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The Efficiency of Decentralised and Devolved Government: A Framework

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1. INTRODUCTION

Different countries adopt quite different decentralised governance structures with varying degrees of decentralisation and local electoral control (Ter-Minassian, 1997). A good, though atypical, example is the asymmetrical spatial configuration thrown up by the UK Government's "New Localism" agenda. The English regions have been given delegated authority but have rejected the elected assemblies that would have put this authority under regional democratic control. However, the other countries of the United Kingdom - Northern Ireland (in principle), Scotland and Wales - have been given varying devolved powers. The position of London is different again. Further, in some cases these powers have been imposed from the centre, in other cases they have been adopted as the result of local referenda.[1]

These differences in administrative and constitutional mechanisms come about, at least partly, by historical accident and as a result of wider political factors. However, in this paper we focus on the more narrowly defined efficiency implications of such arrangements. This is useful for identifying the motives that might underlie particular administrative set ups and the possible efficiency losses associated with specific forms of decentralisation or devolution. In particular, we develop a framework that allows a comparison of the effectiveness of implementing policy through three alternative systems. These are: a centralised; a decentralised; and a fully devolved structure. In this analysis we build on the work of Canes-Wrone *et al*, (2001) and Maskin and Tirole (2004) on representative democracy. The novelty is that we place this analysis in the context of a potentially decentralised or devolved regional administration.

The paper is structured in the following way. In Section 2 we position the present paper in the existing literature. In Section 3 we explain our own approach in broad outline. In Sections 4, 5 and 6 we give more detail about the way in which we conceptualise decision taking in centralised, decentralised and fully devolved systems. The analysis focuses on the interaction between exogenous quality variation in officials, private information and local democratic procedures. Section 7 uses computation to identify the parameter domains within which each of the organisational forms is the most efficient. Section 8 gives comments and a conclusion.

2. PREVIOUS LITERATURE

The efficiency of different institutional forms of governance receives limited treatment in the standard economic texts. Whilst the existence of government is taken as a starting point for most economic policy debates, the internal operation - and efficiency - of government itself is of rather less concern. However, in principle three strands of the economics literature are relevant to the present paper. These deal with: the geographic extent of the national governments; the spatial distribution of decentralised government arrangements within the national territory; and the public choice literature, incorporating the associated political economy approach to the nature of incentives within government.

There is a nascent economics literature that attempts to explain the size of nations using a broad economic efficiency approach (Alesina and Spolaore, 2005). This literature takes the optimal size of a nation as a trade-off between economies of scale in the production of public goods and the physical and cultural "distance" felt by peripheral regions from the centre, where the supply of these public goods is concentrated. With a single national tax structure, the benefits from a unified country are distributed in a regionally differentiated way, with some territories having a possible incentive to secede. However, while secession may improve welfare in the seceding region, it will have a detrimental impact on total welfare. Two solutions are suggested to deal with this problem. First, providing that transfers do not lead to significant distortions, it might be optimal to make fiscal transfers from better- to poorer-provided areas. Second, public good provision might be decentralised. Whilst we are well aware of the issues raised by regional heterogeneity in this approach (Christie and Swales, 2005), it is a topic ignored in the present paper.

There is a much more extensive literature on the distribution of government functions within national boundaries from the perspective of the optimal provision of "local" public goods. Tiebout's (1956) influential paper on locational decisions represented a major step in the analysis of labour mobility determined by public good provision rather than explicit labour market conditions. Subsequent work by Musgrave (1959) and Oates (1972, 1999) has determined much of the lexicon on federalism and shaped the arguments that have surrounded it since. However, in this paper we are not concerned with the type of public good to be provided at the local level: we assume that this has been decided already. Rather we focus more on the most efficient way that these local public goods can be provided. In comparing decentralised, rather than national, decision making on the provision of local public goods we touch on the fiscal federalist approach, but this is not a central concern of the paper.

