allow government to learn about differences in competence, socially preferable to a formulaic allocation that only distinguishes between councils on the basis of local needs.

One would expect the optimal provision mechanism to vary across different local goods and services. The value of detailed local knowledge—and hence the desirability of decentralized provision—will obviously be greater in some policy areas than others; it is probably quite unimportant for providing benefit advice, and much more relevant for introducing successful traffic calming in residential areas. The significance of a given intrinsic ability difference between councils is also likely to vary. Larger scale, more complex, and less familiar projects can be expected to suffer more from a lack of competent officers than, say, maintaining refuse collection services.

However, even in areas where administrative competence is very important, for challenge funding to enable central government to learn about councils' abilities at least some councils have to devote resources to producing intrinsically worthless dossiers. For challenge funding to be preferable to formula funding, then, dossiers must be sufficiently *efficient discriminators*. Central to this is the relationship between the administrative competence of councils and the ease with which they can produce slick dossiers. How strong this link is will be in part an empirical question, but it seems likely that it could also be affected by the design of the challenge funding application process. For example, if higher ability councils can achieve high quality submissions more cheaply because they have the necessary expertise in-house then making it difficult to access outside assistance by placing a tight time limit on dossier preparation could help to cut total costs.

In principle, government could eliminate the social costs of dossier production entirely by holding a procurement auction in which councils make binding offers to produce certain projects in return

for pre-determined shares of the budget. In Section 3.1, I discussed possible practical obstacles to this approach. In Section 3.5.2 I analysed a simple form of such an auction, in which only the central government budget was available to be spent, and showed that such a process might not be a panacea. Whilst it avoids the social waste associated with challenge funding, it introduces a new inefficiency due to the rigidity of the budget split. In the next chapter I develop more fully the analysis of procurement auctions when the buyer is able to ring-fence its financial contribution.

4. PROCUREMENT AUCTIONS WITH RING-FENCING

4.1 Introduction

In Chapter 3 I contrasted challenge funding with a very simple auction. In that model, I made the assumption that councils were unable to contribute their own resources to the government's priority. Together with the ring-fencing constraint, this meant that councils simply offered the amount they could produce from the budgets on offer. In this chapter I develop further the idea of central government using a procurement auction to allocate money to local councils. For the reasons set out in Section 3.1 of Chapter 3, I continue to assume that the government has to use a first price auction, and to fix the budget split in advance of the auction.[1] However, I now relax the restriction on councils contributing their own resources.

In the model of challenge funding in Chapter 3, councils' willingness to devote effort to producing slick dossiers was limited because it was (social) waste. With only one public good in the world councils interested in maximizing the amount of money spent on the public good in their area would obviously simply offer to produce whatever they were able to with the total amount available from the government and their own budget. However, in reality councils are responsible for a large number of different goods and services. Frequent complaints suggest that local spending priorities are not perfectly aligned with those of the centre (as does the fact that not all councils are controlled by the party in government at Westminster).[2] Thus, while local councils appear to welcome additional resources from government even if they are ring-fenced, they will face a trade-off between spending on their own priorities rather than the centre's, and increasing total local expenditure by winning the auction with a bid part-financed by their own budget.

[1] As well as being impractical in this context, with privately informed, risk averse bidders (see below), a discriminatory price auction for multiple units of a homogenous good is a hard problem. See, e.g., Wang and Zender (2002).

[2] e.g. "Greater devolution has been compromised with the increase in [ring-fencing] of funding to local services, reducing the freedom of local councils to decide where their spending priorities should lie, giving local councils less room to manoeuvre and invest in local priorities." (Submission to the Lyons inquiry by the Special Interest Group of Metropolitan Councils.)

In a conventional model of procurement from the private sector (e.g. McAfee and McMillan (1986), Dasgupta and Spulber (1989)), if a bidder wins a contract with a price above the cost to him of fulfilling the contract he makes a profit. The legal relationship between local and central government is rather different. In particular, central government's ability to ring-fence money it allocates to councils allows it, in effect, to impose implicit type-specific minimum bids on councils. The assumption that each council's ability is private information means that the government cannot literally set out the minimum bid it will accept from each council—and so probably could not use this kind of constraint in dealing with the private sector. However, if its allocation will be ring-fenced a local council has nothing to gain by offering to provide any less than the amount it can produce with the centre's money.

The literature on procurement auctions focuses mainly on the case of a purchaser wishing to source a fixed quantity of goods or services at minimum price. However, the policy initiatives I am interested in, such as the Single Regeneration Budget or the Transport Innovation Fund, involved the funding department allocating a fixed amount of money to be divided between local councils. This may simply be a product of the centre's internal budgeting procedures. In the absence of a single individual with the information and computational ability necessary to implement an optimal allocation of national resources, simply fixing the annual budget for a particular priority may be a sensible approach. However, it probably also reflects the particular nature of the problems being addressed. The centre is involving local government precisely because it is local councils that know what the centre "wants" in any detail. Simply inviting bids for X miles of cycle track, or Y speed bumps is likely to result in missed opportunities for real, locally sensitive improvements to transport infrastructure.

Thiel (1988) shows that a multi-dimensional procurement auction with a fixed budget and diminishing returns to scale is isomorphic to a conventional auction (i.e. an auction in which bidders offer to pay money in return for a valuable object) with risk averse bidders.[3] From Maskin and Riley's (1984) analysis of auctions with risk averse bidders, therefore, we know that revenue equivalence does not hold between first and second price procurement auctions for a fixed budget.

Several papers examine split-award procurement auctions similar to the one used in this chap-

[3] A related literature on scoring auctions supposes that, instead of having a fixed budget, buyers evaluate price as one of several aspects of a bid. See, e.g., Asker and Cantillon (2008).

ter, in which the buyer purchases from more than one supplier. The most closely related auction format is that used in Perry and Sakovics (2003). They assume the auctioneer has a fixed quantity of a homogeneous good to procure, and examine the equilibrium when (with three or more bidders) a split-award auction is held in which bidders submit separate offers for a larger and smaller share, and the winner of the larger share is eliminated from the contest for the smaller share.

Perry and Sakovics (2003) analysis differs from mine in several respects, however. In particular, they assume that suppliers operate under constant rather than decreasing returns to scale, so my central motivation for split-awards is absent. Instead, they assume there are entry costs, and focus on the potential for a split-award to induce more suppliers to enter the auction.

Anton and Yao (1989, 1992) examine a somewhat different situation. In their model, there are only two suppliers, who submit bids for both the whole amount and for some split. The buyer then chooses whether to buy from one or both suppliers. They assume that suppliers operate under decreasing returns to scale so that a split award reduces the total cost for given per-unit bids. However, they also suppose that suppliers have some information about each other's costs. This allows for tacit collusion between the bidders, so they can capture at least some of the surplus generated by the split award.[4] Other papers on split-award auctions include Seshadri, Chatterjee, and Lilien (1991) and Bernheim and Whinston (1986).

After setting out the model in Section 4.2, in Section 4.3.1 I characterise equilibrium bids and compare them to the equilibrium that would arise if the government did not ring-fence the budget. The ring-fencing constraint can be interpreted as a way of imposing type-specific minimum bids. If the unconstrained equilibrium bids all lie above the constraint then, as one would expect, the constraint has no effect. If, however, some or all of the unconstrained equilibrium bidding function lies below the constraint then imposing the constraint necessarily increases at least some equilibrium bids. Moreover, bids may not simply increase to the level of the constraint. Proposition 10, the main theoretical contribution of this chapter, sets out conditions under which imposing the ring-fencing constraint lifts bids from strictly below to *strictly above* the constraint—so by ring-fencing the budget the government can induce councils to contribute to its priority.

[4] A bidder can always veto the split-award by submitting a very high bid for a share of the split alongside a low bid for the full amount.

Section 4.3.2 looks briefly at the government's problem. The combination of ring-fencing and the split budget means that equilibrium bids may be very complex, so general results on the optimal budget split are not available. However, in Proposition 11 I do establish that allowing for councils to contribute resources may increase the government's payoff from an auction by enough to more than offset the rigidity cost that arises from determining the budget split before learning the abilities of the councils. In Chapter 3 the government only preferred an "auction" if the rigidity cost was low relative to the social cost of producing dossiers. In this case, though, even if the costs of dossiers are negligible council contributions may be sufficiently large to make an auction preferable.

4.2 Model

In this chapter I model a contest between three councils, rather than the two assumed in chapter 3, so that there is a genuine contest for the smaller budget share. I also replace the simple two-type distribution used in Chapter 3 with

Assumption 7. *Each council's (privately observed) ability θ is an independent draw from a continuous, atomless distribution with pdf $f(\theta)$ and cdf $F(\theta)$ where $f(\theta) > 0 \ \forall \theta \in [0,1]$.*

which makes the auction analysis both more tractable and more readily comparable with existing literature. Second, I assume a specific production function:

Assumption 8. *If a local authority of ability θ spends £x on the government's priority it produces a gross payoff to the government of $\theta x^{\frac{1}{p}}$ where $p \geq 1$.*

The third important change in this chapter is that I allow councils to contribute their own resources to the government's priority, while retaining the ring-fencing constraint so that no council has an incentive to bid below $\theta x^{\frac{1}{p}}$ for a government grant of £x. Denoting a council of ability θ's bids for the smaller and larger budget shares $b(\theta, X-x)$ and $t(\theta, x)$ respectively, we have:

Assumption 9. *For a given budget split $\{X-x, x\}$ where $x > X-x$, councils' bids satisfy:*

$$b(\theta, X-x) \geq \theta(X-x)^{\frac{1}{p}}$$
$$t(\theta, x) \geq \theta x^{\frac{1}{p}}$$

Clearly if councils can choose to contribute their own resources to the government's priority, we need to model a council's preference for spending on its own priorities rather than the government's.

I will suppose that resources taken from the council's own budget are weighted by a constant $\lambda > 1$.[5,6] The payoff to a council of ability θ from winning the smaller budget share, $X - x$, with a bid of b is:

$$\pi(b, \theta, X - x) = (X - x) - \lambda\big((\frac{b}{\theta})^p - (X - x)\big) \tag{4.1}$$

while that from winning the larger share x with a bid of t is:

$$\pi(t, \theta, x) = x - \lambda\big((\frac{t}{\theta})^p - x\big) \tag{4.2}$$

4.3 Results

4.3.1 Equilibrium bidding

In this section I describe equilibrium bidding behaviour by councils for a given budget split. Lemma 12 sets out the form of the equilibrium bidding function for the smaller share, while Lemma 13 does the same for the larger share. The final result of the section, Proposition 10, is the main theoretical contribution of this chapter. Ring-fencing constraints in auctions have not been studied before, and I show that the presence of such a constraint may itself induce councils to contribute resources where they would not otherwise.

I begin by examining the equilibrium bidding function for the smaller share, $X - x$, which is a simpler problem than that for the larger share. Since I take the budget split as given in this section, to simplify notation I refer to the equilibrium bidding functions for the larger and smaller share as $t(\theta)$ and $b(\theta)$ respectively. For a council of ability θ, the expected profits from bidding for the smaller share as if it had ability s are:

$$\pi_2(\theta, s) = F(s)\big((X - x)(1 + \lambda) - \lambda\frac{b(s)^p}{\theta^p}\big) \tag{4.3}$$

[5] With only 2 public goods, this would clearly be inconsistent in that it implies constant returns to scale in production of the council's priority but diminishing returns for the national priority. However, in reality local councils undertake a very wide range of activities (and levy a tax, which they could choose to cut). As long as councils optimise the allocation of resources over these other activities, and the amount transferred to the government's priority is small relative to the council's total budget, a constant marginal cost of local public funds is not an unreasonable approximation.

[6] In principle we could have $\lambda > 0$, and all the results carry through for $\lambda \in [0, 1]$. However, the problem is both less interesting and less plausible if λ is very close to 0 so councils' preferences are (almost) exactly aligned with the government's as (a) they would obviously be willing to spend a large proportion of their budget on the government's priority and (b)might well be spending on things the government wanted anyway. Assuming $\lambda > 1$ implies that at most councils will match government funding 1:1.

In the absence of the ring-fencing constraint (i.e. if this were a standard first price auction), the equilibrium bidding function would be:

$$b(\theta) = b_u(\theta) \equiv \left((X-x)\frac{1+\lambda}{\lambda}\int_0^\theta \frac{z^p f(z)}{F(\theta)}dz\right)^{\frac{1}{p}} \tag{4.4}$$

In the presence of the constraint, councils will never bid below the constraint since they have to spend at least the amount they are given by government on the government's priority. Equilibrium bids may, however, lie at the constraint, so

$$b(\theta) = \theta(X-x)^{\frac{1}{p}} \tag{4.5}$$

However, they may also lie above the constraint for one or more ability ranges: $[\theta^l_{i,s}, \theta^h_{i,s}]$ (indexed by $i \in \mathrm{N}^*$). In this case, it turns out the equilibrium bidding function depends on $\theta^l_{i,s}$ and is:

$$b(\theta) = b_c(\theta, \theta^l_{i,s}) \equiv (X-x)^{\frac{1}{p}}\left((\theta^l_{i,s})^p\frac{F(\theta^l_s)}{F(\theta)} + \frac{1+\lambda}{\lambda}\int_{\theta^l_{i,s}}^\theta \frac{z^p f(z)}{F(\theta)}dz\right)^{\frac{1}{p}} \tag{4.6}$$

Lemma 12 describes the equilibrium bids for the smaller share:

Lemma 12. *If* $p\lambda > \theta\frac{f(\theta)}{F(\theta)}\ \forall\theta \in [0,1]$*, then all councils will bid at their constraints i.e.* $b(\theta) = \theta(X-x)^{\frac{1}{p}}\ \forall\theta \in [0,1]$.

Otherwise, councils will bid above their constraints for one or more ranges $[\theta^l_{i,s}, \theta^h_{i,s}]$*. The lower bound of the lowest range is* $\theta^l_{1,s} = min(\theta | p\lambda < \theta\frac{f(\theta)}{F(\theta)})$*. For* $i > 1$*, the lower bound is* $\theta^l_{i,s} = min(\theta | \theta > \theta^h_{i-1,s}$ *and* $p\lambda < \theta\frac{f(\theta)}{F(\theta)})$*. The upper bound is* $\theta^h_{i,s} = min\{1, min(\theta | \theta > \theta^l_{i,s}$ *and* $b_c(\theta) = \theta(X-x)^{\frac{1}{p}})\}$*. There will be* n *ranges, where* $n = min(i | \nexists \theta^l_{i+1,s} \in [0,1])$.

Within each range, councils will bid at $b(\theta) = b_c(\theta, \theta^l_{i,s})$*, while between ranges councils will bid at their constraints, so* $b(\theta) = \theta(X-x)^{\frac{1}{p}}$.

Proof in Appendix E

The condition for councils to bid at their constraints in equilibrium comes from considering a council with ability level θ's incentive to bid slightly above its constraint, given that the types around θ are bidding at their constraints, i.e. :

$$\frac{d}{ds}_{s=\theta}\big(F(s)((X-x)(1+\lambda) - \lambda\frac{s^p(X-x)}{\theta^p})\big) \tag{4.7}$$

if this is negative over some range of values of θ, all councils bidding at their constraints is an equilibrium in this range. Conversely, if expression 4.7 is positive, then it cannot be an equilibrium. As one would expect, councils are more likely to contribute resources (to bid above their constraints) if their preferences are more closely aligned with the government's—so λ is small. They are also more likely to contribute if p is small. As p increases, the impact of additional resources on total output falls—so resources are a less good substitute for ability in the production function. As a result it is more expensive to imitate a higher ability type, so there is less competitive pressure on councils, and equilibrium bids tend to be lower.

We construct the equilibrium bidding function when councils do not bid at their constraint over the whole range by considering the first point at which the bidding function must depart from the constraint—defined as $\theta^l_{1,s}$ in Lemma 12. For some range of values of θ bounded below by this point, the bidding function must satisfy the same first order condition as the unconstrained function: the marginal costs and benefits of increasing one's bid must be equal. However, the initial condition is different in the constrained case. Rather than $b(0) = 0$, we have $b(\theta^l_{i,s}) = \theta^l_{i,s}(X-x)^{\frac{1}{p}}$. Solving this yields a constrained bidding function which is *conditional on* $\theta^l_{i,s}$—and is defined above as $b_c(\theta, \theta^l_{i,s})$. The equilibrium bidding function follows $b_c(\theta, \theta^l_{i,s})$ from $\theta^l_{i,s}$ until either θ reaches its maximum value ($\theta = 1$) or $b_c(\theta, \theta^l_{i,s})$ returns to the constraint.

Turning to equilibrium bids for the larger share, the basic logic is the same as for the smaller share. However, as Perry and Sakovics note, a council's expected profit from the auction for the smaller share is its opportunity cost from winning the larger share—so equilibrium bidding behaviour may depend on expected profits from the auction for the smaller share. Denote the expected profit to a council of ability θ from participating in the auction for the smaller share $\tilde{\pi}_2(\theta) = F(\theta)((X-x)(1+\lambda) - \lambda\frac{b(\theta)^p}{\theta^p})$. If the equilibrium bidding function is $t(\theta)$, then the payoff to a council from bidding as a type $s > \theta$ when its true ability is θ is:

$$\pi_1(\theta, s) = F(s)^2(x(1+\lambda) - \lambda\frac{t(s)^p}{\theta^p}) + 2(1-F(s))\tilde{\pi}_2(\theta) \tag{4.8}$$

In this case, in the absence of the constraint the equilibrium bidding function would be:

$$t_u(\theta) = \left(x\frac{1+\lambda}{\lambda}E(z^p_{2,2}|z<\theta) - \int_0^\theta \frac{z^p 2f(z)\tilde{\pi}_2(z)}{\lambda F(\theta)^2}dz\right)^{\frac{1}{p}} \tag{4.9}$$

where $E(z_{2,2}^p|z<\theta)=\int_0^\theta \frac{z^p 2f(z)F(z)}{F(\theta)^2}dz$ i.e. the expected value of the second most able council's ability (raised to the power p) when θ is the ability of the winning council and there are three councils in the auction.

As was the case for the smaller share, if the constrained bidding function lies above the constraint for one or more ranges $[\theta_{i,g}^l,\theta_{i,g}^h]$, we need to define the constrained function in terms of the value of θ at which $t_c(\theta)$ departs from the constraint, $\theta_{i,g}^l$, and we have:

$$t(\theta)=t_c(\theta,\theta_{i,g}^l)\equiv\left(\frac{1}{\lambda F(\theta)^2}\int_{\theta_{i,g}^l}^{\theta} z^p 2f(z)\big(x(1+\lambda)F(z)-\tilde{\pi}_2(z)\big)dz+(\theta_{i,g}^l)^p x\frac{F(\theta_{i,g}^l)^2}{F(\theta)^2}\right)^{\frac{1}{p}} \quad (4.10)$$

Taking these bidding functions and the results from Lemma 12, Lemma 13 sets out equilibrium bidding behaviour for the larger share:

Lemma 13. *If* $p\lambda>2\theta\frac{f(\theta)}{F(\theta)}(1-\frac{\tilde{\pi}_2(\theta)}{xF(\theta)})\ \forall\theta\in[0,1]$ *then all councils will bid at their constraints, i.e.* $t(\theta)=\theta x^{\frac{1}{p}}$.

Otherwise, councils will bid above their constraints in one or more ranges of θ, $[\theta_{i,g}^l,\theta_{i,g}^h]$. *These are defined analogously to those in Lemma 12, so* $\theta_{1,g}^l=min(\theta|p\lambda<2\theta\frac{f(\theta)}{F(\theta)}(1-\frac{\tilde{\pi}_2(\theta)}{xF(\theta)}))$. *For* $i>1$, *the lower bound is* $\theta_{i,g}^l=min(\theta|\theta>\theta_{i-1,g}^h$ *and* $p\lambda<2\theta\frac{f(\theta)}{F(\theta)}(1-\frac{\tilde{\pi}_2(\theta)}{xF(\theta)})$ *and* $p\lambda\geq 2\theta'\frac{f(\theta')}{F(\theta')}(1-\frac{\tilde{\pi}_2(\theta')}{xF(\theta')})\forall\theta'\in[\theta_{i-1,g}^h,\theta_{i,g}^l])$. *The upper bound is* $\theta_{i,g}^h=min\{1,min(\theta|\theta>\theta_{i,g}^l$ *and* $t_c(\theta)=\theta x^{\frac{1}{p}})\}$. *There will be* n *ranges, where* $n=min(i|\nexists\theta_{i+1,g}^l\in[0,1])$.

In each range, councils will bid at $t(\theta)=t_c(\theta,\theta_{i,g}^l)$, *while between ranges councils will bid at their constraints, so* $t(\theta)=\theta x^{\frac{1}{p}}$.

Proof in Appendix E

Much of the intuition behind this lemma is the same as for Lemma 13. As one would expect, higher expected profits from the auction for the smaller share reduce both the likelihood that councils will bid above their constraint in the auction for the larger share, and the size of bids when they do lie above the constraint.

I now look in more detail at the relationship between the constrained and unconstrained bidding functions. One might initially have expected that the equilibrium bidding function would coincide with the unconstrained equilibrium ($b_u(\theta)$) whenever the latter lay above the constraint,

and would coincide with the constraint otherwise. In fact, though, there will be values of p and λ and ability distributions such that for some ranges of θ, though the unconstrained function lies below the constraint, the constrained bidding function lies above the constraint—so the imposition of the constraint raises bids from below the constraint to *strictly* above it. We have:

Proposition 10. *If $\exists\theta$ such that the unconstrained bidding function lies below the ring-fencing constraint ($b_u(\theta) < \theta(X-x)^{\frac{1}{p}}$) but $\frac{d}{d\theta}F(\theta)(b_u(\theta)^p - \theta^p) > 0$, then there will be at least one range of values of θ over which the imposition of the ring-fencing constraint will raise equilibrium bids for the smaller budget share from strictly below to strictly above the constraint.*

Similarly, if $\exists\theta$ such that the unconstrained bidding function lies below the ring-fencing constraint ($t_u(\theta) < \theta x^{\frac{1}{p}}$) but $\frac{d}{d\theta}F(\theta)(t_u(\theta)^p - \theta^p) > 0$, then there will be at least one range of values of θ over which the imposition of the ring-fencing constraint will raise equilibrium bids for the larger budget share from strictly below to strictly above the constraint.

Parameters exist that meet these conditions.

Proof. To see why this is, recall that in the unconstrained equilibrium the benefit of increasing one's probability of winning by bidding as a marginally higher type must be exactly offset by the reduced expected profit. In the auction for the smaller share this is:

$$f(\theta)((X-x) + \lambda((X-x) - (\frac{b_u(\theta)}{\theta})^p) = \frac{\lambda F(\theta)}{\theta^p}\frac{d(b_u(\theta)^p}{d\theta}$$

Imposing the ring-fencing constraint means that all councils must bid at least at their constraint.

Suppose initially that they do in fact all respond by bidding at the constraint. If the unconstrained function lies below the constraint, then introducing the constraint leaves the effect of bidding as a marginally higher type on one's probability of winning unchanged. However, it affects expected profits in two ways. First, shifting bids up to the constraint reduces each type's profit by a discrete, possibly large, amount. This will reduce the incentive to bid higher. However, it will often also change the cost of bidding as a marginally higher type because the gradient of the cost of bidding at the constraint, $\frac{\lambda}{\theta^p}\frac{d\theta^p(X-x)}{d\theta}$ differs from $\frac{\lambda}{\theta^p}\frac{d(b_u(\theta)^p)}{d\theta}$. If $\frac{\lambda}{\theta^p}\frac{d\theta^p(X-x)}{d\theta}$ is sufficiently much *smaller* than $\frac{\lambda}{\theta^p}\frac{d(b_u(\theta)^p)}{d\theta}$—i.e. the cost of bidding as a marginally higher type drops enough—to outweigh the discrete loss of profits conditional on winning, then the constrained

equilibrium will not involve councils all bidding at their constraints. The condition for this is:

$$\frac{\lambda}{\theta^p}F(\theta)(\frac{d(b_u(\theta))^p}{d\theta}-\frac{d\theta^p}{d\theta}) > f(\theta)\underbrace{\lambda((X-x)-\frac{(b_u(\theta))^p}{\theta^p})}_{\text{lost profits}}$$

which rearranges to the condition in the proposition. The condition for the larger share is simply the analogue. If it holds, the imposition of the constraint will induce councils to contribute their own resources by raising equilibrium bids from strictly below to strictly above the constraint. Example 2 below provides an illustration. □

A final point to note is that even if the unconstrained function rises above the constraint, it will not necessarily coincide with the constrained function. If the constrained function lies above the constraint at the point at which the unconstrained function intersects the constraint, [7] then the equilibrium bidding function would have to "jump" downwards if it were to join the unconstrained function—and this could not be an equilibrium because bids would not be monotonic in ability. Hence the constrained and unconstrained bidding functions will only coincide if it happens that the constrained function rises above the constraint at exactly the point at which the unconstrained function crosses the constraint.

4.3.2 The Government's Problem

As in Chapter 3, the government's problem is to choose $x \in [\frac{X}{2}, X]$ to maximise its expected payoff. This payoff is simply the sum of the expected winning bids for the larger and smaller shares, given that the winner of the largest share will have the highest ability of the three councils,[8] and the winner of the smaller share will have the second highest ability of three:

$$Govt(x) = \int_0^1 t(\theta_3, x)3f(\theta_3)F(\theta_3)^2 d\theta_3 + \int_0^1 b(\theta_2, x)6f(\theta_2)F(\theta_2)(1-F(\theta_2))d\theta_2 \qquad (4.11)$$

In light of Lemmas 12 and 13, it is clear that this may be a very complex expression since both equilibrium bidding functions may lie partly on, and partly above, the constraint, and $t(\theta, x)$ depends, inter alia, on $b(\theta, x)$. Example 1 in the next section solves the government's problem for a particularly simple case, but a full characterisation is beyond the scope of this chapter.

[7] The constrained function rises above the constraint at the minimimum value of θ s.t. $p\lambda < \theta\frac{f(\theta)}{F(\theta)}$, whereas the unconstrained function rises above it at the minimum value of θ s.t. $\left(\frac{1+\lambda}{\lambda}E(z^p|z<\theta)\right)^{\frac{1}{p}} > \theta$. These may, but in general need not, be the same point.

[8] the probability that the winner of the larger share has ability θ_3 is $f(\theta_3)F(\theta_3)^2$, while the probability that the winner of the smaller share has ability θ_2 is $f(\theta_2)F(\theta_2)(1-F(\theta_2))$

Nevertheless, it is useful to set out two benchmarks. First, if no councils bid above their constraints, then we have the same problem as in Section 3.5.2 of Chapter 3, but with a continuous distribution of types. The government's expected payoff, for a given budget split $\{x, X-x\}$ is:

$$Govt(x, constr) = \int_0^1 3f(\theta_3)F(\theta_3)^2\theta_3 x^{\frac{1}{p}}d\theta_3 + \int_0^1 6f(\theta_2)F(\theta_2)(1-F(\theta_2))\theta_2(X-x)^{\frac{1}{p}}d\theta_2 \quad (4.12)$$

which implies that the optimal choice of x is:

$$x^*_{constr} = \frac{X(\frac{E(\theta_3)}{E(\theta_2)})^{\frac{p}{p-1}}}{1+(\frac{E(\theta_3)}{E(\theta_2)})^{\frac{p}{p-1}}}$$

As one would expect, this is smaller if $E(\theta_2)$ is closer to $E(\theta_3)$. It is also smaller if p is larger, so marginal productivity is declining more rapidly.

The second useful benchmark is the case where councils do not make contributions, but the government can decide the budget split after it learns councils' abilities (or, equivalently, in which the government simply knows these abilities ex ante). This is the continuous version of the challenge funding game in which bids are infinitely efficient discriminators, so the government learns types costlessly.