Finally, there is an extensive literature on public choice theory (Mueller, 2003), flowing from the seminal work of authors such as Arrow (1951), Bergson (1938) and Downes (1957). This body of work analyses how different national public choices can be made, particularly in a democratic setting. A key aspect of our paper is the impact of introducing an elected, rather than appointed, regional official. We therefore engage with this literature, though the issues are transposed to the regional level. Also we concentrate here on a limited set of problems that a democratic arrangement can generate. We are aware of this limitation and plan to extend the analysis in the future.

3. OUTLINE

Our analysis identifies the problem of administering the provision of local public goods as a choice between three options. The first is centralised (*national*) decision taking by a national official. This centrally made choice might be inappropriately adjusted to local conditions – the standard fiscal federalist problem. The second is decentralised (*regional*) decision taking delegated to an unelected local official whose expected quality is lower than that of the national official. Here there is a trade-off between the quality and specificity of decision applied at the local level. The third is local democratic (*devolved)* decision taking where the local official is chosen through a system of representative democracy. In this case we focus particularly on the possible benefits of improved selection as against the potential cost of an incumbent pandering to the electorate.

Pandering involves the official's adopting inefficient policies in order to improve the chances of re-election.

For pedagogic purposes we use an extremely simplified model framework. The nation has n identically sized regions. For each region, there are two possible states, A or B, which we refer to as the region's type, two available policies, labelled α and β. In each time period, each region's type is chosen independently from a prior probability distribution. There is a probability p_A for type A and p_B ($= 1 - p_A$) for type B. However, A is the most likely type so that $1 \geq p_A \geq ½ \geq p_B \geq 0$. The value of p_A is a measure of inter-regional heterogeneity. The lower the value of p_A, within the relevant range, the greater the degree of heterogeneity. Where it is relevant, we assume that the value of p_A is common knowledge.

3.1 The Citizen (Voter)

All citizens have identical tastes and endowments. Therefore whilst external conditions vary spatially - so that optimal policy can differ between regions - there is no intra-regional variation across citizens so that the regional population can be represented by an individual citizen and, where appropriate, the regional electorate by an individual voter. When the (Greek) policy decision coincides with the (Roman) region's type, so that, for example, policy α is applied to region type A, the pay-off to the regional population - and, where relevant, the regional electorate - is 1. Where the region and policy type fail to coincide, so that policy β is applied to region type A, for example, the pay-off to the regional population is 0.[2] We distinguish the regional citizen/voter as male and the regional population's expected pay-off is shown as $E(\Pi)$ with the subscript V (for voter).

3.2 The Official

An individual official, identified for heuristic purposes as female, takes the relevant policy decisions. The official can be of high (H) or low (L) quality, with the corresponding prior probabilities, p_H and p_L ($= 1 - p_H$), with $1 \geq p_H \geq 0$. Where relevant, we always take the probability p_H to be common knowledge, though the quality of any particular official is private information. The expected payoff for the official is identified as E(Π), with the subscript O (for official).

We assume that the only motivation for the official, whether appointed or elected, is to leave a legacy – a valuable policy that she implemented and is therefore associated with her. We therefore assume that, as with the citizen, the official receives a pay-off of unity when the policy and region type match and zero when they do not. In particular, the official is assumed to get no benefit from being in office *per se*. However, her motives are not truly altruistic – if that were the case, low quality officials would not seek office.

Under the national and regional administrations, the official is simply appointed. Under the devolved organisation, the official is initially appointed and can remain in office for two time periods. However, there is an election between these two periods. If the election removes the incumbent, the new official only serves for one period.

3.3 The Official's Quality

At the beginning of each time period, the official gets a signal that indicates the region's type. For a high quality official, this signal is always correct. However, for a low quality official, the signal includes a degree of error. We want this error to have two key characteristics. First, the signal should still be informative, so that in any single time period the official receives her maximum expected pay-off through following the signal. Second, for the low quality official, the signal less effectively distinguishes between states A and B.