The government's problem is simply

$$max_x \theta_3 x^{\frac{1}{p}} + \theta_2(X-x)^{\frac{1}{p}}$$

which implies an optimal choice of x, as a function of $\{\theta_2, \theta_3\}$ of

$$x^*(\theta_2, \theta_3) = \frac{X(\frac{\theta_3}{\theta_2})^{\frac{p}{p-1}}}{1+(\frac{\theta_3}{\theta_2})^{\frac{p}{p-1}}}$$

and an expected government payoff of:

$$Govt(x, \text{full-inf}) = \int_0^1 \int_0^{\theta_3} \frac{3f(\theta_3)F(\theta_3)^2 X(\frac{\theta_3}{\theta_2})^{\frac{p}{p-1}} + 6f(\theta_2)(1-F(\theta_2))F(\theta_2)X}{(\frac{\theta_3}{\theta_2})^{\frac{p}{p-1}}+1} d\theta_2 d\theta_3$$

We have:

Proposition 11. *If the government chooses to hold auctions for two pre-determined, ring-fenced budget shares $\{x, X-x\}$, where the winner of the larger share (x) is eliminated from the contest for the smaller share (x), equilibrium bids will be as described in Lemmas 12 and 13. There are values of the parameters p and λ, and forms of the type distribution $F(\theta)$ such that the government's expected payoff from an auction is strictly greater than $Govt(x, full\text{-}inf)$.*

Proof. See example 1 below. □

The key point in Proposition 11 is that an auction can induce sufficient contributions from councils to more than off-set the rigidity cost imposed by the auction format. The next example illustrates this. The second example illustrates Proposition 10.

4.3.3 Examples

Example 1: $\theta \sim U[0,1]$

The first example assumes that councils' abilities are drawn from the standard uniform distribution, and is therefore the continuous analogue of the distribution used in Chapter 3.[9] The uniform distribution is particularly easy to work with in this context because councils will always bid at their constraints for the smaller share. From Lemma 12, we know that the condition for this is:

$$p\lambda > \theta \frac{f(\theta)}{F(\theta)} \tag{4.13}$$

Under the uniform distribution, this condition will hold as long as $p\lambda > 1$—which is true by assumption. We therefore have that $\tilde{\pi}_2(\theta) = F(\theta)(X - x)$. Whether councils will also bid at their constraints for the larger share depends in part on the government's choice of x—which in turn of course depends on whether the government expects councils to bid above their constraints.

Holding x fixed, councils will bid at their constraints over the whole range if:

$$p\lambda \geq \frac{2(2x - X)}{x} \tag{4.14}$$

and will bid above their constraints over the whole range otherwise. Since condition 4.14 is independent of θ, depending on x bids will either be at the constraint for across the whole ability range, or above the constraint across the whole range. The unconstrained and constrained bidding

[9] There, councils were equally likely to be "high" or "low" ability.

functions therefore in fact coincide—and are $t(\theta, x) = \theta\big(\frac{2x(1+\lambda)-2(X-x)}{\lambda(p+2)}\big)^{\frac{1}{p}}$

Under the uniform distribution, the expected ability of the winner of the larger share is $E(\theta_{3,3}) = \frac{3}{4}$, while that of the council that wins the smaller share is $E(\theta_{2,3}) = \frac{1}{2}$. If councils bid at their constraints, the government's expected payoff is therefore:

$$Govt = \frac{3}{4}x^{\frac{1}{p}} + \frac{1}{2}(X-x)^{\frac{1}{p}} \tag{4.15}$$

and its optimal choice of x is $\frac{\left(\frac{3}{2}\right)^{\frac{p}{p-1}}}{1+\left(\frac{3}{2}\right)^{\frac{p}{p-1}}}X$. This is consistent with councils in fact all bidding at their constraints for the larger share if $p\lambda > 2\big(1-\left(\frac{2}{3}\right)^{\frac{p}{p-1}}\big)$. If, on the other hand, the government expects councils to bid above their constraints for the larger share, then its expected payoff is:

$$Govt = \frac{3}{4}\big(\frac{2x(1+\lambda)-2(X-x)}{\lambda(p+2)}\big)^{\frac{1}{p}} + \frac{1}{2}(X-x)^{\frac{1}{p}} \tag{4.16}$$

which implies an optimal choice of x of:

$$\frac{(1+\frac{1}{2}(3(2+\lambda)(\frac{1}{2\lambda+p\lambda})^{\frac{1}{p}})^{\frac{p}{p-1}})X}{2+\lambda+\frac{1}{2}(3(2+\lambda)(\frac{1}{(2\lambda+p\lambda)})^{\frac{1}{p}})^{\frac{p}{p-1}}} \tag{4.17}$$

This is consistent with councils in fact bidding above their constraints for the larger share if $(2-p\lambda)(3(2+\lambda)(\frac{1}{2\lambda+p\lambda})^{\frac{1}{p}})^{\frac{p}{p-1}} > 2\lambda(2+p)$

These regions are illustrated in Figure 4.2. The figure also marks the area in which, were the government to set x at its maximum ($x = X$), councils would bid above their constraints for the larger share in equilibrium, but which cannot form part of an equilibrium if the government is optimising. This area is characterised by relatively large values of p. When marginal productivity is declining relatively rapidly, the benefits of dividing the budget are larger, while the benefits of councils contributions are smaller—as are the contributions themselves. As is clear from Figure 4.2, there is a region of $\{p, \lambda\}$ space in which there are two possible equilibria. The government's choice of x determines which will be realised. Figure 4.1 shows that the government will sometimes, but not always, prefer to set x to induce councils to bid above their constraints for the larger share. As one might expect, the government prefers the equilibrium with council contributions when p and λ are smaller. When λ and p are small, councils' contributions will be

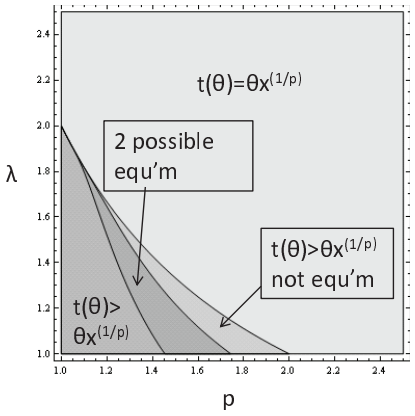

Fig. 4.1: Possible equilibria when $\theta \sim U[0,1]$.

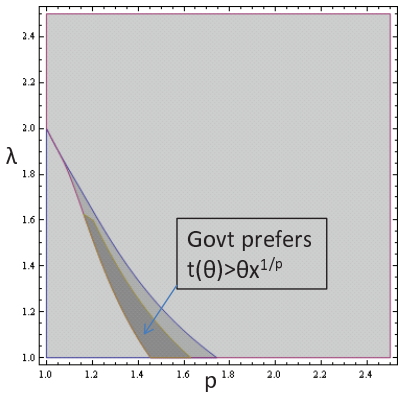

Fig. 4.2: The government's preferred equilibrium in the region where both $t(\theta) = \theta x^{\frac{1}{p}}$ and $t(\theta) > \theta x^{\frac{1}{p}}$ are possible, for appropriate values of x.

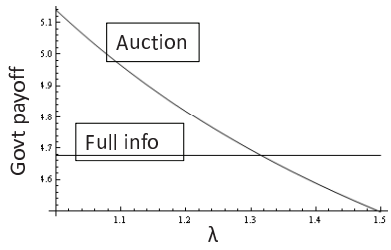

Fig. 4.3: Comparison of the government's full-information payoff, and its payoff from an auction, when $\theta \sim U[0,1]$, $p = 1.3$ and $X = 10$.

larger. Moreover, when p is small, the government wants to put most of the budget into the larger share (so it gets spent by the most able council) in any case—and therefore it is less costly to shift resources into the larger share in order to induce councils to bid higher.

A second important point that can be illustrated using this example is that there are values of p and λ such that council contributions will be sufficient to outweigh the rigidity cost i.e. the government may strictly prefer an auction to a challenge funding process, even when challenge funding dossiers are extremely good discriminators. Figure 4.3 illustrates this for the case where $p = 1.3$. The horizontal line in Figure 4.3 is the government's full-information payoff—what it would get if it could divide the budget *after* learning the abilities of the two most able councils. The other line is the government's payoff from an auction. As one would expect, the government is more likely to prefer an auction when λ is small, since the more closely central and local priorities are aligned, the more councils will contribute to the centre's priority.

Example 2: $\theta \sim Beta[a, \beta < 1]$

In the previous example, the distribution was such that either the bidding function lay at the constraint, or it followed the unconstrained function. This example illustrates Proposition 10—the possibility that the presence of the constraint may cause councils to bid *strictly* above the constraint even though the unconstrained function lies strictly below it. As one might expect, this is the most complex case to analyse. Since the purpose of the example is to illustrate the possibility of this novel equilibrium behaviour, I restrict attention to equilibrium bids for the smaller share

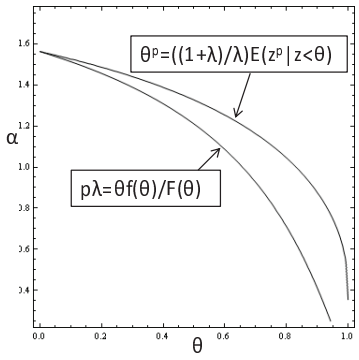

Fig. 4.4: Conditions for constrained and unconstrained bids to lie above the constraint, $p = \lambda = 1.25$, $\beta = 0.25$.

and so do not consider the government's optimal response.

As discussed in Section 4.3.1, the likelihood of the constraint inducing councils to contribute resources is higher when the gradient of the distribution function is large relative to that of the constraint. I use the Beta distribution in this example, with $\beta < 1$ and $\alpha > \beta$ so the cumulative density function rises sharply for θ close to 1. I also assume that $p = \lambda = 1.25$.

Figure 4.4 plots the values of θ and α at which two key conditions hold with equality. The lower of the two lines is:

$$p\lambda = \theta \frac{f(\theta)}{F(\theta)}$$

This is the condition that determines whether councils bidding at their constraints forms an equilibrium. For a given value of α, councils with ability levels to the left of the line will bid at their constraints in equilibrium, while those with ability levels to the right of the line will bid above their constraints. The higher line is:

$$\frac{1+\lambda}{\lambda} \int_0^{\theta} \frac{z^p f(z)}{F(\theta)} dz = \theta^p$$

At values of θ to the left of this line (again for a given α) the unconstrained bidding function, $b_u(\theta)$, lies below the constraint whilst to the right of it $b_u(\theta)$ is above the constraint. In example 1 these lines coincided—councils bid above their constraints iff the unconstrained bidding function lies above the constraint. In this example, however, there is a range over which councils bid above their constraints even when the unconstrained function lies below the constraint.

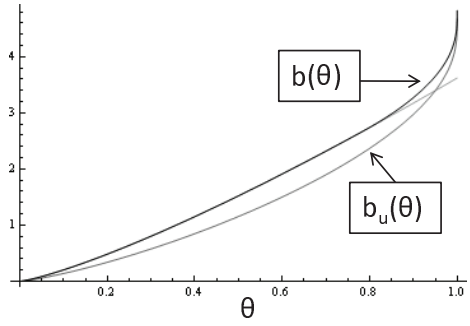

Fig. 4.5: Equilibrium bidding function and unconstrained bidding function (and constraint) for $\theta \sim Beta[0.75, 0.25]$, $p = 1.25$, $\lambda = 1.25$ and $X - x = 5$.

I now calculate a specific equilibrium bidding function for $\alpha = 0.75$. When $\alpha = 0.75$, $\theta^l_{1,s} = 0.784$ and from Lemma 12, the unconstrained bidding function is:

$$b_c(\theta, \theta^l_{1s} = 0.784) = (X - x)^{\frac{1}{p}} \left((0.784)^p \frac{F(0.784)}{F(\theta)} + \frac{1+\lambda}{\lambda} \int_{0.784}^{\theta} \frac{z^p f(z)}{F(\theta)} dz \right)^{\frac{1}{p}}$$

Since $b_c(\theta, \theta^l_{1,s} = 0.784) > (X - x)^{\frac{1}{p}}$ $\forall \theta \in [0.784, 1]$ we have that $\theta^h_{1,s} = 1$, and so there is only one range for which equilibrium bids lie above the constraint. Figure 4.5 shows the equilibrium bidding function, as well as the constraint and the unconstrained bidding function (for a budget share of $X - x = 5$).Although the range over which ring-fencing raises bids strictly above the constraint is relatively small, the distribution function is such that it raises the government's expected payoff quite noticeably; the government's expected payoff with ring-fencing is 9% high than its payoff from the unconstrained equilibrium.[10]

4.4 Conclusion

In this chapter I have examined split-award procurement auctions in a novel setting—one in which the buyer is able to ring-fence the money it awards to the winning suppliers. The analysis was motivated by the relationship between central and local government in the UK as set out in Section 3.1 of Chapter 3. My main policy conclusion, Proposition 11, shows that it is possible for an auction with transferable resources to be strictly preferred by the government to a chal-

[10] It is worth also noting that in this example, because the unconstrained equilibrium does rise above the constraint for very high values of θ and the distribution is heavily left-skewed, the government would actually do better from the unconstrained equilibrium than it would if all councils were to bid at their constraints. Moving from all councils bidding $\theta(X - x)^{\frac{1}{p}}$ to the unconstrained equilibrium increases the government's expected payoff by 13%.

lenge funding process even if in the latter dossiers are *infinitely* efficient discriminators so the social costs of challenge funding are negligible (or, equivalently, if the government has perfect information about the abilities of individual councils). This contrasts to the case analysed in Chapter 3, where councils could not transfer resources to the government's priority, so the rigidity cost of the auction could not be offset by (from the government's perspective) an increased budget.

The analysis of Section 4.3.1 also makes a theoretical contribution, by characterising equilibrium bidding in a split-award auction with ring-fencing. Of particular interest is the result in Proposition 10 that when bids in a (hypothetical) unconstrained equilibrium would lie strictly below the ring-fencing constraint, imposing the constraint may actually increase equilibrium bids to *strictly* above the constraint—so the constraint itself induces councils to contribute their own resources.

Clearly, this is unlikely to be transferable to procurement from the private sector. Even if ring-fencing were feasible, when councils bid above the ring-fencing constraint they effectively supply the government at a price below cost—and profit maximising firms are unlikely to be willing to do this. However, there may be implications for government dealings with the "third sector".[11] Such organisations resemble local councils in the important respects of (a) having various sources of revenue and (at least partially) flexible budgets, and (b) plausibly having priorities that are neither perfectly aligned with, nor diametrically opposed to, those of the government. The government and local authorities seem to be able to ring-fence grants allocated to third sector organisations (National Audit Office, 2006). If ring-fencing were also compatible with competitive tendering rules, the analysis of this chapter suggests it might well be beneficial to allocate more money via an auction-type process instead of using more conventional grants.

[11] The UK Treasury and Cabinet Office (2007) define the third sector as "non-governmental organisations that are value-driven and which principally reinvest their surpluses to further social, environmental or cultural objectives. It includes voluntary and community organisations, charities, social enterprises, cooperatives and mutuals".

5. PARISH COUNCILS AND THE WELL-BEING POWER

5.1 Introduction

Town and parish councils are the lowest tier of democratic government in England and Wales. Historically, major urban areas have been unparished, although recent legislation has allowed for the creation of parish councils in unparished areas including London. Nevertheless, there are approximately 8,500 town and parish councils in England, varying massively in size from small rural communities of fewer than 100 households, to sizeable towns of over 30,000 households.

Unlike principal local authorities,[1] parish councils[2] have very few statutory duties, but a considerable number of powers, including provision of community centers and transport schemes, and maintenance of footpaths and amenity areas.[3] To finance their activities, they are able to levy a precept as well as apply for grants and charge for services.

The broad direction of government policy in this area is toward encouraging more "neighbourhood governance", including greater activity on the part of parish councils (see, e.g., DETR (2000), DCLG (2006)). In 2003 the government introduced a "Quality Council Scheme" to encourage greater professionalism and democratic engagement amongst parish councils. The government is also using the current round of local government re-organisation to place more emphasis on the role of parish councils. County councils that have, or are hoping to, become unitary authorities are expected to have "clear and accountable community (ie neighbourhood/parish) governance arrangements" (DCLG, 2006). Alongside the broad localism agenda, the reorganisation itself provides a motivation for attempting to enhance the role of neighbourhood government. Local authorities in the UK are already far less "local" than comparable tiers of government in other

[1] Since "local council" is ambiguous, in this context county, unitary, borough and district councils are referred to as principal local authorities.

[2] For brevity, I will refer to town and parish councils as "parish councils" throughout this chapter.

[3] For a full list see the National Association of Local Councils website, http://www.nalc.gov.uk/

countries. The new unitary authorities will exacerbate this situation.[4] While larger authorities may bring coordination benefits and economies of scale, it seems likely that they will be less good at providing locally tailored services and encouraging community engagement—and therefore that there may be a role for "very local" government in offsetting this.

The small amount of existing research on parish councils is largely qualitative, but suggests that there is immense variation in the extent to which parishes use their powers.[5] Some raise little or no precept and fulfill only their basic duties, while others, primarily larger town councils, have substantial budgets (of £100,000s) and provide a wide range of services. This suggests that the effect of greater devolution to parish councils is unlikely to be uniform.

In 2000, principal local authorities were given a "power of well-being" which allows them to spend money on (almost) anything not expressly forbidden by other legislation. In a potentially important parallel development to those outlined above, this power was extended to parish councils that meet certain criteria at the start of 2009. The criteria include some of the tests a council must pass to achieve Quality status.[6] The government's guidance notes state that "the introduction of the well-being power for principal authorities enabled them to move away from their necessarily cautious approach to innovation and joint action which had previously limited their contribution to the improvement of the quality of life of their communities"[7] and that "it is hoped that the extension of the power will do the same in relation to local councils" (CLG, 2009).

In this chapter, I am interested in the likely effects of the extension of the well-being power to parish councils, and specifically in how we might expect its use to vary across parishes and whether there are likely distributional implications.

[4] For example Cornwall, where six second tier authorities were abolished and replaced by a single county-wide unitary authority in April 2009, has a population of around 532,000. In contrast, in 2006 Austria, Spain, Germany and Italy all had a local council population average of less than 10,000, and the average in France was 1,650 (Stoker (2006).

[5] For more details, see Section 5.7.

[6] Specifically, at least two-thirds of councillors must have stood for election (though need not have faced a contest), the clerk must hold a CiLCA or similar qualification and be trained in the use of the well-being power, at least 80% of councillors must be trained in the use of their well-being power, and the council must have produced a "statement of intent as to community engagement".

[7] This claim is not, in fact, wholly supported by the evaluation conducted by CLG, which found that "use of the Well-Being Power remained limited over the life of the evaluation" and "efforts to promote awareness of the Power were hampered by the complexity of the legal power... confusion amongst users between the Well-Being Power and the broader concept of well-being, and the difficulties of effectively communicating information in constantly changing organisations". It concludes that the experiences of both central and local government "are a good illustration of how policy implementation can confound expectation".

There is evidence that people lower down the socio-economic scale tend to get lower quality provision from public services organised at the national (and principal local authority level) such as the state education system and the NHS. Whether encouraging more service provision at the very local level will reduce or exacerbate these inequalities is unclear. Whilst there are theoretical arguments on both sides, there is as yet very little evidence.

Dixon et al (2003) review the evidence on inequalities in the NHS. They conclude that whilst the evidence from aggregate studies is not clear-cut, the micro literature which looks at usage of specific services finds "strong evidence that lower socio-economic groups use services less in relation to need than higher ones". They offer three sources of these inequalities: "lack of suitable transport and restrictions on time [for lower socio-economic groups]; superior connections and communications by middle class patients; and differences in beliefs about severity of illness and the need to seek medical attention" (Dixon et al, 2003).

A recent investigation into school choice by Burgess and Briggs (2009) finds that not only do poor children tend to go to less good schools, but that even once location is controlled for (i.e. eliminating selection-by-housing-market effects) non-poor children are still significantly more likely to attend good schools than their poor contemporaries. Burgess and Briggs suggest a number of possible explanations for this difference: "different preferences for school quality, or different constraints such as information, ability to "work the system" or to pay for travel to distant schools".[8]

It is sometimes argued that very local governance can help to tackle these kinds of discrepancies. If power is handed to communities, citizens can circumvent large bureaucracies and are able to tailor spending to their needs. For example, Blears (CLG, 2007b) claims that "passing power from Whitehall to the town hall and direct to local communities... is the surest way of making local services reflect people's needs" and that "genuine empowerment can bring positive change and build the resilience necessary to prevent problems such as anti-social behaviour, which left unchallenged will blight communities". In a similar vein, Andrews (2006) argues that "voluntary and community sector are [indispensable] in reaching into communities and neighbourhoods that we, in Government, can be shut out of", that partnerships involving the community sector can make a "difference to our most disadvantaged communities in particular" and that this difference

[8] For a largely qualitative account of other advantages enjoyed by middle class families in the state education system see Reay (2008). Other references for inequitable access to/use of public services include Le Grand (2006), Goddard (2008), Duffy (2000)).

is greatest "when people have a real say in decisions that affect their lives; above all, when they take those decisions for themselves".

On the other hand though, as Winterton (2009) puts it, this requires local councils to "[step] up to the plate". Increasing the powers available to local communities will only have an impact in those areas where they are used. If the inequitable distribution of public services is due to lower socio-economic groups having less time, money and information, perhaps devolving power to ever smaller, and typically more homogenous, communities will lead instead to greater inequalities. Lowndes and Sullivan (2008) suggest that "there is a danger that neighbourhood governance could compound what Sharpe (1970) calls 'the geography of inequity'. If neighbourhoods are to draw more upon their own resources in terms of human, social and economic capital–what is the fate of communities that lack resources?"

The primary aim of this chapter is to cast some light on this debate. There is good evidence for inequities in the provision of national public services. It remains unclear, though, whether devolving more powers down to the very local level will mitigate or exacerbate these inequalities. There are theoretical arguments on both sides and it is therefore essentially an empirical question.

Since the well-being power has only just been introduced, there is no data available on it. However, I do have information on a very similar power was granted to parish councils in section 137 of the 1972 Local Government Act. This "s137 power" allows a parish to spend a limited amount per elector (£5.30 in 2005/06) on anything where the council can demonstrate that the "direct benefit accruing to their area or any part of it or to all or some of the inhabitants of their area will be commensurate with the expenditure to be incurred". This is not identical to the well-being power. The latter has no expenditure cap, and there is no requirement to demonstrate that benefit is commensurate to expenditure.[9] On the other hand there are no criteria a council must satisfy before it is be entitled to use s137.[10] Despite these caveats, the two provisions are in most respects very similar. It therefore seems worth examining the use of s137 as a (partial) guide to the future;

[9] Most councils that reported using s137 did not spend up to the cap. However, some did report that in spite of this the cap had affected their decisions, by ruling out the possibility of running large projects via s137. There may therefore be some councils who use the general well-being power, but did not use s137.

[10] Currently only quite a small minority of parish councils have applied for, and been granted, Quality status (according to the NALC, there were 674 Quality councils on 31^{st} July 2009. `http://www.nalc.gov.uk/Toolkits/Quality_Status.aspx`)—and survey evidence suggested that getting a CiLCA-qualified clerk is the main obstacle for many councils. However, the general well-being power creates a stronger, more specific incentive to meet the criteria.

if we observe inequalities in the use of s137, this suggests the impact of the new well-being power may also be inequitable.

In the next section I describe the data that I have available to address the question of whether variations in the use of the s137 power are linked to variations in deprivation (or affluence), and in Section 5.3 I estimate simple, non-structural logit models of the use of s137. I find evidence that parishes with high levels of living environment deprivation are significantly less likely to make use of their s137 powers. However, areas with higher levels of income and education deprivation are more likely to make use of the power. At first glance this latter result suggests that neighbourhood empowerment might benefit some less well-off areas. However, at least part of the difference is explained by the fact that income deprivation is more common in larger, urban parishes, whereas the opposite is true for living environment; previous research has found that larger councils are more likely to be active in various ways, including making more use of s137.

An important point about the government's deprivation measures is that they are exactly that—measures of deprivation—and as the CLG guidance stresses, the absence of deprivation is not the same thing as affluence. This is especially relevant here since most of the severely deprived areas of England are in unparished, urban areas. I therefore also examine associations between various measures of affluence, and other demographic variables, and the use of s137. I find that the proportion of over 65s in the population, and the proportion of adults with high levels of education (or in professional or managerial jobs), are both positively and significantly associated with the use of the power. Moreover, with these controls, educational (or income) deprivation is once again somewhat significant. Section 5.4 presents results of censored regressions on total spending under s137, as a robustness check. The results are qualitatively very similar. I conclude, therefore, that we should indeed expect the use of the new general well-being power to be unevenly distributed, with larger parishes and those with more elderly people and people of high socio-economic status using it more.

Attempting to alter the demographic or socio-economic composition of parishes is not a plausible policy response to this. One possibility would be to decide whether to continue with the policy by comparing the benefits of more local powers to those communities that will use it against the costs of increased inequality, especially via reduced general provision, and the likely transfer of resources to more active and innovative areas. However, it may be possible to do better than this.

In Section 5.5 I probe the results in light of a large body of literature which shows that better educated, more affluent and older people are more likely to to engage in voting and other forms of civic participation. I propose two possible mechanisms via which the fact that a parish has a higher proportion of these more politically active groups in its population might translate into an increased likelihood of the council using its general spending powers: *electoral pressure*, and *capacity*. I then use data on parish council elections, in conjunction with the main data set on the use of s137, to attempt to distinguish between these two hypotheses. I find little support for the electoral pressure hypothesis, but suggestive evidence for a capacity-based explanation of the results. On this latter account, members of more politically active groups are both more likely to be willing to stand as parish councillors, and also have the resources and/or enthusiasm to exert more effort in post. This further investigation allows me, in Section 5.6, to make a number of suggestions for ways to mitigate the likely distributional impact of increased reliance on neighbourhood governance in general, and of the well-being power specifically.

As noted above, most of the empirical body of the chapter uses very simple, non-structural models. This is partly because I am interested in the straightforward policy question of the likelihood that the extension of the well-being power to parishes will have adverse distributional consequences. However, it also reflects both practical and theoretical limitations. On the practical side, there is very little detailed data available on parish councils. Even with more data, though, a fully specified structural model would require a clear underlying theoretical framework of the operation of parish councils. As yet, such a model does not exist. In Section 5.7, I explore both potentially relevant existing theory, and the features that the qualitative literature on parish councils suggest might be important to capture in a future model.

5.2 Data

I use three data sets for the analysis. The first is the most recent census, conducted in 2001, which used civil parishes as one of its geographical units. It contains information on, amongst other things, numbers of households, age, education, labour force participation and occupation.

The second is the government's 2007 indices of multiple deprivation (IMDs) which use a combination of 2001 census data and more recent administrative records to construct measures of

deprivation by Lower-level Super Output Area. For each type of deprivation, a higher value of the IMD variable corresponds to a higher level of deprivation. Measuring "deprivation" is not straightforward, and these indices are not ideal for my purposes because only the income and employment measures are strictly cardinal.[11] The overall index in particular is not suitable for inclusion in regression analysis, but the sub-indices are probably a reasonable approximation (see CLG (2007)). These cover income, employment, education, health, crime, barriers to services and housing, and living environment. I have the overall score for each LSOA for each category, as well as some of the component data. Unfortunately, a few LSOAs cross parish boundaries. Where this happens, I calculate a parish average based on the proportion of the parish population lying in a given LSOA.[12]

The third is from a survey undertaken as part of a wider research study into the Quality Parish and Town Council scheme commissioned by DEFRA (Woods et al, 2006). Since the focus of the study was on the Quality scheme, a survey was sent to each of the 303 councils with Quality status at the end of May 2006, alongside 700 non-Quality councils. The survey mainly focused on the Quality scheme, but also asked whether or not the parish council used its s137 power in the 2005/06 financial year, and if so how much it spent. The overall response rates were 67% and 43% respectively, but some responses were incomplete. The sample contains a disproportionate number of larger parishes, partly through design (see below) and possibly partly due to selection effects (see Woods et al, 2006). There is no evidence of selection on any of the other observables available from the census. I have a total of 420 useable responses, of which 238 used s137 and 182 did not.[13]

Quality status is never a significant predictor of the use of s137 powers. However, the non-Quality councils were chosen to be similar to the Quality councils. As a consequence, more populous parishes are over-represented in the sample relative to the national profile of parishes. I weight the sample by the number of households in each parish to approximate the true distribution. Even with this correction, though, the methodology is not ideal and it is still quite a small sample. The results should therefore be treated with caution and a larger survey would be wanted for firm

[11] The income measure is simply the fraction of the population affected by income deprivation i.e. living in a household in receipt of an income-related benefit (JSA, income support, WFTC etc), similarly, the employment measure is the fraction of the population affected by employment deprivation.

[12] i.e. if a parish lies entirely within an LSOA, its IMD scores will be those of the LSOA, even though the LSOA covers a larger area. If, on the other hand, a parish lies partly in two different LSOAs, its score is a population-weighted average of those of the two LSOAs. Fortunately, most parishes contain one or more complete LSOAs.

[13] Of those that used s137, 137 were Quality councils, while of those that did not, 87 were Quality councils.

policy conclusions.

5.3 Use of s137 powers and parish characteristics

Since my primary interest is in the possible distributional consequences of extending the general well-being power to parishes (and of the neighbourhood governance agenda more broadly), I begin by looking at whether the use of s137 is predicted simply by measures of deprivation. I use the Department for Communities' Indices of Multiple Deprivation. The key results are presented in Table 5.1. There are seven individual indices, but the only ones that show a significant relationship with the use of s137 powers are living environment and education or income.[14]

As the table shows, areas with high levels of living environment deprivation tend to make less use of their s137 powers. The living environment index combines measures of poor quality housing, serious road accidents involving pedestrians and cyclists, and air pollution. As models II, VIII and X shows, it seems to be primarily the poor housing component that drives the effect.

Parishes with higher levels of income or educational deprivation, on the other hand, appear to make *more* use of their s137 powers. The income deprivation score is simply the percentage of the population living in a household in receipt of income-related benefits. The education score combines information on poor performance by children, and low levels of adult qualifications. Since most of these are highly correlated, I pick one variable from each group. Although they are jointly significant at the 5% level, neither is individually significant.

[14] Unsurprisingly, these are closely correlated with each other and also with the employment indicator.

	I	II	III	IV	V	VI	VII	VIII	IX	X
Liv. Env. IMD	−0.04015**	-	-	-	-	−0.0467***	−0.0568***	-	-	-
	(0.0162394)					(0.0172)	(0.0189			
Poor Housing	-	−5.154***	-	-	-	-	-	−5.045***	−5.463***	−5.088***
		(1.841)						(1.864)	(1.901)	(1.848)
RTAs	-	−0.188	-	-	-	-	-	−0.269	−0.285	−0.235
		(0.412)						(0.408)	(0.406)	(0.400)
Air Quality	-	−1.083	-	-	-	-	-	−1.149	−1.08	−1.097
		(1.007)						(1.030)	(1.053)	(1.014)
Educ IMD	-	-	0.0313**	-	-	0.0409*	-	0.0313**	-	-
			(0.0151)			(0.0160)		(0.0159)		
KS3	-	-	-	0.0822	-	-	-	-	-	−0.0665
				(0.0602)						(0.0633)
Adult Low Quals.	-	-	-	0.000591	-	-	-	-	-	0.00742
				(0.0208)						(0.0211)
Income IMD	-	-	-	-	5.939*	-	10.979***	-	7.867*	
					(3.580)		(4.285)		4.279	
Constant	0.642***	2.783**	−0.235	4.974	−0.305	0.296	0.121	2.518*	2.392*	6.489
	(0.239)	(1.337)	(0.214)	(4.165)	(0.278)	(0.278)	(0.310)	(1.367)	(1.388)	(4.537)
N	420	420	420	420	420	420	420	420	420	420
Log-likelihood	-284.936	-282.649	-287,879	-287.58	-288.554	-280.592	-279.109	-280.038	-279.334	-279.759
χ^2	6.11(1d.f.)	9.11(3d.f.)	4.28(1d.f)	3.93(2d.f.)	2.75(1d.f)	11.39(2d.f.)	10.97(2d.f.)	12.42(4d.f.)	11.93(4d.f.)	12.31(5d.f.)

Tab. 5.1: Logit regression: 1 if the council reported using its s137 powers in 2005/2006, 0 otherwise. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

The results on deprivation, therefore, seem to be rather mixed.

Previous research has found that larger councils are more likely to be active in various dimensions, including making more use of their s137 powers, so I now include the number of households in a parish.[15] The deprivation results provide a second reason for considering the role of parish size. One way to characterise the difference between living environment deprivation, and income or educational deprivation, is as a rural/urban distinction; higher rates of living environment deprivation, especially poor housing, are typically found in rural areas and higher rates of income and educational deprivation in more urban parishes.

Models I and II of Table 5.2 confirm that larger parishes are indeed more likely to make use of their s137 powers. More interestingly, models III–VII show that whilst the negative effect of living environment deprivation is robust to controls for parish size, income and education deprivation are no longer significant (although the coefficients on the IMD scores are still positive).

[15] If measures of total population or parish electorate are used instead, the results are very similar.

	I	II	III	IV	V	VI	VII
All hhlds.	$2.43E$-4^{***}	$4.59E$-4^{***}	$3.7E$-4^{**}	$4.27E$-4^{***}	$4.36E$-4^{***}	$2.97E$-4^{***}	$2.79E$-4^{***}
	($6.08E$-5)	($1.40E$-4)	($1.3E$-4)	($1.65E$-4)	($1.61E$-4)	($1.19E$-4)	($9.62E$-3)
All hhlds^2	-	$-3.16E$-8^{*}	$-2.34E$-8	$-2.97E$-8	$-3.05E$-8^{*}	$-1.83E$-8^{*}	$-1.71E$-8^{*}
		($1.83E$-8)	($1.90E$-8)	($1.85E$-8)	($1.83E$-8)	($1.31E$-8)	($1.18E$-8)
Liv. Env. IMD	-	-	-0.0306^{*}	-	-	-0.0364^{**}	-0.0445^{**}
			(0.0168)			0.018	(0.0199)
Educ. IMD	-	-	-	0.0123	-	0.168	-
				(0.0172)		(0.0183)	
Income IMD	-	-	-	-	-0.554	-	7.713
					(0.302)		(6.719)
Constant	-0.232	0.011	0.106	-0.478^{*}	-0.554^{*}	-0.0181	-0.126
	(0.173)	(0.338)	(0.332)	(0.245)	(0.301)	(0.324)	(0.353)
N	420	420	420	420	420	420	420
Log-likelihood	-283.285	-281.324	-278.315	-280.976	-280.878	-277.092	-275.878
χ^2	15.97(1d.f.)	20.67(2d.f.)	22.39(3d.f)	21.16(3d.f.)	2.16(3d.f.)	23.47(4d.f.)	23.48(4df.)

Tab. 5.2: Logit regression: 1 if the council reported using its s137 powers in 2005/2006, 0 otherwise. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

The rural/urban distinction raises a further point. The main urban areas of England are almost entirely unparished.[16] Nationally, the vast majority of the most severely deprived areas are located in these unparished metropolitan areas so the variation in IMD scores across my sample is somewhat muted. For example, the maximum income deprivation score in the sample is 23%, with a mean of 8%, whereas the national maximum is 83%, with a mean of 16%.

However, as government guidance notes, "lack of deprivation does not necessarily equate to affluence" (CLG, 2007). In light of this, and also the suggestion that neighbourhood governance forces neighbourhoods to draw more upon their own resources, I now incorporate a variety of other socio-economic variables. The census provides data on the number of adults qualified to level 3 or above,[17] the number in professional or managerial occupations, the number of owner occupiers and the number of households with a car as possible measures of affluence. I also try two demographic variables: households with dependent children, and adults over the age of 65.

Table 5.3 reports the results of my main specification and two variants. Table G.1 in Appendix G shows that most of the "affluence" variables are insignificant, as is the fraction of households with dependent children. In main specification in the table, I, parish size still has a positive, significant association with the probability that a parish council makes use of its s137 powers, and, as in Table 5.2 the quadratic households term is also still significant and negative. The significant negative association between living environment deprivation and the use of s137 also persists.

The important new features, though, are the highly significant coefficients on the fraction of over 25s qualified to level 3 or above, and the fraction of over 25s who are over 65. Entered linearly, the fraction of adults qualified to level 3 or above is not significant, but adding a quadratic term results in coefficients significant at the 1% level, with the same positive-but-decreasing relationship found with parish size. The coefficient on the fraction of over 65s is also significant at the 1% level and positive. Moreover, incorporating controls for the fraction of highly qualified adults and the fraction of over 65s restores the significance of the positive coefficient on educational deprivation.

As well as being statistically significant, the variables in this specification also seem to be numerically important. Holding all the other variables at their means, a one standard deviation

[16] Despite being recently legalised, there are no parish councils at all in London.
[17] Level 3 is equivalent to 2+ A-levels. The census does not provide separate numbers for individuals at Level 4/5 (higher education) by parish.

increase in the fraction of over 25s qualified to level 3 or above increases the estimated probability of a council using s137 by 5.8 percentage points. Similarly, a one standard deviation increase in the fraction of over 65s increases the estimated probability by 6.8 percentage points. Turning to the deprivation variables, increasing the living environment score by one standard deviation from its mean reduces the estimated probability by 8.5 percentage points, while doing the same for education deprivation increases this probability by 12.8 percentage points.

Specification II substitutes the fraction of the economically active population who are in managerial or professional jobs for the fraction of highly qualified adults. The results are very similar, although educational deprivation is no longer significant. Specification III is the same as I, except that the income deprivation index is used instead of the education one. Its coefficient is positive and somewhat significant (at the 10% level).

The central implication of these results is that parishes that used their s137 powers and those that did not differ systematically. Larger parishes were significantly more likely to use the powers. Areas with lower levels of living environment deprivation, especially poor quality housing, were also more likely to have used them, which may reflect specifically rural deprivation.

Crucially, both the proportion of elderly people and and the proportion of well-educated (or professional) adults in a parish are positively associated with the use of s137. This has potential distributional implications and in Section 5.5 I attempt to explain this result in order to draw out more specific policy conclusions.

5.4 Robustness check—censored regressions

Amongst councils that did make use of their s137 powers there is considerable variation in the amount spent. It would therefore seem sensible to attempt to model this variation too, via a censored regression model. Unfortunately, the data violate the normality assumption required for tobit analysis and it is not possible to implement Powell's Censored Least Absolute Deviations (CLAD) model (Powell, 1984) with the required weightings in available statistical packages. I therefore present only tentative results as a check on the results of the previous section, and use four alternatives to see if any predictions are robust across them: weighted tobit; unweighted tobit; unweighted CLAD; and CLAD estimated using the data multiplied up in (approximate)

	I	II	III
All hllds.	$1.97E\text{-}4^{**}$	$2.05E\text{-}4^{**}$	$2.62E\text{-}4^{**}$
	$(9.85E\text{-}5)$	$(1.08E\text{-}4)$	$(1.19E\text{-}4)$
All hhlds.^{2}	$-9.79E\text{-}9^{*}$	$-9.81E\text{-}9^{*}$	$-1.39E\text{-}8^{*}$
	$(6.12E\text{-}9)$	$(6.67E\text{-}9)$	$(8.42E\text{-}9)$
Frac. L3+	36.128^{***}	-	23.968^{**}
	(12.502)		(10.259)
Frac L3+^{2}	-49.820^{***}	-	-35.607^{**}
	(18.255)		(16.028)
Frac. Mang./Prof.	-	25.678^{**}	-
		(10.801)	
Frac. Mang./Prof.^{2}	-	-26.881^{***}	-
		(10.160)	
Frac. 65+	5.734^{***}	4.847^{**}	4.042^{**}
	(2.224)	(2.167)	(1.95)
Liv. Env. IMD	$-.0485^{**}$	$-.0453^{**}$	-0.0520^{**}
	(0.0200)	(0.0201)	(0.0209)
Educ. IMD	$.0857^{**}$	0.0376	-
	(0.0336)	(0.0334)	
Income IMD	-	-	10.461^{*}
			(6.133)
Constant	-7.784^{***}	-6.913^{**}	-4.923^{***}
	(2.453)	(3.226)	(1.862)
N	420	420	420
Log-likelihood	-267.305	-266.767	-269.584
χ^2	$31.01(7d.f.)$	$30.96(7d.f.)$	$29.38(7d.f.)$

Tab. 5.3: Logit regression: 1 if the council reported using its s137 powers in 2005/2006, 0 otherwise. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

proportion to the weights.[18] The problem with the last of these is, of course, that the standard errors will be far too small.

As the dependent variable, I use the level of s137 spending per elector. Four parishes reported levels of spending well above the legal limit (of £5.30 per elector in the relevant financial year). I replace their reports with the maximum allowable, although excluding them has no substantive effect on the results.[19] It could be argued that the total amount spent would be a more appropriate measure, since s137 spending may have public good aspects. However, it need not be used for actual public goods—the requirement is for the benefit to be "commensurate" to the amount spent. Moreover, since the main source of income for many parishes is the precept, and parishes vary enormously in size, the per elector amount is a better reflection of "tax effort".

The first two columns of Table 5.4 give results from weighted and unweighted tobits respectively. Diagnostic tests suggest that these are problematic. The Pagan and Vella (1989) test against the null hypothesis homoscedasticity have p-values of 0.0063 for the weighted model and 0.107 for the unweighted. We therefore reject homoscedasticity for the weighted model, and it is doubtful for the unweighted. To test for normality, I use Drukker's (2002) tobcm Stata routine which implements the Vella and Pagan tests with bootstrapped standard errors to correct for the possibility that the original tests may be oversized in small samples. Even doing this, the null of normality is strongly rejected with p-values less than 0.0001.

The CLAD models should therefore be preferable. However, the reliability of the unweighted CLAD is cast into doubt by the fact that the sizes and significance levels of some of the coefficients vary noticeably between the weighted and unweighted tobit models. Moreover, the "frequency weighted" version uses a severely inflated sample—although note that the reported (bias-corrected) confidence interval is 99.99% rather than 95%, to partially compensate for this.

Bearing these caveats in mind, it is still useful to compare the estimates across the four columns of Table 5.4. The first thing to note is that the estimated coefficients on the proportion of adults qualified to level 3 or above are positive and significant across the four specifications, while the quadratic high qualifications term is negative and significant. The two tobit specifications and

[18] In effect, this treats the probability weights as frequency weights. It is only approximate because I round the weights to keep the resultant "sample size" computationally manageable.

[19] One council reported a total s137 spend that implied a per elector amount over 4 times the legal limit.

	Tobit (prob. weights)	Tobit (unweighted)	CLAD (unweighted)	CLAD ("frequency" weights)
All hhlds.	$1.371E$-4	$9.97E$-5^{**}	$5.74E$-5	$3.70E$-6
	($9.76E$-5)	($5.00E$-5)	($-2.54E$-5 - $2.57E$-4)	($-3.28E$-5 - $5.59E$-5)
All hhlds.^{2}	$-9.98E$-9	$-5.23E$-9	$-3.10E$-9	$2.28E$-10
	($9.18E$-9)	($3.67E$-9)	($-2.23E$-8 - $4.69E$-9)	($-5.86E$-9 - $5.49E$-9)
Frac. L3+	35.177^{***}	23.616^{***}	6.123	4.982
	(9.480)	(7.47)	(0.589 - 101.587)	(3.135 - 7.931)
Frac. L3+^{2}	-45.785^{***}	-31.309^{***}	−9.242	−5.974
	(13.704)	(10.689)	(−196.679 - −1.441)	(−10.878 - −2.766)
Frac. 65+	4.031^{***}	1.838^{*}	0.299	0.689
	(1.538)	(1.096)	(−0.841 - 2.267)	(0.129 - 1.200)
IMD Liv. Env.	-0.0318^{**}	−0.00719	0.00170	−0.00563
	(0.0138)	(0.00939)	(−0.0175 - 0.0208)	(−0.0150 - −0.00260)
IMD Educ.	0.0735^{***}	0.0451^{**}	0.00682	0.00988
	(0.0229)	(0.0179)	(−0.0192 - 0.0366)	(0.00768 - 0.0157)
Constant	-7.941^{***}	-5.198^{***}	−1.148	−1.048
	(1.941)	(1.531)	(−16.000 - −0.0518)	(−1.738 - −0.699)
Sigma	1.388868	1.315605		
	0.1563879	0.0645556		
N	420	420	420	7150
Log-likelihood	-8301.435	-522.60202		
F(7,413)	3.72			
LR $\chi^2(7)$		20.18		

Tab. 5.4: First 2 columns: tobit regression of reported per elector s137 spending, capped at legal limit (£5.30). In column 1, sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level. Third and fourth columns: CLAD regression of reported per elector s137 spending, capped at legal limit (£5.30). Column 3 unweighted. Column 4 "frequency weighted" using rounded probability weights. Bias corrected standard errors in parantheses. Column 3—95% confidence interval. Column 4—99.99% confidence interval.

the "weighted" CLAD also find positive significant coefficients for the fraction of over 65s and education deprivation, but neither of these are significant in the unweighted CLAD. Lastly, living environment deprivation has a negative significant coefficient in the weighted tobit and clad, but is insignificant in both unweighted specifications.

Overall, I interpret these results as giving some support to the logit results, especially the significance of highly qualified adults. However, I would not want to draw any distinct conclusions about variations in the amount spent by councils who use s137 without more data.

5.5 Interpreting the results

In section 5.3 I found a positive, significant relationship between both the fraction of adults with high levels of education and the fraction of over 65s in a parish, and the use of s137 powers by the parish council. In this section I propose two related, but importantly distinct, possible explanations for this observation and attempt to distinguish between them empirically. The main purpose of this exercise is to inform policy recommendations; if more reliance is to be placed on neighbourhood governance, as things stand citizens in parishes where there are more well educated people and more older people seem likely to benefit more, potentially exacerbating, rather than compensating for, existing inequalities in national public service provision. Altering the demographic make-up of neighbourhoods is probably not a practical solution, but a better understanding of the role of these demographic groups may mean policy can, if necessary, be adapted to compensate. I discuss possible policy responses in section 5.6.

A possibility which I do not explore is that the relationship between parish demographics and differences in parish council behaviour might be the result of a Tiebout-type sorting process in which older and better educated people choose to live in areas with parish councils which (for exogenous reasons) are more likely to make use of their well-being power. There may in fact be some sorting, but it is unlikely to be very widespread, given the number of other considerations that influence location decisions and the relative insignificance of parish council taxes and spending.

As I discuss in more detail below, age and, especially, education have consistently been found to be positively associated with various forms of political and civic participation. Both my proposed interpretations are closely linked to this observation. I begin this section by describing a

data set on parish council elections, and looking briefly at what it can tell us about the "politics" of parish governance. I then set out my two hypotheses in the context of the existing literature and discuss my empirical strategy. In section 5.5.2 I use the parish council elections data to attempt to distinguish between them. It is worth stressing that our understanding of the political economy of neighbourhood governance is quite limited. The theoretical underpinnings of the hypotheses in this section are therefore somewhat loose. In section 5.7 I explore in depth the features a model of neighbourhood governance should incorporate, and set out a number of key open questions.

5.5.1 Theoretical and empirical background

Political Heterogeneity

In this section I use data collected by Woods et al: "Elections to Town, Parish and Community Councils in England and Wales, 1998–2000".[20] Excluding incomplete records, it covers 5302 parishes, and elections conducted from 1998 to 2000. For each parish it provides information on (amongst other things): the number of seats on the parish council; the ratio of electors to seats; and whether there were too few, exactly enough, or more than enough candidates for the seats.

Whilst parish councils are formally the lowest tier of democratic government in those areas where they exist, it does not necessarily follow that we can analyse them in the same framework as other more frequently studied democratic bodies. The data have two particularly striking features. The first is that competitive elections (i.e. ones in which there were more candidates than seats) only occurred in 28.9% of the parishes surveyed. Assuming policy choices are the outcome of a conventional democratic political contest may therefore be misleading.

Second, 27.4% of parishes had exactly as many candidates as seats (with the remaining 43.7% having fewer candidates than seats). This suggests that there may be something special about the "sufficient candidates" outcome. If it was simply a point on a continuum between no candidates and a large number of candidates, one might expect only quite a small number of parishes to fall into this category.

There is qualitative evidence to support the idea that having exactly the right number of candi-

[20] Collected by Woods, Edwards, Anderson, Fahmy and Gardner, based in the New Political Geographies Group of the Institute of Geography and Earth Sciences at the University of Wales, Aberystwyth, as part of the ESRC-funded project "Participation, Power and Rural Community Governance in England and Wales", award number L215252052.

dates should be treated as a distinct outcome, and also that the decision to stand as a councillor may well not be the same in all parishes. Competitive elections are common in larger town councils where major national parties will often put up candidates for most, if not all, seats. They also sometimes occur in smaller parishes in response to particular conflicts. Conversely, Woods et al (Woods et al, unpublished) note that many parish councils are essentially apolitical, and in some "many, if not the majority, of councillors have stood for election in order to fill a vacant seat rather than in order to... oust an incumbent", and some have withdrawn "when they have judged another candidate to be better qualified". Hence, the absence of competitive elections need not reflect a shortage of candidates, or even a shortage of good candidates—and in small communities competitive elections may in fact be a sign of conflict.

I now look briefly at the statistical associations between my key SES variables - the proportion of adults educated to Level 3 or above, and the proportion over 65 - and the availability of candidates. Table 5.5 reports the results of two logits. The dependent variable in the first is whether a parish had at least as many candidates as seats, while that in the second is whether a parish had more candidates than seats, and hence a competitive election. In both, I control for the ratio of electors to seats. Given that the electorate form the pool of eligible candidates, it is perhaps unsurprising that a higher ratio is associated with a higher likelihood of there being (at least) enough candidates.

The results suggest that SES-variables also influence the availability of candidates, although the exact relationship seems not to be entirely straightforward. The coefficient on the proportion of highly qualified adults is positive and highly significant in the first model, and somewhat significant in the second. On the other hand, the proportion of older citizens is insignificant in the first, but highly significant in the second.

Since the election variable in fact takes three possible values, and given the differences between the results in the two logit models, it makes sense also to consider a multinomial logit model. The results of Table 5.6 clarify the pattern suggested by Table 5.5. First, the ratio of electors to seats is always significant in each of the three possible two-way comparisons. However, while increasing the ratio increases the probability that there will be a competitive election, it *reduces* the probability that there will be exactly enough candidates. This is consistent with (though obviously is not a test for) the idea that small, close-knit communities may coordinate parish council

	At least as many candidates as seats	Strictly more candidates than seats
Electors:Seats	0.00178***	.00399***
	(0.00020)	(0.000273)
Frac. L3+	1.233***	0.642*
	(0.335)	(0.370)
Frac. 65+	0.00346	2.572***
	(0.453)	(0.494)
Constant	−0.351**	−2.308***
	(0.173)	(0.197)
N	5302	5302
Log-likelihood	−3598.111	−2904.894
χ^2	81.91(3$d.f.$)	246.47(3.$d.f.$)

Tab. 5.5: Logit regression: 1 if the council had at least as many candidates as seats (first column), or strictly more candidates than seats (second column), 0 otherwise. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

	Base: exactly sufficient
Insufficient	
Electors:Seats	1.80E-3***
	(4.56E-4)
Frac. L3+	−1.202***
	(0.405)
Frac. 65+	1.635***
	(0.565)
Constant	0.268
	(0.213)
Contested	
Electors:Seats	5.26E-3***
	(4.98E-4)
Frac. L3+	−0.0847
	(0.449)
Frac. 65+	3.594***
	(0.615)
Constant	−1.493***
	(0.240)
N	3502
Log-likelihood	-5455.5398
χ^2	261.92(6$d.f.$)

Tab. 5.6: Multinomial logit regression. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

membership.

The proportion of highly qualified adults is positively associated with having either exactly enough or more than enough candidates rather than too few. However, this proportion is insignificant in the comparison between areas with exactly enough candidates, and more than enough candidates.

Lastly, the proportion of older citizens fits the same pattern as the ratio of electors to seats. The positive coefficient found in the ordered logit model is driven by the comparison between parishes with too few candidates, and those with more than enough. The proportion of over 65s is actually *negatively* associated with the likelihood of having exactly the right number of candidates rather than *either* more than enough, or too few. Overall, I conclude that SES-variables do seem to affect the availability of parish councillors, especially the proportion of highly qualified adults.

I now go on to exploit the variation in the political situation between different parishes to better understand the impact of SES variables on the use of s137 powers. As I discuss below, both age and education have been found to be associated with political participation. However, clearly the most common form of political participation—voting—is only possible if competitive elections are held. The fact that some, but not all, parishes have competitive elections allows me to look in detail at what, if any, role variations in citizens' willingness to participate has in explaining variations in the use of s137.

Electoral Pressure Hypothesis

There is a considerable amount of empirical work on the socio-economic and demographic covariates of participation in politics as well as in non-political community activities. The largest body of evidence relates to voter turnout. Evidence from the US (Wolfinger and Rosenstone, 1980) indicates that education is by far the largest and most reliable predictor of whether a citizen votes. Blais' (Blais, 2000) survey of the international evidence concurs, though age, income, religiosity, marital status and union membership have significant effects too.[21] Wolfinger and Rosenstone argue for a resource-based interpretation of their results, suggesting that the better educated are more accustomed to dealing with both abstract concepts and bureaucracy, and so find political participation easier. Verba, Schlozman and Brady (1995) also find that more affluent citizens are

[21] Other references include Bennett and Bennett (1986); Conway (1991); and Milbrath and Goel (1983)

more likely to participate in a range of other political activities.[22]

One possible hypothesis, then, for why parish councils in parishes with a higher proportion of educated (or affluent) adults and older citizens are more likely to exert effort to use their s137 power is *electoral pressure*. This hypothesis supposes a simple Barro-type (Barro, 1973) electoral discipline model with heterogenous citizens. In particular, older citizens and those from higher SES groups are more likely to vote, and perhaps also to be informed about the effort councillors have put in and so able to follow a disciplining strategy. Councillors would prefer not to have to exert effort arranging and monitoring general well-being spending, but derive benefits from being in office. Therefore, those who expect to face a competitive election are more likely they are to exert effort, and, *subject to facing competition*, the higher the proportion of educated and older citizens the more likely they are to exert effort.

Clearly, one would want to endogenise the (perceived) likelihood of competitive elections. I do not do so here, though I discuss in section 5.7 factors that might need to be taken into account when endogenising the existence of competitive elections. For now, I simply assume that whether a council has competitive elections is exogenous and predicted by past experience (so if a councillor won an election to get in to office, she expects to face an election at the end of her term).

The key implication of the electoral pressure hypothesis is that "politically active" demographic groups - the educated (or affluent) and the old - exert influence via the electoral process. It follows that if there are too few candidates (or, strictly, if councillors expect there to be too few candidates) for a competitive election SES variables have no impact. To test for this, I add a dummy variable for whether or not a parish reported competitive elections in the electoral survey to the data set on the use if s137. I run the regression:

$$Prob(s137_i = 1) = \frac{Exp(\beta_1 comp_i + \beta 2 comp_i \times SES_i + \beta_3 SES_i + \beta_4 \mathbf{x}_i)}{1 + Exp(\beta_1 comp_i + \beta_2 comp_i \times SES_i + \beta_3 SES_i + \beta_4 \mathbf{x}_i)} \tag{5.1}$$

where $s137_i$ is equal to 1 if council i used its s137 powers and 0 otherwise, $comp_i$ is a dummy variable equal to 1 if a council had competitive elections and 0 otherwise, SES_i is a vector of SES

[22] Amongst those who donate/participate, the more affluent give not only more money but also a higher proportion of their income than the less affluent. This is particularly interesting, because low income people who donate to church give a much higher proportion of their incomes than those on higher incomes, while donations to charity are roughly proportionate.

variables (education and age) and $\mathbf{x}_i$ is a vector of other controls.