A convenient set of conditions that generates these characteristics is the following. If the low quality official gets a signal A, the signal is always correct. However, a signal of B to a low quality official is only correct with a probability q_L, which lies between ½ and 1. The low quality official therefore maximises her one-period expected return by always matching her policy to the signal. If the signal is A, then the return from adopting policy

α is 1. If the signal is B, adopting policy β gives a greater expected return than adopting policy α: $q_L \geq ½ \geq 1-q_L$. Therefore our suggested formulation provides information for the low quality local official that is increasing in q_L and p_A.

To verify our second desired condition, we determine the distribution of the signal between regional types A and B for the low quality official. From the definition of q_L:

(1) $$q_L = \frac{p_B}{ps_{B,L}} \rightarrow ps_{B,L} = \frac{p_B}{q_L}$$

where $ps_{X,Y}$ is the probability that the signal is of type X, conditional upon the official being of type Y. Given that $1 \geq q_L \geq 0$ expression (1), together with the fact that the relevant probabilities sum to unity, implies that:.

(2) $$ps_{B,L} = 1 - ps_{A,L} \geq p_B = 1 - p_A$$

Rearranging equation (2) gives:

(3) $$ps_{A,L} \leq p_A$$

For the low quality official, the signal therefore distinguishes less effectively between states A and B. It under-predicts the most likely state of the region and over-predicts the less likely state.

Before progressing it will be useful to identify two further sets of relationships implied by the assumptions made about the accuracy of the signal to the low quality official.[3] The first is that under these circumstances the unconditional probability that a signal is B is greater than the actual probability that the region is of type B. This is reversed for signal and regional type A, so that:

(4) $$ps_B \geq p_B;\ ps_A \leq p_A\ .$$

where ps_X is the unconditional probability that the signal is of type X. The intuition here is that a high quality official always receives the correct signal whilst a low quality officials receives a disproportionately large number of B signals. Therefore, overall, the probability of a B signal is greater than the probability of a B regional type.

A second set of result flowing from these assumptions is that the probability that the official is of low quality, conditional on her receiving a B signal, is greater than the unconditional probability that the official is of low quality. Again a set of corresponding relationships hold for the officials of high quality and those receiving an A signal:

(5) $$po_{L,B} \geq p_L;\ po_{H,B} \leq p_H$$

(6) $$po_{L,A} \leq p_L;\ po_{H,A} \geq p_H$$

where $po_{X,Y}$ is the probability that the official is of type X, conditional on her receiving a signal Y. Expressions (5) and (6) reflect the fact that an official receiving an A signal is disproportionately likely to be of high quality, and one receiving a B signal to be of low quality.

3.4 The Policy Decision

When policy is decided at the national level, identified with a superscript N, we assume that the national official is of high quality, so that $p_H = 1$. In this context, this implies that the official always chooses the policy that is optimal for the nation as a whole, though this might be sub-optimal for an individual region. For a region, the expected utility from national decision taking is a function of the number of regions and the probability distribution between the different regional types:

(7) $$E(\Pi_V^N) = \Pi_V^N(p_A, n)$$

When policy is decentralised to the region, which we identify using the superscript R, the decision is taken by an appointed local (regional) official.[4] This regional official is of a lower expected quality than the national official, so that in this case $1 > p_H \geq 0$. Given the discussion in Section 3.3, the implications for the efficiency of the low quality official's decision making depends on the prior probability of the region's type, p_A, and the parameter, q_L, that measures the signal's quality. Therefore the expected utility from decentralised regional decision making depends on the values of p_A, p_H, and q_L.