The electoral pressure hypothesis has two predictions. First, there should be a positive interaction between $comp_i$ and SES_i. Second, if $comp_i$ is interacted with SES_i, the independent explanatory power of SES_i should be reduced relative to that found in section 5.3.

Capacity Hypothesis

While perhaps electoral pressure is the natural interpretation of the evidence for greater use of s137 in parishes where more of the population belong to politically active demographic groups, it is not the only possibility. As we saw above, competitive elections only occur in a minority of parishes, whilst a sizeable fraction of parishes have exactly the right number of candidates standing for the available seats - and almost half cannot recruit as many councillors as seats.

An alternative explanation is that, rather than exerting pressure via the ballot box, educated (or affluent) and older citizens tend to increase parish council activity because they participate directly.

Turning to the literature, while voting is the most widespread form of political participation, qualitatively it is in many ways atypical. I noted above that Verba, Schlozman and Brady (1995) found more affluent citizens were more likely to get involved in various kinds of campaigning and also to serve on local government boards. Gallego (2008) presents similar results based on European data.

Alesina and La Ferrara (2000) study participation in non-political community associations (e.g. religious organisations, sports clubs, trade unions). Their data show that at the individual level, age, education, income and being male are also all significant predictors of higher levels of these forms of participation.[23]

There is also evidence on the demographic characteristics of councillors elected to principal local authorities. It is probably misleading to group acting as a councillor with the other forms of political "participation" discussed—the position may be well paid[24] and, although of course candidates

[23] They also find that being in employment and having school-age children predict higher participation. They then go on to test for the existence of additional effects due to population heterogeneity per se, and find that (ceteris paribus) participation rates are lower in more racially fragmented and economically unequal communities.

[24] Councillors in leadership positions in large authorities may be paid upwards of £60k per year, though backbench councillors and those in smaller authorities typically receive much less.

volunteer, many will face serious electoral challenges. Despite this, it is interesting to note that the NFER report on the 2008 National Census of Local Authority Councillors (National Foundation for Educational Research, 2009) found familiar socio-economic and demographic patterns amongst principal authority councillors: they are disproportionately white, male, old and well-educated.[25]

As Wolfinger and Rosenstone (1980) argue, a possible reason for higher participation rates amongst well-educated and professional citizens may be that they face lower costs of dealing with abstract ideas and bureaucratic procedures. An alternative (or additional) possible explanation is that education transfers participatory values to individuals, so they derive psychological benefits from civic participation. Similarly, it has been suggested that higher rates of participation amongst the old may reflect either lower costs (due to more spare time, and perhaps more experience), or generational differences in civic values—or both.

My *capacity* hypothesis treats parish councils essentially as voluntary organisations. The hypothesis combines two claims. The first is that citizens from more politically active groups are more likely to be willing to serve as parish councillors, and also more likely, once in post, to be more willing to exert effort to provide more services. The second claim is that this translates from the individual level to the parish level—i.e. having a higher proportion of citizens from politically active groups makes it more likely that the parish council will be composed of individuals with the resources and enthusiasm to take action to improve "general well-being". In other words, the proportion of citizens from these groups is, in part, a proxy for the availability of willing volunteers to take part in local governance.

Under this hypothesis, I do not distinguish between parishes with exactly as many candidates as seats and those with more candidates than seats. This is because, as discussed above, it seems that at least in some parishes having exactly the right number of candidates may reflect coordination rather than a shortage of volunteers.

To test the "capacity" hypothesis, I simply incorporate a dummy variable for whether or not

[25] 68.4% were male and 96.6% white, compared to 48.7% and 89.3% respectively in the adult population of England. 86.8% of councillors were aged 45 and over, compared to 51.9% of all adults and 43.5% of councillors were retired, even though pensioners only make up 22.3% of the population as a whole. 51.1% of councillors have at least a degree level qualification, compared to 28.8% of adults.

a parish had at least as many candidates as seats into the specification from section 5.3 i.e.:

$$Prob(s137_i = 1) = \frac{Exp(\gamma_1 enough_i + \gamma_2 SES_i + \gamma_3 \mathbf{x}_i)}{1 + Exp(\gamma_1 enough_i + \gamma_2 SES_i + \gamma_3 \mathbf{x}_i)} \tag{5.2}$$

The hypothesis predicts a positive coefficient on *enough* - a dummy variable for whether parish i had at least enough candidates to fill all its seats - and that incorporating the dummy for *enough* will reduce the explanatory power of the SES variables.

5.5.2 Results

In this section I use the s137 data combined with information on elections to attempt to distinguish between the electoral pressure and capacity hypotheses. Column I of Table 5.7

	I	II	III	IV	V	VI	VII	VIII	IX	X
Enough	-	0.533**	0.443*	0.448*	0.456*	0.507**	-	-	-	-
		(0.253)	(0.259)	(0.259)	(0.268)	(0.265)				
Competitive	-	-	-	-	-	-	0.169	0.0915	−1.087	−0.532
							(0.274)	(1.514)	(1.58)	(1.526)
All hhlds	1.98E-4**	-	4.48E-4***	4.45E-4***	1.90E-4**	2.49E-4*	1.82E-4**	4.32E-4***	1.75E-4**	2.37E-4*
	(9.85E-5)		(1.58E-4)	(1.64E-4)	(8.6E-5)	(1.30E-4)	(1.02E-4)	(1.66E-4)	(9.72E-5)	(1.49E-4)
All hhlds.^{2}	−9.9E-5*	-	−3.27E-8*	−3.08E-8	−1.08E-8*	−1.49E-8	−9.52E-9*	−2.93E-8	−8.97E-9	−1.32E-8
	(6.12E-9)		(1.84E-8)	(1.89E-8)	(7.35E-9)	(2.05E-8)	(6.89E-9)	(1.89E-8)	(8.15E-9)	(1.98E-8)
Frac. L3+	36.128***	-	-	17.8*	35.033***	24.277**	36.084***	20.217**	37.047***	26.724**
	(12.502)			(9.545)	(12.562)	(10.436)	(12.508)	(9.896)	(12.591)	(10.501)
Comp. x Frac L3+		-	-	-	-	-	-	−1.821	−0.382	−1.069
								(3.197)	(3.20)	(3.164)
Frac L3+^{2}	−49.820***	-	-	−27.857*	−48.643***	−35.690**	−49.806***	−30.804**	−50.060***	−38.894**
	(18.255)			(15.437)	(18.49)	(16.373)	(18.27)	(15.505)	(18.309)	(16.12)
Frac. 65+	5.734***	-	-	3.727*	5.695***	4.226**	5.629**	2.42	3.735	2.313
	(2.224)			(2.007)	(2.154)	(2.104)	(2.228)	(2.571)	(2.735)	(2.669)
Comp. x Frac. 65+		-	-	-	-			2.645	5.622	4.379
								(3.995)	(4.176)	(4.034)
Liv. Env. IMD	−0.0485**	-	-	-	−0.0502**	−0.0543***	−0.0485**	-	−0.0509**	−0.0540**
	(0.02)				(0.0204)	(0.0209)	(0.02)		(0.02)	(0.0212)
Educ. IMD	0.0857**	-	-	-	0.0817**	-	0.0849**	-	0.0909***	-
	(0.0336)				(0.0332)		(0.0336)		(0.0341)	
Income IMD	-	-	-	-		10.664*	-	-	-	10.915*
						(6.100)				(6.196)
Constant	−7.784***	−0.222	−0.628**	−4.176***	−7.868***	−5.312***	−7.779***	−4.101**	−7.97	−5.075***
	(2.453)	(0.200)	(0.251)	(1.84)	(2.421)	(1.879)	(2.448)	(1.693)	(2.441)	(1.904)
N	420	420	420	420	420	420	420	420	420	420.000
Log-likelihood	-267.305	-287.08	-278.954	-274.406	-265.042	-266.746	-267.031	-275.634	-265.635	-268.082
χ^2	31.01(7d.f.)	4.44(1d.f.)	24.04(3d.f.)	28.38(6d.f.)	32.85(8d.f.)	31.68(8d.f.)	30.89(8d.f.)	27.46(8d.f.)	32.96(10d.f.)	30.68(10d.f.)

Tab. 5.7: Logit regression: 1 if the council reported using its s137 powers in 2005/2006, 0 otherwise. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

simply repeats model I from Table 5.3 for comparison.

Beginning with the electoral pressure hypothesis, columns VIII–X report the results of regressions based on (variations on) equation 5.1. The data does not seem to support this hypothesis. The interactions between the dummy variable for competitive elections and the SES variables are insignificant, and while the point estimate for the interaction with the fraction of over 65s is positive, that for the interaction with the fraction of well educated adults is negative (and very small). The dummy for competition itself is also insignificant, and has a negative point estimate.

Column II–IV build up to columns V and VI which reports results from the second, simpler electoral model - that based on the capacity hypothesis (from equation 5.2). The evidence seems to be more supportive of this hypothesis. The coefficient on *enough* is positive and somewhat significant n all these specifications, while the coefficients on the SES variables are reduced a little relative to those in the baseline specification in column I. Turning to the marginal effects, holding other variables at their means, moving from $enough = 0$ to $enough = 1$ in the main model, column V, increases the predicted probability a parish uses s137 by 9.9%, which is quite substantial. The effect of a one standard deviation increase in the fraction of adults qualified to level 3 or above falls from 5.8% to 5.1% when we incorporate the *enough* dummy. The effect on the age variable is less noticeable, though, only falling very slightly from 6.8% to 6.7%.

Column VII uses the same model as V, except that the dummy for *enough* is replaced by one for whether a parish had competitive elections. Parishes for which the dummy is equal to 0 therefore include not only those that could not fill all their seats but also those with exactly the right number of candidates. The dummy for competitive elections is insignificant here too, though consistent with the capacity hypothesis, the results are similar, but smaller in magnitude, to those in column V.

It seems, then, that at least part of the explanation for greater use of s137 powers in parishes with more educated and older citizens may be that these groups are more willing and able to participate in local governance. Of course, the evidence here is only suggestive and before drawing firm policy conclusions one would want to repeat this analysis with a larger data set, as well as, ideally, developing a fuller model of neighbourhood governance along the lines discussed in sec-

tion 5.7 below. Nevertheless, in the next section I go on to propose possible policy responses to what, on the basis of this analysis, appears to be an unequal distribution of political-administrative capacity.

5.6 Policy implications

Councils applying for unitary status are required to "deliver clear and accountable community... governance arrangements" because "to enable genuine empowerment there needs to be devolution of power down to local communities" (DCLG, 2006). However, as discussed in the introduction, many parish councils do not make use of the wide range of powers they already have.

The results of this chapter suggest that the communities that do not make use of their s137 powers tend to be those with low levels of political-administrative capacity, and possibly also higher levels of some kinds of deprivation. Without intervention, these communities might reasonably be expected also to benefit less from their new general well-being power in the future. There is a parallel here with the trade-off highlighted in chapter 3—once we allow for the fact that capacity is likely to vary between local areas, the potential benefits of more localised policy making from meeting citizens' needs more accurately have to be weighed against increased variation in the quality of policy making and implementation.

There are three, not necessarily mutually exclusive, approaches one could take to tackling the inequalities in capacity between parishes: lower the administrative barriers faced by all parishes; improve the "capacity" available to low-capacity parishes; or allow parishes to out-source some activities.

The evaluation of the use of the well-being power notes that its "complexity... the combination of considerable discretion with a list of exceptions" (CLG, 2008) reduced take-up. The most obvious instance of this is the prohibition on using the power to raise revenue. Having stated this as a blanket prohibition, the guidance then notes that the power "does not... in any way restrict eligible councils' existing powers to do so" and moreover that "where councils use the power for a different purpose, but incidentally receive income as a result, that does not, in the Governments view, amount to raising money" (CLG, 2009). Given that principal local authority legal officers found this daunting, it seems likely that some parishes will be put off using the power. One option

would be to abolish the restriction. Given that parishes must meet an electoral test, as well as have a qualified clerk, before they can use the power, it is not clear what the social value is of central government attempting to dictate how parishes raise revenue.

There may be other, less radical ways for central and local government to reduce parish councillors' need for legal and bureaucratic experience. In the case of the well-being power, providing simple guidance on activities that are definitely permitted might help, as would arrangements for parishes to run proposals past a legal expert (for free). More generally, simplifying administrative requirements and providing replicable examples of activities undertaken by other councils might make some councils more active. However, there are clearly limits imposed by the need for parishes to exercise their statutory powers in a competent, accountable manner.

Turning to the possibility of increasing the capacity available to parishes, there are reasons to expect this to be harder in the case of parish councils than principal local authorities. Firstly, local authorities have full-time, paid officers. Most parish councils have a part-time, sometimes unpaid, clerk and rely much more heavily on councillors themselves, all of whom are volunteers and many of whom have other jobs. It is consequently much easier to provide training for officers—and failing that an authority can try to recruit individuals with higher skills, if necessary offering higher pay. Second, (with the exception of the very largest town councils) parishes have smaller—often much smaller—pools of individuals on which to draw.

One possibility would be for each principal local authority to help to recruit, and possibly also subsidise the salaries of, a well-qualified administrative team with good legal knowledge to assist under-resourced parishes. A number of parishes already share clerks. The gains from such an approach might be limited by the difficulty of finding objective, non-game-able criteria for deciding which parishes were entitled to assistance, and there might be a loss if new administrators had less highly localised knowledge.

Relatedly, DEFRA has suggested that parishes pool their resources by forming "clusters". This has happened in some areas. However, if parishes are diverse, then clustering is likely to defeat the original objective of allowing communities to tailor services to local needs. Moreover, standard political economy concerns about the willingness of wealthier, better resourced communities to join

with the more disadvantaged suggest that clustering is unlikely to help low capacity communities to draw on the resources of the better-off. Hence, any benefits of clustering will largely be derived from scale effects.

The third approach is to allow parishes to "out-source" capacity-intensive activities. One service that is commonly devolved from principal authorities to parishes is grass-cutting. In a small number of cases, though, the transfer works the other way with parish councils paying their principal local authority to include parish amenity areas in their maintenance work. Some parish charters drawn up by new unitary authorities state that where devolution of services is not appropriate, arrangements should be made to allow parish councils to have more input into service design. There is currently little evidence of concrete action on these pledges, but the grass-cutting example suggests a possible, more ambitious model in which principal authorities offer a "menu" of services to parish councils. Those parish councils that lack the capacity to undertake many activities themselves could choose to become democratic commissioning bodies, and would only need to select their preferred services and calculate the corresponding precept, while those that wanted to go beyond the "menu" would still have the necessary powers to do so.

Of course, councils in some parishes are already willing and able to provide the services they desire autonomously. It would be wasteful for principal authorities to exert effort assisting these councils. Assessing whether a principal local authority was providing a reasonable level of support to parishes seems a natural task for the Audit Commission.

5.7 Neighbourhood governance: discussion and open questions

The approach taken in this chapter is primarily policy-focused and non-structural. This is partly because I am interested in addressing the potential consequences of a significant current policy agenda. However, it also reflects two limitations. The first, stressed in Section 5.2, is the limited amount of available data. It would be desirable to repeat the foregoing analysis with a larger, more carefully sampled data-set with more detailed information on aspects of need and financial resources. To test the capacity hypothesis more directly, it would also be useful to collect data on the characteristics of individual parish councillors (and council candidates).

The second limitation is theoretical. Currently no structural model exists to explain the level

of service provision chosen by different parish councils. Such a model would be useful not only in developing policy for parish councils, but also for the neighbourhood governance agenda more broadly. A better understanding of the operation of, and reasons for the variations between, parish councils could improve the design of new neighbourhood institutions and also help to clarify what neighbourhood governance can be expected to achieve.

In this section I look at existing literature that might inform a full model of parish councils and also set out some key open questions. There are two main strands of literature that are relevant to parish councils: a limited, largely qualitative, literature on the operation of parish councils; and work on aspects of the political economy of democratic government, and on donations of time and money to the provision of public goods.

Parish councils all operate under the same statutory framework. The main conclusion that emerges from the literature on parish councils, though, is that there is substantial variation between parishes in both the external conditions under which they operate, and the way they operate. Most obviously, the populations they serve vary hugely in size from small villages, or even hamlets, to substantial towns—Weston-super-Mare town council serves a population of around $72,000$. Jones, Burnley, Cox and Newman (2005) discuss five other features.[26] First, while most councils have very small budgets, some councils raise and spend large sums—they cite Swanley Town Council which spent £3.2m in 2004. This partly reflects a variation in the tax bases of different parishes due to differences in both total population and levels of wealth. Second, although most parishes finance most of their activities via the precept, examples can be found of a wide range of other income sources, including service charges for leisure facilities and caravan parks, rental income, payment from principal local authorities for devolved services, and grants from both principal local authorities and other bodies. The availability of these other income sources is partly, but clearly not entirely, exogenous.

Turning to the details of spending, staffing resources vary greatly between councils. Most councils only have one member of staff, with many relying on a voluntary clerk, or one paid for only a few hours a week. At the other extreme, larger town councils may have more than fifty full-time employees. Councils obviously also differ in the scale and nature of services they provide. Jones

[26] Similar points are made in Derounian and Skinner (2006).

(2007) notes that often smaller councils "because of limited capacity or modest aspiration, act mainly or solely as local forums". On the other hand, many councils do provide significant services, including recreation facilities, environmental maintenance and cemeteries.

The last important variable Jones et al highlight is the relationship between local councils and their principal local authorities. The attitude of the principal local authority seems to affect the number of councils applying for Quality status (Jones and Newman, 2006), as well as the existence and scale of service devolution and the resolution of "double taxation" issues.[27]

Woods et al (unpublished) also stress the significance of "political" differences between parish councils. They observe that in fact many parish councils are essentially apolitical. In a lot of smaller councils "many, if not the majority, of councillors have stood for election in order to fill a vacant seat rather than in order to... oust an incumbent", and some have withdrawn "when they have judged another candidate to be better qualified". Likewise, "many of the key issues that affect (and divide) the residents of larger communities... are not apparent".[28] They suggest that these councils may be usefully viewed as embedded in what Putnam (1993) describes as "horizontal networks" in which "information flows more freely... that through the vertical networks that are characteristic of wider-scale structures of governance".

However, they also caution that sometimes councillors may place too much reliance on informal social networks and interactions. They cite findings from Gardner (2003) that in some parishes where councillors claim to learn community preferences via informal networks in fact "a substantial proportion of local residents are confused as to the role and functions of local councils... and in some cases are altogether unaware that they are served by a parish, town or community council", raising the question of whether councillors are in fact only "accountable to... their social network".

It seems likely that a good model of parish councils should explain choices about service provision as a function of: the financial resources available to a parish; its physical circumstances;

[27] Principal authorities are able, and often required, to provide some of the services that parish councils are empowered to provide. "Double taxation" occurs when a parish council chooses to fund and provide a service in its parish, whilst the principal authority provides it in the rest of the district/county, but the principal authority does not reduce the parish's tax to reflect its reduced service provision. The unwillingness of principal authorities to address double taxation obviously reduces the incentive for a parish council to provide a service, even if local provision would be superior.

[28] In light of this, they criticise current government policies (such as the Quality Town and Parish Council Scheme) for being "aspatial", assuming that good parish councils will resemble good national-level democracy writ small with vigourously contested elections and pro-active public engagement.

service provision, and willingness to devolve services, on the part of the principal local authority; and the characteristics and preferences of the citizens. The roles of most of these factors are, at least conceptually, reasonably straightforward.[29] However, more work is required on the role of preferences and their translation into policy choices. The political economy literature can help to frame three related open questions in this area.

The first open question is how, if at all, individual preferences over parish taxation and spending decisions are likely to be affected by, and might be measured in, the parish context. Clearly one issue is that parishes are somewhat restricted in the actions they can take. The well-being power now provides considerable freedom over types of spending, but they cannot, for example, engage in direct financial redistribution—though they can of course spend the precept on things that benefit certain groups more than others.

However, the fact that an individual will (or will not) value a given service more than their tax cost[30] may not be enough to explain their policy preferences. The evidence on contributions to public goods in general suggests that many people's preferences are not strictly egoistic, but are instead consistent with the "impure altruism" model in Andreoni (1989)[31]—they do not benefit directly from the utility of others, but rather from the "warm glow" they derive from personally contributing to others' consumption.

Further work has tried to understand more about the extent of (impurely) altruistic preferences. Strömberg (2006) finds evidence for within-family altruism in the budget choices of Swedish municipalities. Cutler, Elmendorf and Zeckhauser (1993), however, find evidence at the county level but *not* at the state level for what they describe as a "community preference" model in which higher proportions of young, old and non-white people, who are the main beneficiaries of local spending, increase public spending even if the median voter is not a beneficiary. Lastly, Alesina, Baqui and Easterly (1999), Poterba (1996) and Luttmer (2001) all find that increased ethnic frag-

[29] They will not necessarily be easy to operationalise, though. In the case of financial resources, good data exists on the tax base, and in principal could be collected on parish asset ownership. The accessibility of grant funding, however, is not directly observable—though proxies such as eligibility for specific grants, and variations in principal local authorities' policies on grants to parishes could be used. The suitability of principal local authority services for a particular parish is also not directly measurable, but seems likely to be lower if (a) the councillor representing the parish does not belong to the majority group on the council and/or (b) the parish is atypically rural (or urban) compared to the rest of the area.

[30] For example those without a car or with mobility problems will have more use for a community bus scheme than car owners.

[31] For more on models of donations to public goods see, e.g., Roberts (1984) and Bergstrom, Blume and Varian (1986).

mentation lowers spending on public goods.

While ethnic fragmentation is not an issue for most parish councils, this evidence seems to suggest that public spending preferences may depend on the identities of those affected. A natural related question, especially in light of Cutler et al's findings, is whether people are more willing to pay for benefits to others in smaller parishes.[32]

The second main open question is how to model the translation of citizens' preferences into parish council policy choices. An important element of this, emphasised in earlier sections, is that unlike most tiers of government parish councillors usually have few if any support staff so individual participation costs are likely *jointly* to affect both who stands as a councillor and what level of services those elected (or co-opted) provide.

The baseline political economy account of the translation of voter preferences to government policy is the median voter model that originated with Downs (1957). This model (and its various extensions) assumes the existence of political actors who choose a policy platform to maximise their chances of winning office. It is not clear how applicable this is to the parish context. First, the material rewards of being a parish councillor are negligible, or even negative. Second, I think an adequate account of (especially smaller) parish councils needs to treat explicitly the fact that candidates are not exogenous political actors but are drawn from the parish population.

Dissatisfaction with the assumption of an exogenous political class motivated a second, potentially more relevant, class of political economy models. Beginning with Osborne and Slivinski (1996) and Besley and Coate (1997), citizen-candidate models assume that any citizen can choose to (incur a cost and) stand for office. The basic models are atemporal and assume that if elected a citizen will simply implement her most preferred policy from the available set.[33] There is typically an equilibrium in these models, though it may not be unique.

A citizen-candidate type model might well be an appropriate representation of the political process in at least some parishes, with allowances for heterogeneity in costs of serving. However,

[32] Also, in light of Gardner's observations cited above, one might want to explore the extent to which people actually know the preferences of other citizens.

[33] Later work has used this framework to study various issues including lobbying (Besley and Coate (2001) and Felli and Merlo (2006)), re-election incentives (Besley and Coate, 1998), long-term career concerns (Diermeier, Keane and Merlo, 2005).

a fundamental assumption in these models is that citizens' preferences conflict, and this conflict motivates participation. As Woods et al note, though, in many small parishes major conflict is almost entirely absent—and it seems likely that much of the time any preference heterogeneity will be swamped by heterogeneity in participation costs.

In this case, potentially more relevant models are presented in Messner and Polborn (2004) and Bilodeau and Slivinski (1996). Both papers address the question of which member of a (heterogenous) group will volunteer to perform a costly task with public benefits. Bilodeau and Slivinski assume multiple periods and model the situation as a war of attrition—all the players suffer each period an unpleasant task is left undone. Their conclusion is that if there is a finite time horizon, in the unique equilibrium the task will be performed immediately by the individual with the highest benefit-to-cost ratio or highest rate of time preference.

Messner and Polborn study a rather different set up, motivated by the problem of filling poorly paid political offices from a small population. They assume that all citizens have homogeneous preferences but the sub-set of citizens who are potential candidates have different levels of publicly known competence—and that a candidate's competence is correlated with her privately known outside option (which is presumably her employment prospects in the private sector labour market). Their model only has a single period, so if no one volunteers, everyone receives their reservation utility, while if there is more than one volunteer, the office holder is chosen via an election. Unlike Bilodeau and Slivinski, they find that bad candidates are more likely to run, since they have both a less valuable outside option and a lower probability of being elected.

Neither of these models necessarily fit the parish case perfectly. Most obviously, there is no set "task" to be performed by a parish councillor—the role of the parish council is to a large extent determined by its members. Moreover, Messner and Polborn's assumption that the outside option for a more talented parish councillor is more valuable does not obviously hold. Firstly, parish council work occurs outside of normal working hours. Second, political participation researchers have examined how the amount of free time an individual has varies with socio-economic status—and found essentially no variation at all (Wolfinger and Rosenstone, 1980).

Together with the papers on parish councils discussed earlier, these considerations suggest that

an initial theoretical model should allow heterogeneity in preferences and heterogeneity in the costs of serving on a parish council to interact, with variation in cost being more important in determining which citizens become councillors in parishes where there is less variation in preferences.

A final open question is what, if any, role political parties play in this process. Two observations motivate this question. First, while candidates in small parishes occasionally stand under a political label, or are known to belong to a particular party, organised party political campaigning seems to be confined to larger councils. Second, party political contested elections are observed even in town councils where *all* the seats are consistently won by a particular party. It seems unlikely that the only motivation for all these candidates is the opportunity to serve on the council. There is no agreed political economy account of the emergence or function of parties, but it seems possible that their involvement in the elections in a parish may have an independent effect on the policies subsequently chosen by the council.

One key implication of this discussion is that not only are there lots of potentially significant sources of variation between parish councils, but many of them may be closely connected to parish *size*. For instance, given per capita levels of financial and other resources, larger parishes will clearly have more resources. On the other hand, they may have lower levels of altruism, or "community spirit". Levels of heterogeneity of both resources and preferences are also likely to vary (non-linearly) with parish size, affecting the identity of those who participate and the choices the council makes—and maybe resulting in, and interacting with, the politicisation of parish decisions.

The size of many parish councils is dictated by geography. Most obviously, in rural areas where settlements are quite isolated parish councils tend only to serve one or two villages and therefore have only small populations. New neighbourhood governance arrangements, in contrast, will presumably be predominantly in towns and cities big enough for multiple "neighbourhoods". The rough scale at which neighbourhood governance should operate is then a key policy choice—and one that would be usefully informed by a nuanced understanding of the mechanisms via which population size influences the level and social value of parish council activity.

5.8 Conclusion

This chapter has two principal conclusions. The first relates to the relatively narrow policy question addressed in the empirical analysis. It has been suggested that giving more power to citizens at the neighbourhood level might allow them to deal with problems neglected by other government agencies, and perhaps therefore correct some of the inequalities in access that characterise national public service provision. However, data on parish councils' use of a (capped) general spending power seems if anything to suggest the opposite. Areas with more educated and older citizens were more likely to use the power. I present suggestive evidence that this may reflect difference in capacity. Unless policy is designed to counter these differences the extension of the general well-being power to the very local level, and the neighbourhood governance agenda more broadly, seems likely to exacerbate, rather than compensate for, geographical inequalities.

The second, broader conclusion I draw from this chapter, however, is that we really know very little about neighbourhood governance. There is a need for more, better data on the choices parish councils make, the individuals who make and implement them, and how closely they match the preferences of the citizens they affect. Ideally this work would be informed by, and designed to distinguish between, competing theoretical propositions but, as I discuss at length in section 5.7, there are currently no models we can take "off the shelf". As well as (and ideally in conjunction with) new empirical work, then, there is also great scope for developing theoretical models of political—in the broadest sense—decision making and service provision at the very local level.

6. CONCLUSION

One of the central themes of this thesis is that, despite many politicians' (and some political theorists) apparent conviction that all people lack is the opportunity to participate, in fact we need to think about incentives to participate and, crucially, differential incentives to participate. In chapter 2, I showed that in a model in which all citizens face the same participation costs, members of the minority group in the population will typically be over-represented amongst those who volunteer, decreasing (though not eliminating) the informational value of the results of a citizens' jury.

In fact, though, the existing evidence, especially on voter turnout, seems to suggest that not all voters face the same attendance costs - and therefore that variation in participation is not all down to levels of support for different policies. Rather, as discussed is chapter 5, education, income and age are strong predictors of political participation. My results on parish councils' use of their s137 general spending power indicate that while deprivation per se is not closely linked to use of the power, areas in which a higher proportion of the population belong to these "politically active" demographic groups tend to make more use of the power—and that this may be partly explained by a greater willingness of people in these groups to participate directly by volunteering to serve on the parish council.

The impact of heterogenous participation costs is likely to vary across contexts. In section 2.5.1 of chapter 2, I showed that allowing for small amounts of cost heterogeneity has only a minimal impact on the predicted outcome of a citizens' jury. However, my assumption there was that an individual's cost was independent from her policy preference. If, for example, affluence is correlated with policy preferences over a range of issues, and the tendency of the more affluent to participate more carries over to citizens' juries, one might expect the policy choice to be skewed towards the preferences of this group (or any group with lower participation costs). Future work might usefully consider modifying the model to allow for such a correlation, to see if such a bias is likely, and if so how large it might be. At the same time one would ideally gather detailed data

on the characteristics and (ex ante) policy preferences of participants in citizens' juries and other "participatory" forums relative to the population from which they are drawn.

Concern about differential participation rates may also apply at the local, and even neighbourhood level. If the costs of standing as a councillor, and participating in elections, are on average lower for people with one set of preferences than another, policy choices may be skewed. As I note in section 5.7 of chapter 5, lack of information and limited social networks mean this kind of bias might occur even if those making policy decisions believe themselves to be acting for the general good, as seems to be the case in some (especially smaller) parishes.

However, another key theme of this thesis is that localness per se may introduce a second, distinct distortion—one *between* areas. A point stressed in the discussions of challenge funding and parish councils, is that while inter-regional heterogeneity in policy preferences and technology make devolved service provision desirable, inter-regional variation in *capacity* may influence its effect as well as altering its optimal extent and implementation. In the context of central government funding for local public goods, discussed in chapters 3 and 4, variation in administrative capacity at the local level may mean the centre has to trade-off the benefits of more locally sensitive policy choices against the potential costs of poor administration if responsibility is devolved. Moreover, it may find it is worth incurring a cost to direct money to where it will be well spent.

The implications of capacity variations for governance at the very local level are also potentially important—perhaps more so given that the smaller the communities we consider, the more likely it is that some will simply have very few, if any, people willing or able to devote significant amounts of time to self-governance, while others will have high levels of participation and administrative skills. As a result, we might expect residents in some neighbourhoods to benefit far more from a policy agenda that gives more power to, and places greater expectations on, very local governance. A number of avenues for future theoretical and empirical work on neighbourhood governance were discussed in section 5.7 of chapter 5.

The equity/efficiency trade-off inherent in the challenge funding approach is clear. However, the implications for equity of variations in participation, at both national and local level, are less straightforward. One possible view is that, if some people prefer not to incur the costs of partici-

pation despite the fact that as a result they may have less influence over policy outcomes or fewer local services, then as long as the choice to participate is equally available to all this individually rational outcome is fair. However, there are two possible reasons to question this. The first is that the correlation between, for example, income and participation is positive—but it is not perfect. Supposing (for the sake of argument) that income perfectly predicts policy preferences, ceteris paribus high-income non-participants are more likely to get their preferred policy than low-income non-participants, simply because the high-income non-participants have the same preferences as the bulk of those who do choose to participate. Second, to the extent that the link between education or income, and participation is a causal one to do with financial and psychological resources, depending on one's views about the fairness of inequalities in education and income, ability and willingness to participate may be felt to be inequitably distributed. In section 5.6 of chapter 5 I suggested some possible policy responses to mitigate the effects of variation in resources between parishes. Especially if participation costs and preferences are correlated, future work might also usefully consider how best to design intensive consultation mechanisms, such as citizens' juries, to minimize inequities in participation.

APPENDIX

A. RELAXING CHAPTER 2'S ASSUMPTION THAT $C_{OP} = C_{CJ}$

I assume throughout the chapter that the basic cost of a jury and a poll are the same. As discussed in Section 2.3, this is probably a reasonable assumption, and clearly if $k \approx 0$ then it is not important. However, it is worth briefly considering to what extent the results rely on this assumption.

If $c_{OP} = c_{CJ}$, then the government prefers the mechanism which has the lower probability of producing the wrong policy choice. Figure A.1 illustrates the effect of assuming that the two mechanisms differ slightly in cost. It is clear that small differences in cost only have a significant impact at values of λ close to $\frac{1}{2}$. Driving this result is the fact that the gross payoffs from the two mechanisms (the probability of selecting the correct policy) only converge as $\lambda \rightarrow \frac{1}{2}$. Although the probability of a minority dominated sample converges under the two mechanism as $\lambda \rightarrow 0$, the probability of the wrong result $\rightarrow 0$ for a jury, but $\rightarrow (1-p)$ for a poll, so unless p is close to 1, the probability of the wrong result does not converge, and so differences in their expected gross payoffs outweigh small differences between the costs of the two mechanisms. In contrast, as $\lambda \rightarrow \frac{1}{2}$, the probability of a minority dominated sample $\rightarrow \frac{1}{2}$ for both mechanisms. Moreover, since the two groups are very similar in size, the loss from making the wrong choice is small, so any differences in the probability of the wrong decision are insignificant. I therefore conclude that the assumption that $c_{OP} = c_{CJ}$ is a useful simplification.

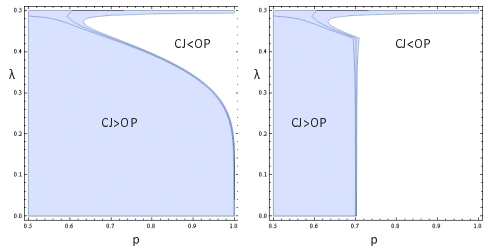

Fig. A.1: The government's preferred consultation mechanism if $c_{CJ} = c_{OP} - 0.001$, $c_{CJ} = c_{OP}$ and $c_{CJ} = c_{OP} + 0.001$ (for $M = 501$, $m = 15$ under compulsion (left-hand figure) and when $c = 0.08$,$\nu = 0$ (right-hand figure))

B. PROOFS FROM CHAPTER 2

B.1 Proof of Proposition 1

Proof.

- There is an equilibrium with no volunteers (so the policy choice is random) if $c > \frac{1}{2}$ because if an individual deviates and volunteers she determines the outcome, increasing her expected payoff by $\frac{1}{2} - c$, which is worth doing iff $c < \frac{1}{2}$.

- If $c < \frac{1}{2}$ there cannot be an equilibrium with m or fewer volunteers because the volunteers would know for sure that they would be jurors. With an odd number of volunteers the outcome is know for certain so volunteers in the minority have an incentive to deviate and save c. With an even number of volunteers there is an incentive for another citizen to volunteer, break the tie and increase her expected payoff by $\frac{1}{2} - c$.

- There may be an (asymmetric, pure strategy) equilibrium with precisely $m + 1$ volunteers, with half coming from each group. In this case, if a volunteer were to deviate and refuse to accept an invitation to the jury, the other side would win for certain i.e. she would receive a payoff of -1. On the other hand, if she accepted an invitation, the probability that the other side would still win is $\frac{m-1}{2m}$ so by deviating she reduces her expected payoff by $\frac{m+1}{2} - c$.

- In any pure strategy equilibrium, there must be equal numbers of volunteers from each side. Suppose that there are n_L left-wing volunteers and n_R right-wing volunteers, and (wlg) that $n_L > n_R$. Note also that if this is to be an equilibrium, it must be the case that $n_R \geq \frac{m+1}{2}$. The payoff to a left-wing volunteer if she accepts an invitation is:

$$\frac{\binom{n_L-1}{\frac{m-1}{2}}\binom{n_R}{\frac{m-1}{2}}}{\binom{n_L+n_R-1}{(m-1)}} \frac{n_R - \frac{m-1}{2}}{n_L + n_R - 1 - (m-1)} \tag{B.1}$$

While the payoff to a right-wing citizen who deviates and volunteers is:

$$\frac{\binom{n_R}{\frac{m-1}{2}}\binom{n_L}{\frac{m-1}{2}}}{\binom{n_L+n_R}{m-1}} \frac{n_L - \frac{m-1}{2}}{n_L + n_R - (m-1)} \tag{B.2}$$

Rearranging, we have that B.2 is larger than B.1 if $n_L(n_L - \frac{m+1}{2}) > n_R(n_R - \frac{m-1}{2})$. Hence if the left-wing volunteers in the proposed equilibrium do not have an incentive to deviate, then a non-volunteer from the right-wing group must have an incentive to volunteer as long as $n_L \geq n_R + 1$ i.e. as long as the left wing form a majority of volunteers.

- There is a single equilibrium with positive attendance for each value of c $\binom{m-1}{\frac{m-1}{2}}(\frac{1}{2})^m < c < \frac{m+1}{2}$ (for $c > \frac{1}{2}$ there is also an equilibrium in which no one volunteers). In any proposed equilibrium with $\frac{n}{2}$ volunteers from each side, if there is an incentive for a non-volunteer to deviate and volunteer, then if there are $\frac{n}{2}+1$ volunteers on one side and $\frac{n}{2}$ on the other, there will also be an incentive for a non-volunteer on the minority side to deviate:

$$\frac{\binom{\frac{n}{2}}{\frac{m-1}{2}}\binom{\frac{n}{2}}{\frac{m-1}{2}}}{\binom{n}{m-1}}\frac{\frac{n}{2}-\frac{m-1}{2}}{n-(m-1)} < \frac{\binom{\frac{n}{2}}{\frac{m-1}{2}}\binom{\frac{n}{2}+1}{\frac{m-1}{2}}}{\binom{n+1}{m-1}}\frac{\frac{n}{2}+1-\frac{m-1}{2}}{n+1-m} \Rightarrow \frac{1}{2} < \frac{(n+2)}{2(n+1)} \tag{B.3}$$

Hence the number of volunteers on each side in equilibrium is determined by the value of n such that

$$\frac{\binom{\frac{n}{2}}{\frac{m-1}{2}}\binom{\frac{n}{2}}{\frac{m-1}{2}}}{\binom{n}{m-1}}\frac{\frac{n}{2}-\frac{m-1}{2}}{n-(m-1)} < c < \frac{\binom{\frac{n}{2}}{\frac{m-1}{2}}\binom{(\frac{n}{2}-1)}{\frac{m-1}{2}}}{\binom{n-1}{m-1}}\frac{\frac{n}{2}-\frac{m-1}{2}}{n-m} \tag{B.4}$$

- As c falls, the equilibrium value of n rises, but rather than $n \to \infty$, $c \to 0$,

$$lim_{n\to\infty}\frac{\binom{\frac{n}{2}}{\frac{m-1}{2}}\binom{\frac{n}{2}-1}{\frac{m-1}{2}}}{\binom{n-1}{m-1}}\frac{\frac{n}{2}-\frac{m-1}{2}}{n-m} = \binom{m-1}{\frac{m-1}{2}}(\frac{1}{2})^m \tag{B.5}$$

If $c = \binom{m-1}{\frac{m-1}{2}}(\frac{1}{2})^m$, there is an infinite range of symmetric mixed strategy PBE in which members of the minority volunteer with probability q_{min} and members of the majority volunteer with probability q_{maj}, where $\frac{q_{min}}{q_{maj}} = \frac{(1-\lambda)}{\lambda}$ so (in expectation) the volunteer pool contains the same number from the minority as the majority.

- If $c < \binom{m-1}{\frac{m-1}{2}}(\frac{1}{2})^m$, in any equilibrium all the members of the minority must volunteer with probability 1. As explained in Section 2.4.2 it is not possible to construct a mixed strategy equilibrium in which both groups volunteer with probabilities in $(0,1)$ for $c < \hat{c}$. I showed above that it is also not possible to have an equilibrium in which one side is guaranteed to win, so there cannot be an equilibrium in which none of the members of one group volunteer. Therefore, the only possible equilibrium involves all the members of one group, and some or all of the members of the other, volunteering. All the members of both groups will volunteer

in equilibrium if

$$c < \binom{m-1}{\frac{m-1}{2}} \lambda^{\frac{m+1}{2}} (1-\lambda)^{\frac{m-1}{2}} \text{ and } c < \binom{m-1}{\frac{m-1}{2}} \lambda^{\frac{m-1}{2}} (1-\lambda)^{\frac{m+1}{2}} \tag{B.6}$$

If this does not hold, then if there is an equilibrium one group must mix and the other all volunteer. The group that mixes (group a) must have an expected payoff exactly $= c$, while the other group (group b) has a payoff $> c$. This is only possible if it is the majority group that mixes. The probability of the remainder of the jurors being evenly split is the same for everyone in the population. The only difference between the expected payoffs is the probability of being replaced by someone from the other group. For the minority to have a strictly lower payoff when they mix and the majority all attend, we'd need $q_{min} \in [0,1]$ s.t. $(1-\lambda) < q_{min}\lambda$ which is impossible. The majority mixing requires $q_{maj} \in [0,1]$ s.t. $\lambda < q_{maj}(1-\lambda)$, which is possible. We would have:

$$c = \binom{m-1}{\frac{m-1}{2}} \frac{\lambda^{\frac{m+1}{2}} (q_{maj}(1-\lambda))^{\frac{m-1}{2}}}{(\lambda + q_{maj}(1-\lambda))^m} < \binom{m-1}{\frac{m-1}{2}} \frac{\lambda^{\frac{m-1}{2}} (q_{maj}(1-\lambda))^{\frac{m+1}{2}}}{(\lambda + q_{maj}(1-\lambda))^m} \tag{B.7}$$

The maximum value of c such that, given λ, c is too small for there to be a value of $q_{maj} \in (0,1]$ such that equation B.7 holds, is the minimum value of c s.t. in equilibrium the entire popualtion will volunteer. We therefore have a (not necessarily strictly) mixed strategy equilibrium for any $c \in [0, \binom{m-1}{\frac{m-1}{2}}(\frac{1}{2})^m]$.

□

B.2 Proof of Lemma 1

Proof. From Proposition 1, we know that as long as $c > 0$, there is some λ^c such that i f$\lambda \in (0, \lambda^c]$, the proportion of volunteers from the minority is λ^c. In this range, the government is therefore prefers an opinion poll to a jury if:

$$\sum_{i=0}^{\frac{m-1}{2}} \binom{m}{i} (\lambda^c)^i (1-\lambda^c)^{m-i} \leq (1-p) \sum_{i=0}^{\frac{M-1}{2}} \binom{M}{i} (\lambda)^i (1-\lambda)^{M-i} + p(1 - \sum_{i=0}^{\frac{M-1}{2}} \binom{M}{i} (\lambda)^i (1-\lambda)^{M-i}) \tag{B.8}$$

As $\lambda \to 0$, the probability of a minority-dominated sample in the opinion poll $\to 0$, so this condition becomes $p \geq \sum_{i=0}^{\frac{m-1}{2}} \binom{m}{i} (\lambda^c)^i (1-\lambda^c)^{m-i}$. Since $\lambda^c > 0$, $\sum_{i=0}^{\frac{m-1}{2}} \binom{m}{i} (\lambda^c)^i (1-\lambda^c)^{m-i} < 1$ - the probability of a minority dominated jury does not go to 0 with λ. □

B.3 Proof of Lemma 2

Proof. Define $\bar{p}$ as the value of p such that the government is indifferent between a poll and a jury at $\lambda = \lambda^c$:

$$\sum_{i=0}^{\frac{m-1}{2}} \binom{m}{i} (\lambda^c)^i (1-\lambda^c)^{m-i} \leq (1-\bar{p}) \sum_{i=0}^{\frac{M-1}{2}} \binom{M}{i} (\lambda^c)^i (1-\lambda^c)^{M-i} + \bar{p}(1 - \sum_{i=0}^{\frac{M-1}{2}} \binom{M}{i} (\lambda^c)^i (1-\lambda^c)^{M-i}) \tag{B.9}$$

$\lambda^c \in (0, 0.5)$, so as long as $m < M$, $\bar{p}$ exists.

In general, for a given value of λ, if the entire population volunteer then there is a value of p, $\tilde{p}(\lambda)$ at which the government is indifferent, which satisfies:

$$\tilde{p}(\lambda) = \frac{(-1 + Beta[1-\lambda, \frac{(1+m)}{2}, \frac{(1+m)}{2}] + Beta[1-\lambda, \frac{(1+M)}{2}, \frac{(1+M)}{2}])}{(-1 + 2Beta[1-\lambda, \frac{(1+M)}{2}, \frac{(1+M)}{2}])} \tag{B.10}$$

This is decreasing in λ for $\lambda \in [0, 0.5]$ and $M > m$:

$$\frac{d\tilde{p}(\lambda)}{d\lambda} = \frac{((1-\lambda)\lambda)^{\frac{M-1}{2}} Beta[\frac{m+1}{2}, \frac{m+1}{2}](-1 + 2Beta[1-\lambda, \frac{m+1}{2}, \frac{m+1}{2}])}{(Beta[\frac{m+1}{2}, \frac{m+1}{2}]Beta[\frac{M+1}{2}, \frac{M+1}{2}](1 - 2Beta[1-\lambda, \frac{M+1}{2}, \frac{M+1}{2}])^2)}$$
$$- \frac{-((1-\lambda)\lambda)^{\frac{m-1}{2}} Beta[\frac{M+1}{2}, \frac{M+1}{2}](-1 + 2Beta[1-\lambda, \frac{M+1}{2}, \frac{M+1}{2}])}{Beta[\frac{m+1}{2}, \frac{m+1}{2}]Beta[\frac{M+1}{2}, \frac{M+1}{2}](1 - 2Beta[1-\lambda, \frac{M+1}{2}, \frac{M+1}{2}])^2)} < 0 \text{ if } \lambda \in [0, 0.5] \text{ and } m < M \tag{B.11}$$

$\lambda \in [0, 0.5]$ implies that the probability of a minority dominated sample is less than a half. It follows that the payoff from an opinion poll is increasing in p, so for a given λ, if $p > \tilde{p}(\lambda)$, then the government will strictly prefer an opinion poll to a citizens' jury.

Since $\tilde{p}(\lambda)$ is decreasing in λ, for $\lambda > \lambda^c$, $\tilde{p}(\lambda) < \bar{p}$ - so if $p > \bar{p}$ the government will strictly prefer a poll to a jury. If $\lambda < \lambda^c$, on the other hand, we know that the probability a jury produces the right result is fixed at $\sum_{i=0}^{\frac{m-1}{2}} \binom{m}{i} (\lambda^c)^i (1-\lambda^c)^{m-i}$. On the other hand, decreasing λ increases the probability that a poll will produce the right result. Hence if $p > \bar{p}$, so the government prefers a poll to a jury if the entire population volunteers at $\lambda = \lambda^c$, it must prefer a poll to a jury if $\lambda < \lambda^c$.

Combined, this implies that if $p > \bar{p}$, the government always prefers a poll to a jury. □

B.4 Proof of Proposition 2

Proof.

- It is straightforward to see that if $c > \hat{c}$, the government will always prefer a poll. From Proposition 1, we know that if $c \geq \hat{c}$, then the volunteer pool for a jury will be evenly split between the two groups. The probability of selecting a minority-dominated jury is therefore $\frac{1}{2}$. In contrast, if $p \in (0.5, 1]$ and $\lambda \in (0, 0.5)$, then the probability an opinion poll produces the right result is strictly greater than $\frac{1}{2}$

- If $p < \underline{p}$, then as $\lambda \to 0$, the government prefers a jury to a poll (since it is indifferent at $\underline{p}$, and the payoff from a poll is increasing in p). It follows that if $p < \underline{p}$, the government prefers a jury to a poll for all $\lambda < \lambda^c$ since in this range an increase in λ has no effect on the performance of a jury, and reduces the probability that a poll produces the right answer. Hence, if the government does prefer a poll, it must do so for some $\lambda > \lambda^c$, but if $\lambda > \lambda^c$, then the entire population volunteers, so the comparison is exactly the same as under compulsion, so $\underline{\lambda}(p, M, comp)$ is the relevant cut-off value of λ

- The fact that if $p > \bar{p}$, the government always prefers a jury, was established in Lemma 2

- To show that if $p \in [\underline{p}, \bar{p}]$, the government choice is non-monotonic, I first establish that $\underline{p} < \bar{p}$. This is straightforward. Algebraically:

$$\bar{p} = \frac{(-1 + Beta[1 - \lambda^c, \frac{(1+m)}{2}, \frac{(1+m)}{2}] + Beta[1 - \lambda^c, \frac{(1+M)}{2}, \frac{(1+M)}{2}])}{(-1 + 2Beta[1 - \lambda c, \frac{(1+M)}{2}, \frac{(1+M)}{2}])} \tag{B.12}$$

while $\underline{p} = Beta[1 - \lambda^c, \frac{(1+m)}{2}, \frac{(1+m)}{2}]$ and

$$\bar{p} - \underline{p} = \frac{((2Beta[1 - \lambda, \frac{(1+m)}{2}, \frac{(1+m)}{2}] - 1)(1 - Beta[1 - \lambda, \frac{(1+M)}{2}, \frac{(1+M)}{2}]))}{(2Beta[1 - \lambda, \frac{(1+M)}{2}, \frac{(1+M)}{2}] - 1)} > 0 \tag{B.13}$$

The performance of a jury is the same for all $\lambda < \lambda^c$. On the other hand, the performance of a poll improves as λ falls, because the probability of a minority-dominated sample falls, and $p > \frac{1}{2}$ so the net effect of this on the probability that a poll produces the right answer is positive. In order to maintain indifference between a jury and a poll, then, the cut-off value of p must decline with λ. On the other hand, if $\lambda > \lambda^c$, then we know that the entire population volunteer, and from the proof of Lemma 2 above, that $\tilde{p}(\lambda)$ rises as λ falls. We therefore have a negative relationship between p and λ if $\lambda > \lambda^c$, and a positive one if $\lambda < \lambda^c$.

□

B.5 Proof of Proposition 3

Proof. It is straightforward to see that the equilibrium will involve cut-off values. Given a proposed equilibrium strategies for the rest of the population, the expected gross benefit of accepting an invitation to a jury is the same for all the individuals in a group. Hence, if accepting (rather than declining) an invitation increases the expected net payoff of an individual with cost c_i, the same must also be true for an individual with cost c_j if $c_j < c_i$.

The benefit from accepting an invitation, given that everyone is playing the equilibrium c_{min}, c_{maj}, $P(\text{win if go}) - P(\text{win if don't go})$, reduces to $\frac{\binom{m-1}{\frac{m-1}{2}}(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)^{\frac{m-1}{2}}(F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^{\frac{m-1}{2}}(F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda+F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^m}$ for a member of the minority and (analagously) for a member of the majority it is

$$\frac{\binom{m-1}{\frac{m-1}{2}}(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)^{\frac{m-1}{2}}(F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^{\frac{m-1}{2}}(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda+F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^m} \tag{B.14}$$

In equilibrium, the cut-off cost level for each side is equal to this expected benefit. The probability that the remainder of the jury is evenly split (and therefore that if an individual attends her vote will be pivotal) is the same for both groups. The expressions differ because, even if she would have been pivotal, if an individual refuses an invitation it does not necessarily mean that her side will lose. Rather, the probability that her side loses, and therefore the probability that she makes a difference by attending, depends on the probability that if she refuses she will be replaced by a member of the opposite group. We therefore have that $Prob(\text{even split})\frac{(F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda+F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))} = c_{min}$ and $Prob(\text{even split})\frac{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda+F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))} = c_{maj}$. It follows that $\frac{(1-\lambda)}{\lambda} = \frac{c_{min}F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})}{c_{maj}F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})}$. Since $\lambda < \frac{1}{2}$ so $\frac{(1-\lambda)}{\lambda} > 1$ and $F(\frac{c-\underline{c}}{\bar{c}-\underline{c}})$ is an increasing function of c (it is a CDF), this implies that $c_{maj}F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}}) < c_{min}F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})$ so $c_{maj} < c_{min}$ and $F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}}) > F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})$. However, $c_{maj} < c_{min}$ also implies that $\frac{c_{min}}{c_{maj}} > 1$ and therefore that $\frac{F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda)}{F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda} > 1$.

To show convergence, first take the case where $c' < c^\lambda$, so $\exists\epsilon > 0$ s.t. $\bar{c}' = c' + \epsilon = c^\lambda$. As long as $\bar{c} \leq \bar{c}'$ all members of the population will volunteer by the definition of c^λ. If $c' \in [c^\lambda, \hat{c})$, there is no equilibrium in which the entire population volunteers. Hence we know that

$$c_{maj} = \binom{m-1}{\frac{m-1}{2}}\frac{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)^{\frac{m+1}{2}}(F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^{\frac{m-1}{2}}}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda+F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^m} \tag{B.15}$$

so as $c_{maj} \to c'$, $\binom{m-1}{\frac{m-1}{2}} \frac{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda)^{\frac{m+1}{2}}(F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^{\frac{m-1}{2}}}{(F(\frac{c_{min}-\underline{c}}{\bar{c}-\underline{c}})\lambda+F(\frac{c_{maj}-\underline{c}}{\bar{c}-\underline{c}})(1-\lambda))^m} \to c'$, and there is only one ratio of minority to majority volunteers consistent with this being $= c'$: $\lambda^{c'} : (1-\lambda^{c'})$. □

B.6 Proof of Proposition 4

Proof. The proof of the main part of the proposition follows from the definitions given in the text. If the proportion of the minority in the volunteer pool is $\in [\underline{\theta}^k, \bar{\theta}^k]$, it is optimal for the government to use a cut-off of k. The proportion of the minority in the volunteer pool is λ if the entire population volunteers, and some $\theta > \lambda$ if the minority all volunteer and the majority mix with probability q which satisfies $\theta = \frac{\lambda}{\lambda+q(1-\lambda)}$.

Given k, it is optimal for the entire population to volunteer as long as $G(maj, \lambda, k, \pi) \geq c$ and $G(min, \lambda, k, \pi) \geq c$ (as defined in the text). Rearranging $G(maj, \lambda, k, \pi)$ and $G(min, \lambda, k, \pi)$, we find that $G(maj, \lambda, k, \pi) < G(min, \lambda, k, \pi) \Leftrightarrow \lambda < \frac{1}{2}$. Since $\lambda < \frac{1}{2}$ by assumption, $G(maj, \lambda, k, \pi) \geq c$ is sufficient (as well as necessary) for the entire population to volunteer.

If $G(maj, \lambda, k, \pi) < c$, the first condition in the proposition ($G(maj, \theta, k\pi) = c$) is sufficient as long as the mixed strategy equilibrium must involve the majority mixing and the entire minority volunteering. This is true by the same argument as in proof B.1. We know that $G(maj, \theta, k, \pi) < G(min, \theta, k, \pi) \Leftrightarrow \theta < \frac{1}{2}$. We also know that members of a group using a strictly mixed strategy must have a weakly lower payoff than those volunteering with probability 1. If the minority were to mix while the majority all volunteered, $\theta << \frac{1}{2}$ so $G(maj, \theta, k, \pi) < G(min, \theta, k, \pi)$ which is inconsistent. Conversely, if the majority mix, as long as the population majority still form a majority of volunteers (so $q \in [\frac{\lambda}{1-\lambda}, 1]$, then $\theta < \frac{1}{2}$, so $G(maj, \theta, k, \pi) < G(min, \theta, k, \pi)$ which is consistent with the proposed strategies. NB if $c = \hat{c}$, there is a continuum of equilibria in which both groups mix, and the ratio of volunteers is $1:1$. For both groups to mix, it must be that $G(maj) = G(min) = c$, and this is only possible if $\theta = \frac{1}{2}$. As before, it is uninteresting because it is (a)a knife-edge and (b)implies the government would not want to use a jury.