(8) $$E(\Pi_V^R) = \Pi_V^R(p_A, p_H, q_L)$$

The distinction between delegated decentralisation and devolution is the presence of a democratic procedure at the regional level. In particular, it becomes possible for the local official to be removed via an election. We assume a rational, forward-looking electorate, so that removal will occur where the expected quality of a possible replacement official is greater than that of the incumbent. Although in principle this process improves the effectiveness of local decision taking, it can have perverse effects. In particular, under certain circumstances a low quality official with an incentive to stay in office will pander to the local electorate. This means that in an attempt to secure re-election, she chooses a policy that she knows to be popular but believes to be wrong. Taking into account such effects, we show that the expected utility from devolved decision taking, identified using a D superscript, is a function also of the official's time discount factor (δ), so that[5]

(9) $$E(\Pi_V^D) = \Pi_V^D(p_A, p_H, q_L, \delta)$$

The remainder of the paper focuses on the relative efficiencies of these alternative decision making mechanisms. In Sections 4, 5 and 6 we specify equations (7), (8) and (9) in greater detail.

4. NATIONAL DECISION TAKING

The national official is always of high quality. This implies that she acts in the national interest, which here means choosing the policy that benefits the majority of the regions.[6] Therefore for an individual region, the probability, p_M, that its own type matches that of the majority of regions is crucial. In fact, given the way in which the model has been parameterised, this probability is also the expected payoff to the regional voter, E (Π^N_V). Therefore when we have national decision taking:

$$E(\Pi_V^N) = p_M(n, p_A) \tag{10}$$

This probability can be calculated using the following three steps. First, determine the probability that any one aggregate configuration of regional types will occur. By an aggregate configuration of regional types, we mean an outcome that would have n-k regions of type A and k of type B, where k is an integer, n≥ k ≥ 0. Second, multiply this probability by the probability that an individual region would be in the majority in such a configuration. Third, sum across all of the possible configurations.

For step one, we use the binomial theorem to determine the probability of each aggregate configuration of regions. Step two is completed using the fact that for each of these terms, the probability that the individual region will be in the majority is max $\left[\frac{n-k}{n}, \frac{k}{n}\right]$.

The third step, summing all these expressions gives the expected value for the regional voter from national decision making as:

$$E(\Pi_V^N) = p_M = \sum_{k=0}^{n}\left[\max\left[\frac{n-k}{n}, \frac{k}{n}\right]\right]\left[\frac{n!\,p_A^{n-k}\,p_B^{k}}{(n-k)!\,k!}\right] \tag{11}$$

where:

$$1 \geq E(\Pi_V^N) \geq \frac{1}{2}, \quad \frac{\partial E(\Pi_V^N)}{\partial p_A} > 0, \quad and \quad \frac{\partial E(\Pi_V^N)}{\partial n} < 0.$$

Figure 4.1 shows how $E(\Pi^N_V)$ varies with p_A for values of n equal to 5 and 10.

5. DECENTRALISED GOVERNMENT

With a decentralised form of government, we assume that in each region a local delegated official determines policy. The underlying set up is exactly as with national decision making. The region is allocated to one of two types (A and B) from the probability distribution (p_A, p_B) and the regional official has a choice between two corresponding policies (α and β). The key advantage of decentralised, as against nationally determined, decision making is that the local official can ignore conditions in the rest of the country when setting policy. However, we also assume that the local official is of lower quality than the national official, and therefore she is more likely to make errors

We use a constructed variable, z_Y, which gives the single period expected pay-off to the citizen if the regional official of quality Y (= H, L) follows her signal. This is calculated as:

(12) $$z_H = 1$$

(13) $$z_L = ps_{B,L}q_L + (1 - ps_{B,L})$$

Substituting equation (1) into equation (13) produces:

(14) $$z_L = p_B + \frac{q_L - p_B}{q_L} = \frac{2q_L - 1}{q_L} + p_A \frac{1 - q_L}{q_L}$$