This covers all possible equilibria in symmetric strategies with positive levels of volunteering. There is always also an equilibrium in which no one volunteers, in which the government treats the vote of a juror who deviates and volunteers as babbling/equally likely to come from the minority as the majority.

To see the second part of the proposition, note that $\bar{\theta}^{k,\pi} = 1-\pi$ when $k = \frac{m+1}{2}$, so the government uses $k = \frac{m+1}{2}$ (i.e. the majority verdict) if $\theta \in [0, (1-\pi)]$. If $\lambda < 1-\pi$ and $c < c^{\lambda}$ then there is an equilibrium with the entire population volunteering. If $c > c^{\lambda}$ and $\lambda, \lambda^c < 1-\pi$, then there is an equilibrium with all of the minority volunteering and members of the majority volunteering with probability q s.t. $\lambda^c = \frac{\lambda}{\lambda+q(1-\lambda)}$. This is exactly as in Proposition 1.

If $\lambda, \lambda^c \ll \frac{1}{2}$, then as $\pi \to \frac{1}{2}$, $\lambda, \lambda^c < 1-\pi$. In general, if $\pi < \frac{1}{2}$ and $\lambda, \lambda^c < 1-\pi$ there may be multiple equilibria. However, $\forall k < \frac{m+1}{2}$,

$$\bar{\theta}^{k,\pi} - \underline{\theta}^{k,\pi} = \frac{(1-\pi)^{\frac{1}{m-2(k-1)}}}{(1-\pi)^{\frac{1}{m-2(k-1)}} + \pi^{\frac{1}{m-2(k-1)}}} - \frac{(1-\pi)^{\frac{1}{m-2k}}}{(1-\pi)^{\frac{1}{m-2k}} + \pi^{\frac{1}{m-2k}}} \underbrace{\to}_{\pi \to \frac{1}{2}} 0 \tag{B.16}$$

hence the range of values of c and λ for which equilibria other than that with $k = \frac{m+1}{2}$ disappears.

□

B.7 Proof of Lemma 3

Proof. The entire population volunteers with $\nu = 0$ if $\lambda \geq \lambda^c$, so clearly $\nu^* = 0$. If $\lambda < \lambda^c$, the effect on the proportion of volunteers from the majority of a marginal decrease in the attendance cost from ω(/increase in ν) is

$$-\frac{d(1-\lambda^{\omega})}{d\omega} = -\frac{(2(1-\lambda^{\omega})(((1-\lambda^{\omega})\lambda^{\omega})^{\frac{-m+1}{2}}))}{((1+m-2\lambda^{\omega}m)\binom{m-1}{\frac{m-1}{2}})} \tag{B.17}$$

and the marginal effect on the government's payoff is:

$$\frac{(2(1-2\lambda)(1-\lambda^{\omega}))}{((1+(1-2\lambda^{\omega})m)Beta[\frac{m+1}{2}, \frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}})} - m\tau \tag{B.18}$$

It is not worth paying any compensation at all if the marginal benefit is negative at $\nu = 0$, i.e. if $\tau \geq \frac{(2(1-2\lambda)(1-\lambda^c))}{(m(1+(1-2\lambda^c)m))Beta[\frac{m+1}{2}, \frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}} \equiv \bar{\tau}$.

It is worth paying enough to get the entire population to volunteer if at ν is s.t. $\lambda^{\omega} = \lambda$ the marginal benefit is positive. This is true if $\tau \leq \frac{(2(1-2\lambda)(1-\lambda))}{m((1+(1-2\lambda)m)Beta[\frac{m+1}{2}, \frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}})} \equiv \underline{\tau}$.

If $\tau \in (\underline{\tau}, \bar{\tau})$ is between these two values, then the optimal level of compensation will equate the marginal benefit and marginal cost i.e. B.18 will equal to 0, which implies λ^{ω^*} as defined in Section 2.5.3:

$$\lambda^{\omega^*}(\lambda,\tau) = \frac{2(1-2\lambda) - \tau m(1+m)Beta[\frac{m+1}{2},\frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}}{2(1-2\lambda) - 2\tau m^2 Beta[\frac{m+1}{2},\frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}} \tag{B.19}$$

Differentiating this with respect to λ gives:

$$\frac{d\lambda^{\omega^*}}{d\lambda} = \frac{(\tau(-1+m)mBeta[\frac{m+1}{2},\frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}))}{(1-2\lambda-\tau m^2 Beta[\frac{m+1}{2},\frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}}))^2} > 0 \tag{B.20}$$

so optimal compensation is decreasing in λ. It is also the case that $\frac{d\underline{\tau}}{d\lambda} = \frac{(-4(1-\lambda^c))}{(m(1+m-2\lambda^c m)Beta[\frac{m+1}{2},\frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}})} < 0$ so the larger λ is, the smaller the range of values of τ over which it is worth paying full compensation. Moreover, if it is worth paying full compensation, then the amount paid still increases as λ decreases, because $\binom{m-1}{\frac{m-1}{2}}\lambda^{\frac{m+1}{2}}(1-\lambda)^{\frac{m-1}{2}}$ is decreasing in λ.

At the other extreme, $\frac{d\bar{\tau}}{d\lambda} = \frac{-((2(3-4\lambda+m(1-4\lambda(1-\lambda)))))}{(m(1+(1-2\lambda)m)^2 Beta[\frac{m+1}{2},\frac{m+1}{2}]\binom{m-1}{\frac{m-1}{2}})} < 0$ so the large λ is, the larger the range of values of k over which it is not worth paying any compensation at all. □

B.8 Proof of Proposition 5

Proof. If $\tau > \bar{\tau}(\lambda = 0)$, we know from Lemma 3 that $\nu^* = 0\ \forall\lambda$, so the government's choice is exactly the same as in Proposition 2 - and non-monotonic in λ. If $\tau \leq \bar{\tau}(\lambda \to 0)$, but $k > \underline{k}(\lambda \to 0)$, then as $\lambda \to 0$, ν^* will induce $\lambda^{\omega^*}(\lambda,\tau)$ as defined in equation B.19. The government's expected payoff from an opinion poll is:

$$\begin{aligned} &-(\lambda((p(\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i})) + ((1-p)(1-\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i})))) \\ &-((1-\lambda)(((1-p)(\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i})) + (p(1-\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i})))) \end{aligned} \tag{B.21}$$

while that from a jury is:

$$\begin{aligned} &-(\lambda\sum_{i=0}^{\frac{m-1}{2}}\binom{m}{i}(\lambda^{\omega^*})^i(1-\lambda^{\omega^*})^{m-i}) - ((1-\lambda)(1-\sum_{i=0}^{\frac{m-1}{2}}\binom{m}{i}(\lambda^{\omega^*})^i(1-\lambda^{\omega^*})^{m-i})) \\ &-(m\tau\binom{m-1}{\frac{m-1}{2}}(\lambda^{\omega^*})^{\frac{m+1}{2}}(1-\lambda^{\omega^*})^{\frac{m-1}{2}}) \end{aligned} \tag{B.22}$$

Setting these equal and solving for p gives:

$$p = \frac{(1-2\lambda)(-1+\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i}+\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}(\lambda^{\omega^*})^i(1-\lambda^{\omega^*})^{M-i})}{((1-2\lambda)(-1+2\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i}))} - \frac{\tau m(c-(1-\lambda^{\omega^*})^{\frac{m-1}{2}}(\lambda^{\omega^*})^{\frac{m+1}{2}}\binom{m-1}{\frac{m-1}{2}})}{((1-2\lambda)(-1+2\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i}))} \quad \text{(B.23)}$$

Differentiating p wrt λ and taking the limit as $\lambda \to 0$ gives $-2\tau m(c-\binom{m-1}{\frac{m-1}{2}}((\lambda^{\omega})^{\frac{m+1}{2}}((1-\lambda^{\omega})^{\frac{m-1}{2}})))$ which is strictly negative as long as $\lambda^{\omega} < \lambda^c$ i.e. $\tau \leq \bar{\tau}(\lambda \to 0)$. Since this holds at $\tau = \underline{\tau}(\lambda \to 0)$ - when $\nu^*(\lambda \to 0) = c - \binom{m-1}{\frac{m-1}{2}}\lambda^{\frac{m+1}{2}}(1-\lambda)^{\frac{m-1}{2}}$ - it also holds for $\tau < \underline{\tau}(\lambda \to 0)$, because further falls in τ have no effect on the level of compensation paid, or on the probability of success, but do reduce the weighted cost of compensation - and reduce this weighted cost by more the smaller λ is (because $c - \binom{m-1}{\frac{m-1}{2}}\lambda^{\frac{m+1}{2}}(1-\lambda)^{\frac{m-1}{2}}$ is decreasing in λ). As a result, if at $\tau = \underline{\tau}(\lambda \to 0)$ at λ close to 0, an increase in p is required to maintain indifference between a jury and a poll following a fall in λ, the same must be true for smaller values of τ. We therefore know that if $\tau < \bar{\tau}(\lambda \to 0)$, there is a negative relationship between the values of λ and p at which the government is indifferent between the two mechanisms for λ close to 0.

$\bar{\tau}(\lambda) \geq \underline{\lambda}(\tau)$ and both $\bar{\tau}(\lambda)$ and $\underline{\tau}(\lambda)$ are decreasing in λ. Moreover, $\bar{\tau}(\lambda^c) = \underline{\tau}(\lambda^c)$. If $\tau > \bar{\tau}(\lambda^c$, then $nu^*(\lambda^c) = 0$, so the government's choice of mechanism is non-monotonic close to λ^c.

It follows that there is a range of values of τ, $\tau \in (\bar{\tau}(\lambda \to 0), \underline{\tau}(\lambda^c))$ over which there are (at least) two non-monotonicities in the government's choice: an increase in λ reduces the range of values of p over which the government prefers a jury if λ is close to 0 or greater than λ^c, but increases it if λ is close to, but below, λ^c.

The value of τ below which the non-monotonicity at λ^c disappears may in fact be less than $\underline{\tau}(\lambda^c)$. If $\tau \leq \underline{\tau}(\lambda^c$, then $\nu^* = \binom{m-1}{\frac{m-1}{2}}\lambda^{\frac{m+1}{2}}(1-\lambda)^{\frac{m-1}{2}}$ $\forall \lambda \leq \lambda^c$. The government's expected payoff

from an opinion poll is still:

$$-(\lambda((p(\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i}))+((1-p)(1-\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i}))))$$
$$-((1-\lambda)(((1-p)(\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i}))+(p(1-\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i})))) \quad \text{(B.24)}$$

while that from a jury is now:

$$-(\lambda\sum_{i=0}^{\frac{m-1}{2}}\binom{m}{i}\lambda^i(1-\lambda)^{m-i})-((1-\lambda)(1-\sum_{i=0}^{\frac{m-1}{2}}\binom{m}{i}\lambda^i(1-\lambda)^{m-i}))-(m\tau\binom{m-1}{\frac{m-1}{2}}\lambda^{\frac{m+1}{2}}(1-\lambda)^{\frac{m-1}{2}}) \quad \text{(B.25)}$$

equating these gives:

$$p=\frac{((1-2\lambda)(-1+\sum_{i=0}^{\frac{m-1}{2}}\binom{m}{i}\lambda^i(1-\lambda)^{m-i}+\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i})-\tau m(c-(1-\lambda)^{\frac{m-1}{2}}\lambda^{\frac{m+1}{2}}\binom{m-1}{\frac{m-1}{2}}))}{((1-2\lambda)(-1+2\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}\lambda^i(1-\lambda)^{M-i}))} \quad \text{(B.26)}$$

and differentiating wrt λ and setting $\lambda=\lambda^c$, $\tau=\underline{\tau}(\lambda^c)$:

$$\frac{dp}{d\lambda}_{|\lambda=\lambda^c,\tau=\underline{\tau}(\lambda^c)}=\frac{2((1-\lambda^c)\lambda^c)^{\frac{M-1}{2}}Beta[\frac{m+1}{2},\frac{m+1}{2}](-1+2\sum_{i=0}^{\frac{m-1}{2}}\binom{m}{i}(\lambda^c)^i(1-\lambda^c)^{m-i})}{(2Beta[\frac{m+1}{2},\frac{m+1}{2}]Beta[\frac{M+1}{2},\frac{M+1}{2}](-1+2\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}(\lambda^c)^i(1-\lambda^c)^{M-i})^2)}$$
$$-\frac{((1-\lambda^c)\lambda^c)^{\frac{m-1}{2}}Beta[\frac{M+1}{2},\frac{M+1}{2}](-1+2\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}(\lambda^c)^i(1-\lambda^c)^{M-i})}{(2Beta[\frac{m+1}{2},\frac{m+1}{2}]Beta[\frac{M+1}{2},\frac{M+1}{2}](-1+2\sum_{i=0}^{\frac{M-1}{2}}\binom{M}{i}(\lambda^c)^i(1-\lambda^c)^{M-i})^2)} \quad \text{(B.27)}$$

This is negative if λ^c is small, but may be positive for large values of λ^c. (For example, if $m=15$ and $M=501$, $\frac{dp}{d\lambda}_{|\lambda=\lambda^c,\tau=\underline{\tau}(\lambda^c)}<0$ if $\lambda^c<0.468332$ but it is positive if $\lambda^c>0.468332$. □

B.9 Proof of Lemma 4

If $\lambda<\lambda^{c,\gamma,maj}$, then it cannot be that in equilibrium the entire eligible population volunteers. It follows that members of the minority volunteer with probability 1 and ordinary members of the majority with some probability $q<1$. If they are allowed to volunteer, members of the special interest group must all volunteer since ordinary members of both groups are (weakly) willing to volunteer, and members of the special interest group get a strictly higher payoff.

If the special interest group is part of the minority and is banned, q must satisfy $c = \binom{m-1}{\frac{m-1}{2}} \frac{(\lambda-\gamma)^{\frac{m+1}{2}}(q(1-\lambda))^{\frac{m-1}{2}}}{(\lambda-\gamma+q(1-\lambda))^m}$, if it is part of the majority and banned, it must satisfy $c = \binom{m-1}{\frac{m-1}{2}} \frac{(\lambda)^{\frac{m+1}{2}}(q(1-\lambda-\gamma))^{\frac{m-1}{2}}}{(\lambda+q(1-\lambda-\gamma))^m}$. if it is part of the minority and allowed to attend $c = \binom{m-1}{\frac{m-1}{2}} \frac{(\lambda)^{\frac{m+1}{2}}(q(1-\lambda))^{\frac{m-1}{2}}}{(\lambda+q(1-\lambda))^m}$ and if it is part of the majority and allowed to attend $c = \binom{m-1}{\frac{m-1}{2}} \frac{(\lambda)^{\frac{m+1}{2}}(q(1-\lambda-\gamma)+\gamma)^{\frac{m-1}{2}}}{(\lambda+q(1-\lambda-\gamma)+\gamma)^m}$. In order for all of the above 4 equations to hold, the proportion of volunteers from the minority must be the same in all of them. It follows that the government's expected payoff is unaffected by a ban on a special interest group if $\lambda < \lambda^{c,\gamma,maj}$.

If $\lambda \in [\lambda^{c,\gamma,maj}, \lambda^c]$, a ban increases the probability of a minority-dominated jury. A ban only affects the composition of the volunteer pool if the special interest group is part of the majority and banned. in this case, the entire eligible population will be willing to volunteer. The payoff to a member of the majority is increasing in the proportion of volunteers from the minority, so the proportion of volunteers from the minority must be higher with a ban than without. Hence the probability of a minority-dominated jury is higher.

If $\lambda \in [\lambda^c, \lambda^{c,\gamma,min}]$, the effect of a ban is ambiguous. A ban increases the proportion of volunteers from the minority if the special interest group belongs to the majority, and vice versa. Which of these effects dominates depends on λ, c and γ. For example, let $\gamma = 0.01$ and $c = 0.05$. These parameters imply $\lambda^c = 0.375$, $\lambda^{c,\gamma,maj} = 0.371$ and $\lambda^{c,\gamma,min} = 0.381$. If $\lambda = 0.3755$, a ban decreases the probability of the right result from 0.840 to 0.837. If $\lambda = 0.38$, though, a ban increases then the probability of the right result from 0.831 to 0.832.

If $\lambda > \lambda^{c,\gamma,min}$ the entire population always volunteers. The government therefore compares the probability of making the right decision if it allows the special interest group to volunteer, $\sum_{i=0}^{\frac{m-1}{2}} \lambda^i(1-\lambda)^{m-i}$, with the probability if it bans it $\frac{1}{2}\sum_{i=0}^{\frac{m-1}{2}}(\lambda-\gamma)^i(1-\lambda)^{m-i} + \frac{1}{2}\sum_{i=0}^{\frac{m-1}{2}} \lambda^i(1-\lambda-\gamma)^{m-i}$. Differentiating this wrt γ yields $\frac{((1-\lambda)^{\frac{m+1}{2}}(\lambda-\gamma)^{\frac{m-1}{2}} - \lambda^{\frac{m+1}{2}}(1-\lambda-\gamma)^{\frac{m-1}{2}}}{(2(1-\gamma)(m+1)Beta[\frac{m+1}{2},\frac{m+1}{2}])}$ which is always positive at $\gamma = 0$—i.e. a move from no ban (which is effectively $\gamma = 0$) to a ban when γ is very small always increases the government's expected payoff. On the other hand, for example, $\lambda = 0.47$ and $\gamma = 0.15$[1], a ban decreases the government's expected payoff from 0.593 to 0.588.

[1] if $c = 0.05$, then $\lambda^{c,\gamma,min} = 0.469$

C. PROOFS FROM CHAPTER 3

Proof of Lemma 7

Proof. For an equilibrium of the challenge funding game to satisfy the intuitive criterion, there must be no possible deviation that is equilibrium dominated for low but not for high types. Suppose such a deviation, $\tilde{q}_p$, existed, so the government would believe $Prob(\theta_h|\tilde{q}_p) = 1$ while $Prob(\theta_h|q^p) = \frac{1}{2}$. Then setting $q_i = \tilde{q}_p$ would yield a payoff of $\tilde{x}_p$, defined as the government's best response to these beliefs: $\tilde{x}_p = argmax_x \theta_h f(x) + \frac{1}{2} f(X - x)$

Hence a deviation will exist (where $\tilde{e}^{pl}$ and $\tilde{e}^{ph}$ are the effort levels required to produce $\tilde{q}_p$ for low and high types respectively) iff

$$\tilde{x}_p - \frac{X}{2} - (C(\tilde{e}^{ph}) - C(e^{ph})) > 0 \text{ high types prefer the deviation}$$
$$\text{and } \tilde{x}_p - \frac{X}{2} - (C(\tilde{e}^{pl}) - C(e^{pl})) \leq 0 \text{ low types do not}$$

If no such $\tilde{q}_p$ exists, the proposed pooling equilibrium will satisfy the intuitive criterion. □

Proof of Lemma 8

Proof. Given the government's beliefs and the fact that it always costs more to produce a higher quality bid, is it straightforward to see that a low ability council will never deviate to submit a bid $q_i \in (0, q^s)$, and a high ability council will never deviate to submit a bid $q_i > q^s$. For a low ability council to want to deviate to produce a bid $q_i \geq q^s$ it would need to be the case that:

$$\frac{1}{2}(\frac{X}{2} + x^s) - C(e^{sl}) > \frac{1}{2}(\frac{X}{2} + (X - x^s))$$

and the definition of q^s is such that this is not true. While for a high ability council to want to deviate to $q_i = 0$, it would have to be that:

$$\frac{1}{2}(\frac{X}{2} + (X - x^s)) > \frac{1}{2}(\frac{X}{2} + x^s) - C(e^{sh})$$

and again this is ruled out by the definition of q^s. Hence the proposed equilibrium strategies are best responses for both types of council.

Turning to the government, if councils follow these strategies then its beliefs are consistent with equilibrium behaviour. Given these beliefs, if $q_i \geq q^s$ and $q_j < q^s$ its expected payoff is: $\theta_h f(x_i) + \theta_l f(X - x_i)$, and the properties of $f(.)$ mean that this is maximised at $x_i = x^s$ as defined in the lemma. Similarly, if $q_i, q_j \geq q^s$ or $q_i, q_j < q^s$, the government's expected payoff is

$$\theta_h(f(x_i) + f(X - x_i) \quad or \quad \theta_l(f(x_i) + f(X - x_i)$$

and again the properties of $f(.)$ mean this is maximised at $x_i = \frac{X}{2}$.

The government's beliefs also comply with the intuitive criterion. Values of $q_i > q^s$ are equilibrium dominated for both types. High ability types are believed to be high ability for certain if they set $q_i = q^s$, so an increase in the quality of their dossiers can have no effect on the amount they are paid, and increases their cost. For low ability types, the definition of q^s is such that they are not willing to expend any more effort than e^{sl} even if as a result they are believed to be high ability for certain. Similarly, if setting $q_i \in (0, q^s)$ would lead to council i being believed to be high ability for certain, both types of council would want to deviate to $q_i \in (0, q^s)$. The intuitive criterion therefore doesn't apply here either.

Finally, uniqueness follows from the standard argument for why the intuitive criterion rules out all but the most efficient separating equilibrium. Clearly low ability councils will only ever set $e_i = 0$ in a separating equilibrium. There are a range of perfect bayesian equilibrium in which high ability councils set $q_i = q'$ where $q' > q^s$ but, defining e' by $q' = q(\theta_h, e')$, $x^s - \frac{X}{2} > C(e')$. However, any $q \in (q^s, q')$ is (by the definition of q^s) equilibrium dominated for low ability authorities, but clearly not for high ability ones. Hence the intuitive criterion rules out any $q > q^s$. Finally, high ability types setting $q < q^s$ is not consistent with separation. □

Proof of Lemma 9

Proof. Again we need to check that there is no possible deviation that is equilibrium dominated for low but not for high types.

x^{sem} is the amount that government pays in the proposed semi-separating equilibrium to a council that sets $q_i = q^{sem}$ if the other council sets $q_i = 0$. The equilibrium probability that a council is high ability given that it sets q^{sem} is $Prob(\theta_h|q^{sem}) = \frac{Prob(q^{sem}|\theta_h)Prob(\theta_h)}{Prob(q^{sem} and \theta_h)} = \frac{1\times\frac{1}{2}}{\frac{1}{2}+\frac{1-p}{2}} = \frac{1}{2-p}$
so the optimal x^{sem} is $x^{sem} = argmax_x \frac{\theta_h+\theta_l(1-p)}{2-p} f(x) + \theta_l f(X-x)$
If a deviation $\tilde{q}$ exists s.t. $Prob(\theta_h|\tilde{q}) = 1$, then if the other council sets $q_i = 0$, a deviating council will simply get x^s as defined for a fully separating equilibrium. If the other council sets q^{sem}, though, the government will pay the deviating council $\tilde{x}$ where $\tilde{x} = argmax_x \theta_h f(x) + \frac{\theta_h+\theta_l(1-p)}{2-p} f(X-x)$
For a deviation to exist it must be that, supposing council j followed the semi-separating equilibrium strategy, a high ability council i would rather deviate to $\tilde{q}$ than set q^{sem}, while a low ability council i would rather mix over $q_i = 0$ and $q_i = q^{sem}$ than set $\tilde{q}$. The probability that council j sets $q_i = 0$ is $\frac{p}{2}$ while the probability that it sets $q_i = q^{sem}$ is $\frac{2-p}{2}$. Therefore the conditions for a deviation to exist are (as stated in the lemma):

$$(\frac{p}{2}(x^s - x^{sem}) + \frac{2-p}{2}(\tilde{x} - \frac{X}{2})) - (C(\tilde{e}^h) - C(e^{h,sem})) > 0$$
$$\text{and } (\frac{p}{2}(x^s - x^{sem}) + \frac{2-p}{2}(\tilde{x} - \frac{X}{2})) - (C(\tilde{e}^l) - C(e^{l,sem})) < 0$$

□

Proof of Lemma 10

Proof. As set out in the proof of Lemma 9, if councils follow the proposed equilibrium strategies, it is optimal for the government to set $x_i = x^{sem}$ when $q_i \geq q^{sem}$ and $q_j < q^{sem}$, and for it to set $x_i = \frac{X}{2}$ when $q_i, q_j \geq q^{sem}$ and also when $q_i, q_j < q^{sem}$.

Given the government's responses, clearly no council will want to deviate to either $q_i > q^{sem}$ or $q_i \in (0, q^{sem})$. A high ability council will want to set $q_i = q^{sem}$ rather than $q_i = 0$ as long as:

$$\frac{1}{2}(px^{sem} + (2-p)\frac{X}{2}) - C(e^{h,sem}) > \frac{1}{2}((2-p)(X - x^{sem}) + p\frac{X}{2})$$

which must be true since $x^{sem} - \frac{X}{2} = C(e^{l,sem})$, and $C(e^{l,sem}) > C(e^{h,sem})$. A low ability council will be indifferent, and therefore prepared to mix, as long as:

$$\frac{1}{2}((2-p)(X - x^{sem}) + p\frac{X}{2}) = \frac{1}{2}(px^{sem} + (2-p)\frac{X}{2}) - C(e^{l,sem})$$

which rearranges to the definition in Lemma 9. □

Proof of Proposition 8

Proof. Since the expected ability of a council is fixed by assumption at $\frac{1}{2}$, a change in θ_h has no effect on the expected payoff to the government from formula funding, while the payoff from centralization is independent of θ_h. We therefore simply have to examine whether the payoff from challenge funding is increasing or decreasing in θ_h. Substituting $1-\theta_h$ for θ_l in the equation for V_G^{CF}, differentiating wrt θ_h and reaaranging (bearing in mind that by the definition of x^{sem} $\frac{\partial V_G^{CF}}{\partial x^{sem}} = 0$ so the coefficient on $\frac{dx^{sem}}{d\theta_h}$ will $= 0$):

$$\frac{dV_G^{CF}}{d\theta_h} = \frac{p^2}{2}(f(x^{sem}) - f(\frac{X}{2})) + p(1-p)(f(\frac{X}{2}) - f(X - x^{sem})) - \frac{dC(e^{h,sem})}{d\theta_h} - (1-p)\frac{dC(e^{l,sem})}{d\theta_h}$$

Since $x^{sem} \geq \frac{X}{2} \geq (X - x^{sem})$, the first two terms of this expression are positive.
$C(e^{l,sem}) = x^{sem} - \frac{X}{2}$. Since $\frac{dx^{sem}}{d\theta_h} > 0$, the final term, $-(1-p)\frac{dC(e^{l,sem})}{d\theta_h}$ is negative.
As discussed in the text, the effect of an increase in θ_h on $C(e^{h,sem})$ is ambiguous. Note that we can define $e^{h,sem}$ as a function of q^{sem} and θ_h. Since q^{sem} is strictly increasing in $e^{h,sem}$, $e^{h,sem}$ is also strictly increasing in q^{sem}. Furthermore, since q^{sem} is strictly increasing in θ, $e^{h,sem}$ is strictly decreasing in θ_h. We have

$$\frac{dC(e^{h,sem})}{d\theta_h} = \frac{dC(e^{h,sem}(q^{sem},\theta_h)}{de}(\frac{\partial e^{h,sem}}{\partial q^{sem}}\frac{\partial q^{sem}}{\partial \theta_h} + \frac{\partial e^{h,sem}}{\partial \theta_h})$$

We can then use the fact that $q^{sem} = q(e^{l,sem}, 1-\theta_h)$, where $C(e^{l,sem}) = x^{sem} - \frac{X}{2}$, and the fact that $\frac{dx^{sem}}{d\theta_h}$ is known and positive, to break down $\frac{\partial q^{sem}}{\partial \theta_h}$:

$$\frac{\partial q^{sem}}{\partial \theta_h} = \frac{\partial q(e^{l,sem}, 1-\theta_h)}{\partial \theta_h} + \frac{\partial q^{sem}(e^{l,sem}, 1-\theta_h)}{\partial e^{l,sem}}\frac{\partial e^{l,sem}}{\partial x^{sem}}\frac{\partial x^{sem}}{\partial \theta_h}$$

$$\Rightarrow \frac{dC(e^{h,sem})}{d\theta_h}$$
$$= \underbrace{\frac{dC(e^{h,sem})}{de}}_{>0}\left(\underbrace{\frac{\partial e^{h,sem}(q^{sem},\theta_h)}{\partial q^{sem}}\frac{\partial q^{sem}(e^{l,sem},1-\theta_h)}{\partial e^{l,sem}}\frac{\partial e^{l,sem}}{\partial x^{sem}}\frac{\partial x^{sem}}{\partial \theta_h}}_{>0} + \underbrace{\frac{\partial e^{h,sem}(q^{sem},\theta_h)}{\partial \theta_h}}_{<0}\right)$$

so the sign of $\frac{dC(e^{h,sem})}{d\theta_h}$ is ambiguous. □

Proof of Lemma 11

Proof. The government's payoff from setting the larger budget share equal to some $\hat{x}$ is $\frac{1}{2}(\theta_h f(\hat{x}) + \theta_l f(X-\hat{x}) + \frac{\theta_h+\theta_l}{4}(f(\hat{x}) + f(X-\hat{x}))$. Setting the differential of this wrt $\hat{x}$ equal to 0 gives the condition in the lemma. We know that x^s satisfies $\frac{\theta_h}{\theta_l} = \frac{f'(X-x^s)}{f'(x^s)}$, while $\frac{(2\theta_h+1)}{(2\theta_l+1)} = \frac{f'(X-x^{bc})}{f'(x^{bc})}$. We have that $\frac{\theta_h}{\theta_l} > \frac{2\theta_h+1}{2\theta_l+1}$, so it must be that $\frac{f'(X-x^s)}{f'(x^s)} > \frac{f'(X-x^{bc})}{f'(x^{bc})}$. Since $f''(.) < 0$, this implies $x^s > x^{bc}$. □

D. DATA FROM CHAPTER 3

Since the total amount of SRB funding going to each region was fixed by central government according to statistical needs indicators, and I use the 1998 Indices of Multiple Deprivation (IMD) for each LA area to measure need, I regress per capita SRB allocation on IMD and region to

Region check (all councils)

IMD score 1998	0.01093 (0.00239)***
South East	-0.01242 -0.07977
South West	0.13835 -0.0855
London	-0.04475 -0.08903
East Anglia	-0.02032 -0.0861
East Midlands	0.01552 -0.08936
West Midlands	-0.02405 -0.09295
North East	0.02057 -0.10178
North West	0.01197 -0.08701
Observations	354
R-squared	0.08

*Note: s.e.in parentheses;***sig.at 1%;Yorkshire & Humberside omitted*

Tab. D.1: Results of regression of per capita SRB allocation on IMD score and region

ensure IMD is reasonably close to the government's indicator- and hence that if challenge funding replicated the outcome of formula funding this would come through in my analysis. The results are in Table D.1. Once deprivation was controlled for the regional dummy variables were all insignificant.

	Council type surveyed					
	Metro-politan	Shire County	Shire District	Unitary	London Borough	Welsh Unitary
East Midlands	0 n/a	3 (60%)	16 (44%)	1 (25%)	0 n/a	0 n/a
East of England	0 n/a	2 (33%)	19 (44%)	1 (20%)	0 n/a	0 n/a
North East	3 (60%)	0 (0%)	3 (23%)	1 (20%)	0 n/a	0 n/a
North West	6 (40%)	1 (33%)	10 (42%)	2 (50%)	0 n/a	0 n/a
South East	0 n/a	0 (0%)	26 (47%)	5 (42%)	0 n/a	0 n/a
South West	0 n/a	2 (33%)	20 (57%)	3 (30%)	0 n/a	0 n/a
West Midlands	3 (43%)	1 (25%)	15 (63%)	2 (67%)	0 n/a	0 n/a
Y&H & (56%)	5 (100%)	1 (57%)	4 (80%)	4 n/a	0 n/a	0
Wales	0 n/a	0 n/a	0 n/a	0 n/a	0 n/a	11 (50%)
London	0 n/a	0 n/a	0 n/a	0 n/a	26 (79%)	0 n/a
Total	17 (47%)	10 (29%)	113 (48%)	19 (40%)	26 (79%)	11 (50%)

Tab. D.2: The distribution of the councils who responded to the LGA's recruitment and retention survey across council types and regions(numbers of respondents in sample (and as a percentage of total number in category))

E. PROOFS FROM CHAPTER 4

Proof of Lemma 12

Proof. This auction satisfies assumptions $1-5$ from Maskin and Riley (2003), with $s_i = \frac{1+\lambda}{\lambda}\theta_i(X-x)^{\frac{1}{p}}$, and the unconstrained equilibrium bidding function is therefore unique (and symmetric). The presence of the ring-fencing constraint means that a council's utility is not continuously differentiable in its bid—if the council bids below its constraint, its payoff is the same as if it had bid at its constraint, so there is a kink in the utility function. The unconstrained bidding function $b_u(\theta)$ solves the first-order differential equation:

$$f(\theta(((X-x)(1+\lambda) - \lambda\frac{b_u(\theta)^p}{\theta^p}) - F(\theta)\lambda\frac{pb'(\theta)b_u(\theta)^{p-1}}{\theta^p} = 0$$

with the initial condition $b_u(0) = 0$. If this lies at or above the constraint $\forall\theta \in [0,1]$ then the constraint does not affect the equilibrium and

$$b(\theta) = b_u(\theta) = (X-x)^{\frac{1}{p}}\big(\frac{1+\lambda}{\lambda}\int_0^\theta \frac{z^p f(z)}{F(\theta)}dz\big)^{\frac{1}{p}}$$

If $b_u(\theta) < \theta(X-x)^{\frac{1}{p}}$ for some θ, this cannot be the equilibrium. Since the unconstrained equilibrium is unique, the presence of the constraint cannot result in an equilibrium bidding function starting from a different initial condition: $b(0) = 0(X-x)^{\frac{1}{p}} = 0$. However, on the constrained bidding function the standard first order condition does not hold. Instead, *at least* for some range $\theta \in [0,\epsilon]$, $\epsilon > 0$, the constraint will bind while the first derivative of the payoff function will be negative i.e.

$$f(\theta)((X-x)(1+\lambda) - \lambda\frac{b(\theta)^p}{\theta^p}) < F(\theta)\lambda\frac{pb'(\theta)b(\theta)^{p-1}}{\theta^p} \text{ and } b(\theta) = \theta(X-x)^{\frac{1}{p}}$$

These simplify to $p\lambda > \theta\frac{f(\theta)}{F(\theta)}$. If this holds $\forall\theta \in [0,1]$, then there is an equilibrium in which all councils bid at their constraint. Moreover, this will be the unique equilibrium. To see this, note first that there can be no discontinuous increases in the equilibrium bidding function. Suppose

that there was—that $\theta'' = \theta' + \epsilon$ but that as $\epsilon \to 0$, $b(\theta'') - b(\theta') \nrightarrow 0$. In this case, a council with ability θ'' could reduce its bid by a discrete amount, increasing its profit conditional on winning without affecting its probability of winning. It therefore cannot be an equilibrium.

Now consider the possibility that a continuous bidding function might rise above the constraint at some point θ'. Denote this function $\hat{b}(\theta)$ so $\frac{d\hat{b}(\theta)}{d\theta} > (X-x)^{\frac{1}{p}}$ for $\theta \in (\theta', \theta' + \xi]$ for some $\xi > 0$. If this were an equilibrium the first order condition would have to hold over this range. To see that it therefore cannot be equilibrium, take $\theta'' = \theta' + \epsilon$. As $\epsilon \to 0$, $\hat{b}(\theta'') \to \theta''(X-x)^{\frac{1}{p}}$ but $\frac{d\hat{b}(\theta'')}{d\theta} > (X-x)^{\frac{1}{p}}$ so as $\theta'' \to \theta'$.

$$f(\theta'')((X-x)(1+\lambda) - \lambda\frac{\hat{b}(\theta'')^p}{\theta''^p}) - F(\theta'')\lambda\frac{p\hat{b}'(\theta'')\hat{b}(\theta'')^{p-1}}{\theta''^p}$$
$$\to f(\theta'')((X-x)) - F(\theta'')\lambda\frac{p\hat{b}'(\theta'')(X-x)^{\frac{p-1}{p}}}{\theta''} < f(\theta'')((X-x)) - F(\theta'')\lambda\frac{p(X-x)}{\theta''} < 0$$

This establishes the first part of the lemma. Now consider the case where $\exists\theta \; s.t. \; p\lambda < \theta\frac{f(\theta)}{F(\theta)}$, but the unconstrained bidding function does not lie (weakly) above the constraint $\forall\theta \in [0,1]$).

The argument that the equilibrium bidding function must be continuous applies here too. However, the continuous bidding function must rise above the constraint at some point. Denote the minimum value of θ s.t. $p\lambda < \theta\frac{f(\theta)}{F(\theta)}$ as $\theta^l_{1,s}$. If all other councils bid at their constraints, the best response for a council with ability marginally above $\theta^l_{1,s}$ is to bid strictly above its constraint. Where the equilibrium bidding function lies above the constraint, it must satisfy the FOC:

$$f(\theta)((X-x)(1+\lambda) - \lambda\frac{b(\theta)^p}{\theta^p}) - F(\theta)\lambda\frac{pb'(\theta)b(\theta)^{p-1}}{\theta^p} = 0$$

However, in order to solve this to find $b_c(\theta) = b(\theta) \; \forall\theta \in [\theta^l_{1,s}, \theta^h_{1,s}]$[1], clearly the relevant "initial condition" is not $b(0) = 0$, since the first order condition does not hold for $\theta < \theta^l_{1,s}$. Rather, continuity requires that $b_c(\theta^l_{1,s}) = \theta^l_{1,s}(X-x)^{\frac{1}{p}}$. Integrating the FOC, using the initial condition to solve for the constant of integration and rearranging, we get:

$$b_c(\theta, \theta^l_{1,s}) = (X-x)^{\frac{1}{p}}\left((\theta^l_s)^p\frac{F(\theta^l_{1,s})}{F(\theta)} + \frac{1+\lambda}{\lambda}\int_{\theta^l_{1,s}}^{\theta}\frac{z^p f(z)}{F(\theta)}dz\right)^{\frac{1}{p}}$$

[1] where the upper limit of this range is defined, as in the lemma, as $min\{1, min(\theta|\theta > \theta^l_{1,s} \; and \; b_c(\theta) = \theta(X - x)^{\frac{1}{p}})\}$

If this function lies above the constraint $\forall\theta \in [\theta^l_{1,s}, 1]$, then the full equilibrium bidding function specified in Lemma 12is simply $b(\theta) = \theta(X-x)^{\frac{1}{p}}\ \forall\theta \in [0, \theta^l_{1,s}]$ and $b(\theta) = b_c(\theta, \theta^l_{1,s})\ \forall\theta \in [\theta^l_{1,s}, 1]$.

Since $b_c(\theta)$ is not necessarily a global maximum of the unconstrained problem, I now check that it nevertheless constitutes the unique equilibrium for any range $[\theta^l_{i,s}, \theta^h_{i,s}]$ as defined in Lemma 12. To see that it is an equilibrium, we can use the fact that for bids above its constraint a council's utility function is continuously differentiable with respect to its bid, and that a council will never bid below its constraint. Hence we just need to show that if $s < \theta$ but $b(\theta) \geq \theta(X-x)^{\frac{1}{p}}$, then $\frac{d\pi_2(\theta,s)}{ds} < 0$, while if $s > \theta$ then $\frac{d\pi_2(\theta,s)}{ds} > 0$(see Maskin and Riley (1984), proof of theorem 2).

$$\begin{aligned}\frac{d\pi_2(\theta,s)}{ds} &= f(s)((X-x)(1+\lambda) - \lambda\frac{(X-x)}{\theta^p}(\theta^l_{1,s}\frac{F(\theta^l_{1,s})}{F(s)} + \frac{1+\lambda}{\lambda}\int_{\theta^l_{1,s}}^{s}\frac{z^p f(z)}{F(s)}dz)) \\ &\quad - F(s)\frac{\lambda}{\theta^p}((X-x)(-\theta^l_{1,s}\frac{f(s)F(\theta^l_{1,s})}{(F(s))^2} - \frac{1+\lambda}{\lambda}\frac{f(s)}{F(s)}\int_{\theta^l_{1,s}}^{s}\frac{z^p f(z)}{F(s)}dz + \frac{1+\lambda}{\lambda}\frac{s^p f(s)}{F(s)})) \\ &= f(s)((X-x)(1+\lambda))(1-\frac{s^p}{\theta^p}) > 0 \text{ iff } s < \theta\end{aligned}$$

Uniqueness of the equilibrium follows from two points. First, as usual (see e.g. Maskin and Riley (1984)), with symmetric type distributions, any equilibrium bidding schedule will be symmetric and must be a strictly increasing, continuous function of θ. Second, I showed above that there can only be one initial condition for the whole bidding schedule $b(\theta)$. Moreover, their construction implies that initial conditions for sections of the ability range in which $b(\theta) = b_c(\theta, \theta^l_{i,s})$ must be unique, given the fact that the equilibrium bidding function is continuous. Hence $b(\theta)$ as defined in Lemma 12 is the unique equilibrium bidding function. □

Proof of Lemma 13

Proof. The equilibrium for the auction for the larger share is of the same form as that for the smaller share, and the proof that $t(\theta)$ as set out in Lemma 13 constitutes the unique equilibrium follows the same principles. The only difference (aside from the budget being x not $X-x$) is that the expected profit function has to be modified to take account of the fact that a losing council will enter the auction for the smaller share.

If the equilibrium bidding function is $t(\theta)$, a council of type θ bidding as type $s > \theta$ expects a payoff:

$$\pi_1(s,\theta) = F(s)^2(x(1+\lambda) - \lambda\frac{t(s)^p}{\theta^p}) + 2(1-F(s))\pi_2(\theta) \tag{E.1}$$

while one bidding as a type $s < \theta$ expects a payoff:

$$\pi_1(s,\theta) = F(s)^2(x(1+\lambda) - \lambda\frac{t(s)^p}{\theta^p}) + (1 - F(s)^2 - (1-F(\theta))^2)((X-x)(1+\lambda) - \lambda\frac{b(\theta)^p}{\theta^p})) \quad \text{(E.2)}$$

where $\pi_2(\theta) = F(\theta)((X-x)(1+\lambda) - \lambda\frac{b(\theta)^p}{\theta^p})$. Differentiating equation E.1 wrt s gives:

$$\frac{d\pi_1(s,\theta)}{ds} = 2f(s)F(s)(x(1+\lambda) - \lambda\frac{t(s)^p}{\theta^p}) - (F(s))^2\lambda\frac{pt'(s)t(s)^{p-1}}{\theta^p} - 2f(s)\pi_2(\theta) \quad \text{(E.3)}$$

As argued in the previous proof, all councils will bid at their constraint in equilibrium if this derivative, evaluated at $s = \theta$ and $t(\theta) = \theta x^{\frac{1}{p}}$, is non-positive over the whole ability range:

$$0 \leq 2f(\theta)F(\theta)x - (F(\theta))^2\lambda\frac{px}{\theta} - 2f(\theta)\pi_2(\theta) \Rightarrow p\lambda \geq 2\theta\frac{f(\theta)}{F(\theta)}(1 - \frac{\pi_2(\theta)}{xF(\theta)}) \quad \forall\theta \in [0,1]$$

If this does not hold over the whole range then, as in Lemma 12, the equilibrium bidding function must rise above the constraint at some point, and the lowest value of θ at which it does this will be $\theta^l_{1,g}$ as defined in the lemma. Again as in Lemma 12, when the equilibrium bidding function lies above the constraint, it must satisfy the first order condition:

$$\frac{d\pi_1(s,\theta)}{ds}_{s=\theta} = 2f(s)F(s)(x(1+\lambda) - \lambda\frac{t(s)^p}{\theta^p}) - (F(s))^2\lambda\frac{pt'(s)t(s)^{p-1}}{\theta^p} - 2f(s)\pi_2(\theta) = 0$$

Note that, of course, at $s = \theta$, this is the same FOC whether s approaches θ from above or below. The initial condition for the lowest range of values of θ for which $t(\theta) = t_c(\theta, \theta^l_{i,g}) > \theta x^{\frac{1}{p}}$ is $t(\theta^l_{1,g}) = t_c(\theta^l_{1,g}, \theta^l_{1,g}) = \theta^l_{1,g}x^{\frac{1}{p}}$. Solving, we get:

$$t_c(\theta, \theta^l_{1,g}) = \left(\frac{1+\lambda}{\lambda}x\int_{\theta^l_{1,g}}^{\theta}\frac{z^p 2f(z)F(z)}{F(\theta)^2}dz - \frac{1}{\lambda}\int_{\theta^l_{1,g}}^{\theta}\frac{z^p 2f(z)\pi_2(z)}{F(\theta)^2}dz + x(\theta^l_{1,g})^p\frac{F(\theta^l_{1,g})^2}{F(\theta)^2}\right)^{\frac{1}{p}}$$

To check this is an equilibrium for each range $[\theta^l_{i,g}, \theta^h_{i,g}]$, we again simply have to insert it into the relevant expression from $\frac{d\pi_1(s,\theta)}{ds}$ and ensure this is negative for all $s > \theta$ and positive for $s < \theta$. Taking the first case, we have

$$\begin{aligned}\frac{d\pi_1(s,\theta)}{ds} &= 2f(s)F(s)(x(1+\lambda) - \lambda\frac{t(s)^p}{\theta^p}) - F(s)^2\lambda\frac{pt'(s)t(s)^{p-1}}{\theta^p} - 2f(s)F(\theta)((X-x)(1+\lambda) - \lambda\frac{b(\theta)^p}{\theta^p}) \\ &= \frac{2f(s)}{\theta^p}\big(-F(s)x(1+\lambda)(s^p - \theta^p) + s^p\pi_2(s) - \theta^p\pi_2(\theta)\big) \quad \text{(E.4)}\end{aligned}$$

The sign of this is the sign of $\big(-F(s)x(1+\lambda)(s^p - \theta^p) + s^p\pi_2(s) - \theta^p\pi_2(\theta)\big)$. Since $s > \theta$ and

$\pi_2(s) > \pi_2(\theta)$, it is not clear that this is negative. To show that it is, we differentiate again wrt θ and show that this derivative is positive—and hence that the closer s is to θ, the larger $\frac{d\pi_1(s,\theta)}{ds}$. Since $\frac{d\pi_1(s,\theta)}{ds} = 0$ when $s = \theta$, it follows that when $s > \theta$, $\frac{d\pi_1(s,\theta)}{ds} < 0$. We need to consider two cases—when $b(\theta) = \theta(X-x)^{\frac{1}{p}}$ and when $b(\theta) > \theta(X-x)^{\frac{1}{p}}$.

$$\frac{d}{d\theta}\big(-F(s)x(1+\lambda)(s^p-\theta^p)+s^p\pi_2(s)-\theta^pF(\theta)(X-x)\big) = \big(F(s)x(1+\lambda)p\theta^{p-1}-p\theta^{p-1}F(\theta)(X-x)-\theta^pf(\theta)(X-x)\big) \tag{E.5}$$

using the fact that if councils are bidding at their constraints we know $p\lambda > \theta\frac{f(\theta)}{F(\theta)}$ so $f(\theta) < p\lambda\frac{F(\theta)}{\theta}$, we have:

$$F(s)x(1+\lambda)p\theta^{p-1} - p\theta^{p-1}F(\theta)(X-x) - \theta^pf(\theta)(X-x) > p\theta^{p-1}(1+\lambda)(F(s)x - F(\theta)(X-x)) > 0 \tag{E.6}$$

If $b(\theta) > \theta(X-x)^{\frac{1}{p}}$ the problem is simpler and we just have,

$$\frac{d}{d\theta}\big(-F(s)x(1+\lambda)(s^p-\theta^p)+s^p\pi_2(s)-\theta^p\pi_2(\theta)\big) = p\theta^{p-1}F(s)x(1+\lambda)-p\theta^{p-1}F(\theta)(X-x)(1+\lambda) > 0 \tag{E.7}$$

A council will therefore never want to bid as $s > \theta$.

Now consider $s < \theta$.

$$\begin{aligned}\frac{d\pi_1(s,\theta)}{ds} &= 2f(s)F(s)(x(1+\lambda)-\lambda\frac{t(s)^p}{\theta^p})-F(s)^2\lambda\frac{pt'(s)t(s)^{p-1}}{\theta^p}-2f(s)F(s)((X-x)(1+\lambda)-\lambda\frac{b(\theta)^p}{\theta^p})\\ &= 2f(s)F(s)\big(x(1+\lambda)(1-\frac{s^p}{\theta^p}) - (X-x)(1+\lambda)(1-\frac{s^p}{\theta^p}) + \frac{\lambda}{\theta^p}(b(\theta)^p - b(s)^p)\big)\\ &= 2f(s)F(s)\big((2x-X)(1+\lambda)(1-\frac{s^p}{\theta^p}) + \frac{\lambda}{\theta^p}(b(\theta)^p - b(s)^p)\big) > 0 \quad \text{if } s < \theta \end{aligned} \tag{E.8}$$

□

F. LOGIT DIAGNOSTICS FROM CHAPTER 5

In this section I report the results of diagnostic and goodness-of-fit tests on my central logit model—specification III in Table 5.3. Looking first at overall goodness-of-fit, the standard tests (Hosmer-Lemeshow and Osius-Rojek) are not available for sample-weighted data (Hosmer and Lemeshow, 2000). I therefore use a test, similar to the Hosmer-Lemeshow test, proposed by Archer and Lemeshow (2006) and Archer, Hosmer and Lemeshow (2007). For my main specification, the F-adjusted mean residual test statistic was 0.966, which has a p-value of 0.468—suggesting that the model fits quite well.

A second statistic of interest is the area under the ROC curve, which is used to judge how well the model discriminates. The area, this time calculated using estimated coefficients from the weighted model to predict using unweighted data,[1] is 0.63. This is well above 0.5, but nevertheless below the level usually taken to indicate good discrimination.

Turning to diagnostic statistics, in the absence of procedures for dealing with sampling weights, Hosmer and Lemeshow recommend treating the data as if they resulted from a simple random sample—i.e. running the relevant logit model with no weights and using the resulting coefficients and associated predicted probabilities—and then implementing any discoveries in the main, design-based model. Figures F.1, F.2 and F.3 plot predicted probabilities against, respectively, Hosmer-Lemeshow Delta-χ^2 and Delta-D influence statistics, and the Pregibon Delta-Beta influence statistic. The Delta-Beta values are all quite low—Hosmer and Lemeshow suggests that the influence diagnostic needs to be over 1.0 to impact on estimated coefficients. However, there are several quite large, and out-lying observations in Figures F.1 and F.2.

The effect in the weighted model of omitting the 1 observation in the upper left-hand corner of both graphs, and then of omitting both this and the three observations in the top right hand

[1] As suggested in Hosmer and Lemeshow (2000)

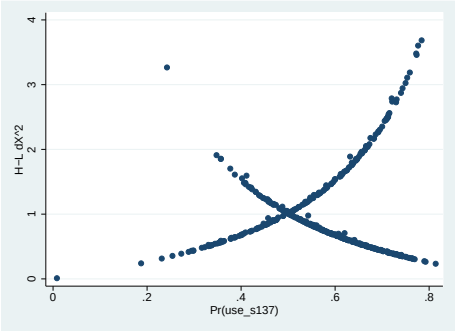

Fig. F.1: Plot of predicted probabilities against Hosmer-Lemeshow Delta-χ^2 statistic

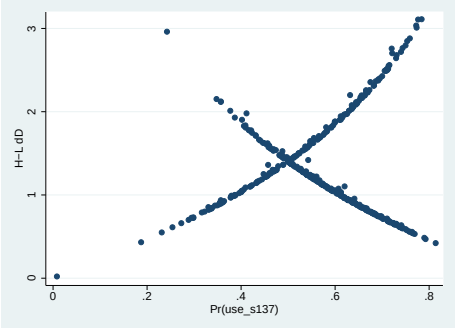

Fig. F.2: Plot of predicted probabilities against Hosmer-Lemeshow Delta-D statistic

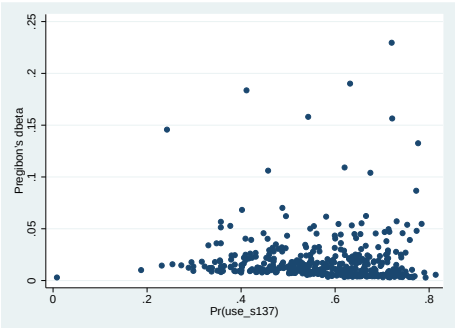

Fig. F.3: Plot of predicted probabilities against Pregibon Delta-Beta statistic

corner with a Delta-χ^2 statistic above 3.2 and/or a Delta-D statistic above 2.95 are reported in Table F.1. The only really noticeable difference is the reduction in the significance of the parish

	Full sample	One omission	Four omissions
All hhlds.	$1.98E\text{-}4^{**}$	$1.96E\text{-}4^{**}$	$1.94E\text{-}4^{**}$
	$(9.85E\text{-}5)$	$(9.91E\text{-}5)$	$(9.89E\text{-}5)$
All hhlds.^{2}	$-9.79E\text{-}9^{*}$	$-9.29E\text{-}9$	$-7.84E\text{-}9$
	$(6.12E\text{-}9)$	$(7.74E\text{-}9)$	$(6.53E\text{-}9)$
Frac. L3+	36.128^{***}	36.314^{***}	36.773^{***}
	(12.502)	(12.519)	(12.541)
Frac. L3+^{2}	-49.820^{***}	-49.997^{***}	-50.600^{***}
	(18.255)	(18.272)	(18.295)
Frac. 65+	5.734^{***}	5.739^{***}	5.771^{***}
	(2.224)	(2.224)	(2.225)
Liv. Env IMD	-0.0485^{**}	-0.0488^{**}	-0.0488^{**}
	(0.0200)	(0.0199)	(0.0198)
Educ. IMD	0.0857^{**}	0.0871^{***}	0.0881^{***}
	(0.0336)	(0.0337)	0.0338)
Constant	-7.784^{***}	-7.834^{***}	-7.933^{***}
	(2.453)	(2.459)	(2.468)
N	420	419	416
Log-likelihood	-267.305	-266.44	-264.126
χ^2	$31.01(7d.f.)$	$31.29(7d.f.)$	$32.01(7d.f.)$

Tab. F.1: Logit regression: 1 if the council reported using its s137 powers in 2005/2006, 0 otherwise. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

size variables. In light of this, and the fact that there is nothing obviously unusual about the parishes that correspond to these observations (they are not, for example, all town councils), I conclude that there is no good reason to exclude these observations from the analysis, or to be particularly concerned that they might be distorting the results.

G. ADDITIONAL S137 REGRESSIONS FROM CHAPTER 5

	I	**II**
All hllds.	2.31E-4	1.106E-4
	(1.84E-4)	(1.23E-4)
All hhlds.^{2}	−1.35E-8	−6.45E-9
	(1.23E-8)	(−9.38E-9)
Frac. L3+	2.803	48.491***
	(3.120)	(17.580)
Frac L3+^{2}	-	−66.622***
		(25.171)
Frac. Car	−2.599	−59.828
	(4.162)	(52.638)
Frac. Car^2	-	33.374
		(31.752)
Frac. Owner Occ.	1.697	12.645
	(1.825)	(12.096)
Frac. Owner Occ.^{2}		−6.291
		(8.239)
Frac. 65+	2.027	14.858
	(4.113)	(18.452)
Frac. 65+^{2}	-	−12.867
		(24.977)
Frac. Dep. Chldrn.	−.00985	1.461
	(4.838)	(21.474)
Frac. Dep. Chldrn.^{2}		5.684
		(34.751)
Liv. Env. IMD	−0.0368	−0.0358
	(0.0249)	(0.0268)
Educ. IMD	0.0430	0.105**
	(0.0363)	(0.0495)
Constant	−0.589	8.456
	(4.875)	(23.383)
N	420	420
Log-likelihood	−205.303	−198.637
χ^2	22.91(9$d.f.$)	29.34(14$d.f.$)

Tab. G.1: Logit regression: 1 if the council reported using its s137 powers in 2005/2006, 0 otherwise. Sample weighted by All Households to reflect distribution across all English parishes in 2001 census. Robust standard errors in parentheses, *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

BIBLIOGRAPHY

[1] Aldred, J. and Jacobs, M. (2000), "Citizens and Wetlands: Evaluating the Ely Citizens Jury", Ecological Economics, 34, 217–232.

[2] Alesina, A., Baqui, R. and Easterly, W. (1999), "Public Goods and Ethnic Divisions", Quarterly Journal of Economics, 114(4), 1243–1284.

[3] Alesina, A. and La Ferrara, E. (2000), "Participation in Heterogenous Communities", Quarterly Journal of Economics, 115(3), 847–904.

[4] Andreoni, J. (1989), "Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence", Journal of Political Economy, 97(6), 1447–1458.

[5] Andrews, K. (2006), speech to the Together We Can conference, 30th March 2006, available at: `http://www.communities.gov.uk/speeches/corporate/together-we-can-conference`

[6] Andrews, R., Boyne, G., Law, J., and Walker, R. (2005), "External Constraints on Local Service Standards: The Case of Comprehensive Performance Assessment in English Local Government", Public Administration, 83(3), 639–656.

[7] Anton, J. and Yao, D. (1989), "Split Awards, Procurement and Innovation", RAND Journal of Economics, 20(4), 538–552.

[8] Anton, J. and Yao, D. (1992), "Coordination in Split Award Auctions", Quarterly Journal of Economics, 107(2), 681–707.

[9] Archer, K. and Lemeshow, S. (2006), "Goodness-of-fit test for a logistic regression model estimated using survey sample data", The Stata Journal, 6(1), 97–105.

[10] Archer K., Lemeshow S. and Hosmer D. (2007), "Goodness-of-fit tests for logistic regression models when data are collected using a complex sampling design", Computational Statistics and Data Analysis, 51, 4450–4464.

[11] Asker, J. and Cantillon, E. (2008), "Properties of Scoring Auctions", RAND Journal of Economics, 39(1), 69–85.

[12] Audit Commission, *Comprehensive Performance Assessment*, available at: `http://www.audit-commission.gov.uk/cpa`

[13] Barabas, J. (2004), "How Deliberation Affects Policy Opinions", American Political Science Review, 98(4), 687–701.

[14] Barro, R. (1973), "The Control of Politicians: An Economic Model", Public Choice, 14(1), 19-42.

[15] Bennett, S and Bennett, L. (1986), "Political participation" in Long, S. (ed.), *Annual Review of Political Science (Vol. 1)*, Norwood, NJ: Ablex.

[16] Bergstrom, T., Blume, L. and Varian, H. (1986), "On the private provision of public goods", Journal of Public Economics, 29(1), 25–49.

[17] Bernheim, B. and Whinston, M. (1986), "Menu Auctions, Resource Allocation, and Economic Influence", Quarterly Journal of Economics, 101(1), 1–32.

[18] Besley, T. and Coate, S. (1997) "An Economic Model of Representative Democracy", Quarterly Journal of Economics, 112(1), 85–114.

[19] Besley, T. and Coate, S. (1998), "Sources of Inefficiency in a Representative Democracy: A Dynamic Analysis", American Economic Review, 88(1), 139–156.

[20] Besley, T. and Coate, S. (2001), "Lobbying and Welfare in a Representative Democracy", Review of Economic Studies, 68(1), 67–82.

[21] Bilodeau, M. and Slivinski, A. (1996), "Toilet Cleaning and Department Chairing: Volunteering a public service", Journal of Public Economics, 59(2), 299–308.

[22] Birchall, J. and Simmons, R. (2004), *User Power: The Participation of Users in Public Services*, London: National Consumer Council.

[23] Blais, A. (2000), *To Vote or Not to Vote: The Merits and Limits of Rational Choice Theory*, Pittsburgh: University of Pittsburgh Press.

[24] Blears, H. (2008), speech to the National Association of Local Councils Annual Conference, 21st May 2008, available at: http://www.communities.gov.uk/speeches/corporate/nalcconference2008

[25] Börgers, T. (2004), "Costly Voting", American Economic Review, 94(1), 57-66.

[26] Brown, G. (2007), speech to the National Council of Voluntary Organisations, 3rd September 2007, available at: http://news.bbc.co.uk/2/hi/uk_news/politics/6980747.stm

[27] Brown, G. (2010), *Towards a New Politics*, speech at the IPPR 2nd February 2010, available at: http://www.ippr.org.uk/uploadedFiles/events/gordon_brown_ippr_feb_10.pdf

[28] Bryan, F. (2003), *Real Democracy*, Chicago: University of Chicago Press.

[29] Bulkley, G., Myles G., and Pearson, B. (2001), "On the Membership of Decision-Making Committees", Public Choice, 106, 1–22.

[30] Burgess, S. and Briggs, A. (2009), "School Assignment, School Choice and Social Mobility", Economics of Education Review, in press.

[31] Cameron, D. (2009), *Fixing Broken Politics*, speech given at the Open University, 26th May 2009, available at: http://www.conservatives.com/News/Speeches/2009/05/David_Cameron_Fixing_Broken_Politics.aspx

[32] Campbell, C. (1999), "Large electorates and decisive minorities", Journal of Political Economy, 107(6), 1199-1217.

[33] Canes-Wrone, B., Herron, M. and Shotts, K. (2001), "Leadership and Pandering: A Theory of Executive Policymaking", American Journal of Political Science, 45(3), 532–550.

[34] Caplan, B. (2007), *The Myth of the Rational Voter: Why Democracies Choose Bad Policies*, Princeton: Princeton University Press.

[35] Cho, I. and Kreps, D. (1987), "Signaling Games and Stable Equilibria", Quarterly Journal of Economics, 102(2), 179–221.

[36] City of Ottowa (2010), available at: http://www.ottawa.ca/residents/cdf/index_en.html

[37] Communities and Local Government (2007a), *Using the English Indices of Deprivation 2007: Guidance*, available at:

http://www.communities.gov.uk/communities/neighbourhoodrenewal/deprivation/deprivation07/

[38] Communities and Local Government (2007b), *An Action Plan for Community Empowerment: Building on success*, Wetherby: Communities and Local Government Publications.

[39] Communities and Local Government (2008), *Unlocking the talent of our communities*, Leeds: Communities and Local Government Publications

[40] Communities and Local Government (2009), *Power to promote well-being of the area: Statutory guidance for local councils*, London: Communities and Local Government Publications.

[41] Communities and Local Government (2009), "Local Government Finance Key Facts: England", London: Communities and Local Government Publications.

[42] Conservative Party (2008), *A Stronger Society: Voluntary Action in the 21st Century*, available at: http://www.conservatives.com/Policy/Where_we_stand/voluntary_Sector.aspx

[43] Conservative Party (2009), *Control Shift: Returning Power to Local Communities*, available at:http://www.conservatives.com/Policy/Where_we_stand/Local_Government.aspx

[44] Conway, M. (1991), *Political Participation in the United States*, Washington DC: CQ Press.

[45] Coote, A. and Lenaghan, J. (1997), *Citizens' Juries: Theory Into Practice*, London: Institute for Public Policy Research.

[46] Cutler, D., Elmendorf, D. and Zeckhauser, R. (1993), "Demographic Characteristics and the Public Bundle", NBER Working Paper No.4283.

[47] Dahl, R. (1961), *Who Governs?*, London: Yale University Press

[48] Dasgupta, S. and Spulber, D. (1989), "Managing procurement auctions", Information Economics and Policy, 4(1), 5–29.

[49] Department of Communities and Local Government (2006), *Strong and prosperous communities, Local Government White Paper*, London:HMSO.

[50] Department of the Environment, Transport and the Regions (2000), *Our Countryside: The Future*, London: HMSO.

[51] Derounian, J. and Skinner, E. (2006), "Can parish councils rise to the challenge?", in Warren, M. and Yarwood, R. (eds.), *The Rural Citizen: governance, culture and wellbeing in the 21st century: Conference Proceedings*, Plymouth: University of Plymouth.

[52] Diermeier, D., Keane, M. and Merlo, A. (2005), "A Political Economy Model of Congressional Careers", American Economic Review, 95(1), 347–373.

[53] Dixon, A., Le Grand, J., Henderson, J., Mung, R. and Poteliakhoff, E. (2003), "Is the NHS equitable? A review of the evidence", LSE Health and Social Care Discussion Paper Number 11.

[54] Downs, A. (1957), *An Economic Theory of Democracy*, New York: Harper and Row.

[55] Drukker, D. (2002), "Bootstrapping a conditional moments test for normality after tobit estimation", The Stata Journal, 2(2), 125–139.

[56] Duffy, B. (2000) "Satisfaction and Expectations: Attitudes to public services in deprived areas", Working Paper 45, Centre for Analysis of Social Exclusion, London School of Economics.

[57] Edlin, A.S. and Shannon, C. (1998), "Strict Single Crossing and the Strict Spence-Mirrlees Condition: A Comment on Monotone Comparative Statics ", Econometrica, 66(6), 1417–1425

[58] Ellwood, S., Tricker, M. and Green, J. (1998) *A financial review of Parish and Town Councils in England and their discretion to spend under Section 137 of the Local Government Act 1972*, London: DETR.

[59] Felli, L. and Merlo, A. (2006), "Endogenous Lobbying", Journal of the European Economic Association, 4(1), 180–215.

[60] Ferejohn, J. and Fiorina, M. (1974), "The Paradox of Not Voting: A Decision Theoretic Analysis", American Political Science Review, 68(2), 525–546.

[61] Filimon, R., Romer, T. and Rosenthal, H. (1982), "Asymmetric Information and Agenda Control", Journal of Public Economics, 17(1), 51–70.

[62] Fishkin, J. and Laslett, P. (2003), "Introduction", in Fishkin, J. and Laslett, P. (eds.), *Debating Deliberative Democracy*, Oxford: Blackwell Publishing.

[63] Font, J. and Blanco, I. (2007), "Procedural legitimacy and political trust: The case of citizen juries in Spain", European Journal of Political Research, 46(4), 557-589.

[64] Frey,B. and Stutzer, A. (2002), "What Can Economists Learn From Happiness Research?", Journal of Economic Literature, 40(2), 402–435.

[65] Fung, A. (2002), "Creating Deliberative Publics: Governance After Devolution and Democratic Centralism", Good Society, 11(1), 66-71.

[66] Fung, A. and Wright, E. (eds) (2003), *Deepening Democracy: Institutional Innovations in Empowered Participatory Governance*, London: Verso.

[67] Gallego, A. (2008), "Unequal Political Participation in Europe", International Journal of Sociology, 37(4), 10–25.

[68] Gardner, G. (2003), *Actor-networks, identity and the hybridity of power in place recomposition*, unpublished PhD thesis, University of Wales, Aberystwyth.

[69] Ghosal, S. and Lockwood, B. (2009), "Costly voting when both information and preferences differ: is turnout too high or too low?", Social Choice and Welfare, 33(1), 25–50.

[70] Goddard, M. (2008) "Quality in and Equality of Access to Healthcare Services in England", Working Paper 40, Centre for Health Economics, University of York, UK.

[71] Goeree, J. and Großer, J. (2007), "Welfare Reducing Polls", Economic Theory, 31(1), 51–68.

[72] Gutmann, A. and Thompson, D. (1996), *Democracy and Disagreement*, Cambridge: Harvard University Press.

[73] HM Treasury (1996), *The Challenge Handbook: Advice for Government departments establishing Challenge initiatives*, London: Challenge Funding Unit.

[74] HM Treasury and Cabinet Office (2007), *The Future Role of the Third Sector in Social and Economic Regeneration: Final Report*, London: TSO.

[75] Hindriks,J and Lockwood, B. (2009), "Decentralisation and Electoral Accountability: Incentives, Separation and Voter Welfare", European Journal of Political Economy, 25(3), 385–397.

[76] Hines, J.R. and Thaler, R. (1995), "Anomalies: The Flypaper Effect", Journal of Economic Perspectives, 9(4), 217–226.

[77] Hope, P. (2007), *The role of the third sector in transforming public services*, speech given at ModernGov07 Conference, 30th October 2007, available at:
`ttp://www.cabinetoffice.gov.uk/about_the_cabinet_office/speeches/hope.aspx\`
`#modern`

[78] Hosmer, D. and Lemeshow, S. (2000), *Applied Logistic Regression*, New York: John Wiley & Sons Inc.

[79] Hunt, E. (2007), *Good Enough for Government Work? Static Efficiency Considerations in a Unitary State*, unpublished MPhil thesis, University of Oxford.

[80] The Jefferson Centre (2004), *Citizens' Jury Handbook*, available at:
$http://www.jefferson-center.org/$

[81] John, P., Ward, H. and Dowding, K. (2004), "The Bidding Game: Competitive Funding Regimes and the Political Targeting of Urban Programme Schemes", British Journal of Political Science, 34(3), 405-428.

[82] John, P. and Ward, H. (2005), "How Competitive Is Competitive Bidding? The Case of the Single Regeneration Budget Program", Journal of Public Administration, Research and Theory, 15(1), 71–87.

[83] Jones, A., Burnley, J., Cox, E. and Newman, I. (2005), *The Potential of Parish and Town Councils to Support Neighbourhood Arrangements*, London: Local Government Information Unit.

[84] Jones, A. and Newman, I. (2006), *Parish and Town Council Clustering*, London: Local Government Information Unit.

[85] Jones, A. (2007), "New Wine in Old Bottles? England's Parish and Town Councils and New Labour's Neighbourhood Experiment", Local Economy, 22(3), 227–242.

[86] Jordan, G. (2007), "Policy Without Learning: Double Devolution and Abuse of the Deliberative Idea", Public Policy and Administration, 22(1), 48–73.

[87] Kawamura, K. (2008), "A Model of Public Consultation", working paper available at:
$http://homepages.ed.ac.uk/kkawamur/$

[88] Klevena, H. and Kreinerb, C. (2006), "The Marginal Cost of Public Funds: Hours of Work Versus Labor Force Participation", Journal of Public Economics, 90, 1955–1973.

[89] Krasa, S., and Polborn, M. (2009), "Is mandatory voting better than voluntary voting?", Games and Economic Behaviour, 66(1), 275–291.

[90] Kuper, R. (1997), "Deliberating waste: The Hertfordshire Citizens' Jury", Local Environment, 2(2), 139-153.

[91] Landa, D. and Meirowitz A. (2009), "Game Theory, Information, and Deliberative Democracy", American Journal of Political Science, 53(2), 427–444.

[92] Ledyard, J. (1984), "The Pure Theory of Large Two-Candidate Elections", Public Choice, 44, 7–41.

[93] Le Grand, J. (2006), "Equality and Choice in Public Services", Social Research, 73(2), 695–711.

[94] Leigh, I. (2000), *Law, Politics, and Local Democracy*, Oxford: Oxford University Press.

[95] Lenaghan, J., New, B. and Mitchell, E. (1996), "Setting priorities: is there a role for citizens' juries?", British Medical Journal, 312, 1591–1593.

[96] Lezaun, J. and Soneryd, L. (2007), "Consulting citizens: technologies of elicitation and the mobility of publics", Public Understanding of Science, 16(3), 279-297.

[97] List, C., McLean, I., Fishkin, J., Luskin, R.C. (2000), 'Deliberation and Preference Structuration and Cycles: Evidence from deliberative polls', Paper presented at the meetings of the American Political Science Association.

[98] Lockwood, B. (2006), "The Political Economy of Decentralisation", in Ahmad, E. and Brosio, G. (eds.), *The Handbook of Fiscal Federalism*, Cheltenham: Elgar.

[99] Lorz, O and Willman, G. (2005), "On the Endogenous Allocation of Decision Powers in Federal Structures", Journal of Urban Economics, 57, 242-257.

[100] Lowndes, V. and Sullivan, H. (2008), "How Low Can You Go? Rationales And Challenges For Neighbourhood Governance", Public Administration, 86(1), 53–74.

[101] Luttmer, E. (2001), "Group Loyalty and the Taste for Redistribution", Journal of Political Economy, 109(5), 500–528.

[102] Lyons, M (2007), *Place-shaping: a shared ambition for the future of local government. Final Report*, London: TSO.

[103] Maer, L. (2007), *Citizens Juries: House of Commons Library Standard Note*, (SN/PC/04546), London: House of Commons Library

[104] Maskin, E. and Riley, J. (1984), "Optimal Auctions with Risk Averse Buyers", Econometrica, 52(6), 1473–1518.

[105] McAfee, R. and McMillan, J. (1986), "Bidding for Contracts: A Principal-Agent Analysis", RAND Journal of Economics, 17(3), 326–338.

[106] McGrath, M. (2009), *New Laboratories of Democracy: How Local Government is Reinventing Civic Engagement*, PACE, available at: `http://www.pacefunders.org/publications/NewLaboratoriesofDemocracy.pdf`

[107] McLean,I. (2005), *The Fiscal Crisis of the United Kingdom*, Basingstoke: Palgrave Macmillan.

[108] Meirowtiz, A., and Shotts K. (2009), "Pivots Versus Signals in Elections", Journal of Economic Theory, 144(2), 744–771.

[109] Messner, M. and Polborn, M. (2004), "Paying Politicians", Journal of Public Economics, 88(12), 2423–2445.

[110] Milbrath, L. and Goel, M. (1983), *Political Participation: How and Why do People Get Invovled in Politics?*, Washington, D.C.: University Press of America.

[111] Miliband, E. (2007), *Participation, charities and the Media*, speech to a Charity Commission/BBC conference on participation, 19th March 2007, available at: `http://www.cabinetoffice.gov.uk/media/cabinetoffice/corp/assets/publications/speeches/milibande/pdf/charities_media.pdf`

[112] Miller, D. (2003), "Deliberative Democracy and Social Choice", in Fishkin, J. and Laslett, P. (eds.), *Debating Deliberative Democracy*, Oxford:Blackwell Publishing.

[113] Morgan, J., and Stocken, P. (2008), "Information Aggregation in Polls", American Economic Review, 98(3), 864-896.

[114] MORI (2005), `http://www.mori.com/polls/2005/mpm050523.shtml`

[115] National Audit Office (2006), *Financial relationships with third sector organisations*, available at: `http://www.nao.org.uk/publications/0506/financial_relationships.aspx`

[116] National Foundation for Educational Research (2009), *National Census of Local Authority Councillors 2008*, Slough: NFER.

[117] Oates, W. (1972), *Fiscal Federalism*, New York: Harcourt, Brace and Jovanovich.

[118] Oates, W. (1979), "Lump-Sum Grants Have Price Effects". in Mieszkowski, P. and Oakland, W. (eds.), *Fiscal Federalism and Grants-in-Aid*, Coupe Papers in Public Economics, Urban Institute, Washington, D.C.

[119] Oates, W. (1999), "An Essay on Fiscal Federalism", Journal of Economic Literature, 37(3), 1120–1149.

[120] Obama, B. (2009), "Transparency and Open Government", Federal Register, 74(15), 4685–4686.

[121] ODPM (2003), "Research on capacity-building needs: Final report", available at: `http://www.communities.gov.uk`

[122] Osborne, M. and Slivinski, A. (1996), "A Model of Political Competition with Citizen-Candidates", Quarterly Journal of Economics, 111(1), 65–96.

[123] Osborne, M., Rosenthal J., and Turner, M. (2000), "Meetings with Costly Participation", American Economic Review, 90(4), 927–943.

[124] Pagan, A. and Vella, F. (1989), "Diagnostic Tests for Models Based on Individual Data: A Survey", Journal of Applied Econometrics, 4, S29–S59.

[125] Palfrey, T., and Rosenthal, H. (1983), "A Strategic Calculus of Voting", Public Choice, 41(1), 7–53.

[126] Palfrey, T., and Rosenthal, H. (1985), "Voter Participation and Strategic Uncertainty", American Political Science Review, 79(1), 62–78.

[127] Parkinson, J. (2004), "Why Deliberate? The Encounter Between Deliberation and New Public Managers", Public Administration , 82(2) , 377–395.

[128] Participatory Budgeting Unit, *http : //www.participatorybudgeting.org.uk*

[129] Paul, C., Nicholls, R., Priest, P. and McGee, R. (2008), "Making policy decisions about population screening for breast cancer: The role of citizens deliberation", Health Policy, 85(3), 314–320.

[130] People and Participation, `http://www.peopleandparticipation.net/display/Methods/Citizens`

[131] Perry, M. and Sakovics, J. (2003), "Auctions for Split-Award Contracts", Journal of Industrial Economics, 51(2), 215–242.

[132] Pickard, S. (2002), "Citizenship and Consumerism in Health Care: A Critique of Citizens Juries", Social Policy and Administration, 32(3), 226–244.

[133] Pingree, R. (2006), "Decision Structure and the Problem of Scale in Deliberation", Communication Theory, 16(2), 198–222.

[134] Poterba, J. (1996), "Demographic structure and the political economy of public education", NBER Working Paper No. 5677.

[135] Powell, J. (1984), "Least Absolute Deviations Estimation for the Censored Regression Model", Journal of Econometrics, 25, 303–325.

[136] Putnam, R. (1993), *Making Democracy Work: Civic traditions in modern Italy*, Princeton: Princeton University Press.

[137] Reay, D. (2008), "Tony Blair, the promotion of the 'active' educational citizen, and middle-class hegemony", Oxford Review of Education, 34(6), 639-650.

[138] Redoano,M and K.Scharf (2004), "The Political Economy of Policy Centralisation: Direct vs. Representative Democracy", Journal of Public Economics, 88, 799–817

[139] Riker, W. and Ordeshook P. (1968), "A Theory of the Calculus of Voting", American Political Science Review, 62(1), 25–43.

[140] Roberts, R. (1984), "A Positive Model of Private Charity and Public Transfers", Journal of Political Economy, 92(1), 136–148.

[141] Rowe, G. and Frewer, L. (2004), "Evaluating Public-Participation Exercises: A Research Agenda", Science Technology Human Values, 29(4), 512–556.

[142] Ruggeri, G (1999), "The Marginal Cost of Public Funds in Closed and Small Open Economies", Fiscal Studies, 20(1), 41-60.

[143] Seabright, S. (1996), "Accountability and Decentralisation in Government:an Incomplete Contracts Model", European Economic Review, 40(1), 61–91.

[144] Secretary of State for Justice and Lord Chancellor (2007), *The Governance of Britain*, London: HMSO.

[145] Seshadri, S., Chatterjee, K., and Lilien, G. (1991), "Multiple Source Procurement Competitions", Marketing Science, 10(3), 246–263.

[146] Shapiro, I. (1999), "Enough of Deliberation", in Macedo, S. (ed.), *Deliberative Politics: Essays on democracy and disagreement*, New York: Oxford University Press.

[147] Sharpe, L. (1970), "Theories and Values of Local Government", Political Studies, 18(2), 153-174.

[148] Singapore Government (2010), available at: `http://www.igov.gov.sg/Strategic_Plans/iGov_2010/`

[149] Smith, P. (2003), "Formula Funding of Public Services: an Economic Analysis", Oxford review of Economic Policy, 19(2), 301–322.

[150] Somin, Ilya (1998), "Voter ignorance and the democratic ideal", Critical Review, 12(4), 413–458.

[151] Steel, C., Jochum, V. and Grieve, J. (2006), "Community governance and active citizenship in rural areas: the relationship between parish councils and voluntary and community organisations", in Warren, M. and Yarwood, R. (eds.), *The Rural Citizen: governance, culture and wellbeing in the 21st century: Conference Proceedings*, Plymouth: University of Plymouth.

[152] Stoker, G. (2006), *Key Developments in English Local Government*, Lecture prepared for presentation at Zhejiang University, October 2006, available at: `http://www.ipeg.org.uk/papers/key_dev_eng_loc_gov.pdf`

[153] Strömberg, D. (2006), "Demography, Voting and Public Expenditures: Theory and Evidence from Swedish Municipalities", Institute for International Economic Studies, Stockholm.

[154] Strumpf, K. (2002), "Does Government Decentralisation Increase Policy Innovation?", Journal of Public Economic Theory, 4(2), 207–241.

[155] Taylor-Gooby, P.F. and Hastie, C.L. and Bromley, C. (2003), "Querulous Citizens: Welfare Knowledge and the Limits to Welfare Reform", Social Policy and Administration, 37(1), 1–20.

[156] Thiel, S. (1988), "Multidimensional Auctions", Economics Letters, 28(1), 37–40.

[157] Turner, M. and Weninger, Q. (2005), "Meetings with costly participation: An empirical analysis", Review of Economic Studies, 72(1), 247–268.

[158] Tyler,P., Brennan, A. and Rhodes, J. (1998), "The Distribution of Single Regeneration Budget Challenge Fund Expenditure in Relation to Local Area Needs in England", Discussion Paper 91, Department of Land Economy, Cambridge.

[159] Verba, S., Schlozman, K. and Brady, H. (1995), *Voice and equality: Civic voluntarism in American politics*, Cambridge: Harvard University Press.

[160] Walzer, M. (1999), "Deliberation and what else?", in Macedo, S. (ed.), *Deliberative politics: Essays on democracy and disagreement*, New York: Oxford University Press.

[161] Wang, J. and Zender, J. (2002), "Auctioning Divisible Goods", Economic Theory, 19(4), 673–705.

[162] Ward, H. (2002), "A Spatial Model of Bidding Tournaments for the Public Funding of Projects", Essex Papers in Politics and Government.

[163] Ward, H. and John, P. (1999), "Targeting benefits for electoral gain: constituency marginality and the distribution of grants to English local councils", Political Studies, 47(1), 32–52.

[164] Wilde, J.A. (1968), "The Expenditure Effects of Grant-in-Aid Programs", National Tax Journal, 21, 340-348.

[165] Wilson, D and Game, C. (2002), *Local Government in the United Kingdom*, Basingstoke: Palgrave.

[166] Winterton, R. (2009), speech at the National Association of Local Councils' Annual Conference and Exhibition, 4th September 2009, available at:
`http://www.communities.gov.uk/speeches/localgovernment/nalcconference2009`

[167] Wolfinger, R. and Rosenstone, S. (1980), *Who votes?*, New Haven: Yale University Press.

[168] Woods, M., Edwards, B., Anderson, J., Gardner, G. and Hughes, R. (2003), *Research Study into the Role, Functions and Future Potential of Community and Town Councils in Wales: Report to the Welsh Assembly Government*, Cardiff: Welsh Assembly Government.

[169] Woods, M., Edwards, B., Anderson, J. and Gardner, G. (2005), *Participation, Power and Rural Community Governance in England and Wales*, ESRC.

[170] Woods, M., Gardner, G. and Gannon, K. (2006), *Research Study of the Quality Parish and Town Council Scheme*, DEFRA.

[171] Woods, M., Gardner, G., Edwards, B. and Anderson, J., "Engineering Local Democracy? Scale, Community Governance and Local Democratic Renewal in England and Wales", unpublished.

[172] Yildirim, H. and Taylor, C. (2010), "Public Information and Electoral Bias", Games and Economic Behavior, 68(1), 353–375.