Because the signal is informative, with decentralised government the local official always follows her signal. Therefore, the expected value for the local citizen from a regionally decentralised decision making procedure is equal to the expected value when the official always follows her signal. This is identified as z, so that:

$$(15) \qquad E(\Pi_V^R) = z = p_H z_H + p_L z_L = \frac{2q_L - 1 + p_H(1-q_L)}{q_L} + p_A \frac{(1-p_H)(1-q_L)}{q_L}$$

where

$$\frac{\partial E(\Pi_V^R)}{\partial p_A}, \frac{\partial E(\Pi_V^R)}{\partial p_H}, \frac{\partial E(\Pi_V^R)}{\partial q_L} \geq 0,$$

$$\frac{\partial E^2(\Pi_V^R)}{\partial p_A^2}, \frac{\partial E^2(\Pi_V^R)}{\partial p_H^2} = 0, \frac{\partial E^2(\Pi_V^R)}{\partial q_L^2} \leq 0,$$

$$\frac{\partial E^2(\Pi_V^R)}{\partial p_A \partial p_H}, \frac{\partial E^2(\Pi_V^R)}{\partial p_A \partial q_L}, \frac{\partial E^2(\Pi_V^R)}{\partial p_H \partial q_L} \leq 0,$$

and as:

$$p_A, q_L \text{ or } p_H \to 1, E(\Pi_V^R) \to 1$$

The expected payoff to the regional voter is positively related the prior probabilities that the region is of type A, that official is of high quality and that the B signal to the low quality official is accurate. The value of $E(\Pi_V{}^R)$ is linear in p_A and p_H and is concave in q_L. As any of the key parameters p_A, p_H or q_L approaches unity, the expected value of the citizen's pay-off approaches unity. This last result is because where any of these three parameters is unity, either there is zero probability of a region's being in a B state, there are no low quality officials or a low quality official makes no errors.

6. DEVOLVED GOVERNMENT

To move from decentralised to devolved regional decision-making involves adding a democratic layer at the regional level that we characterise as local representative democracy.[7] Such a democratic procedure has potential beneficial impacts on both moral hazard and selection problems. Essentially, if the electorate can vote out an official who exhibits low or misdirected effort, or who has poor decision-making skills, the quality of local decision-making should rise. However, in a situation of asymmetric information between the incumbent local official and the electorate, the official might use inefficient actions in order to gain re-election.

For pedagogic reasons we drastically simplify the local democratic process, adopting a variant of the model used in Canes-Wrone *et al* (2001). The behaviour of the elected official and the regional electorate is analysed as a non-co-operative two-period game of incomplete information. The solution concept used is a perfect Bayesian equilibrium. The basic set up is as under decentralised decision making: the official can be of either high or low quality, and whilst the corresponding probabilities, p_H and p_L, are common knowledge, the regional official's actual quality is private information. The payoffs are exactly as for decentralised decision making except that as this is a two period game, a time-discount factor of δ, $1 \geq \delta \geq 0$, is applied to pay-offs in the second period. We assume that the only information that the voter has about the incumbent official is her choice of policy in period 1. In particular, the voter has no means of knowing the actual region type in period 1 in advance of voting and therefore cannot verify whether the official chose the optimal policy.

For a perfect Bayesian equilibrium, we need to identify a set of strategies and beliefs that have the following characteristics. First, the strategy of the official is optimal, given the strategy of the voter. Second, the voter's beliefs are consistent with the Bayesian updating of his priors, given the strategy of the official. Third, the strategy of the voter is optimal, given his beliefs. In this case, the strategy of the official consists of the choice of policy in periods 1 and 2, conditional on her quality and the signal that she receives in periods 1 and 2. For the voter, the decision is whether to retain or remove the incumbent official, conditional on the official's policy choice in period 1. We show that the key belief concerns the probability that the official is low quality, given that she chose policy β in period 1, $po_{L,\beta}$.

There are two possible equilibria, depending on the value of key prior probabilities. These is a straightforward pure strategy, non-pandering equilibrium, where the official, of either quality, always follows her signal. There is also a mixed-strategy, pandering equilibrium where a low quality official receiving a period-1 B signal will play a mixed strategy, and therefore sometimes pander. In this case the voter also plays a mixed strategy when the official adopts a β policy.

6.1 A Non-Pandering Equilibrium

The non-pandering equilibrium has the following strategies and beliefs:

Incumbent Official:

Strategy: $P_t = S_t$

Voter:

Belief: $po_{L,\beta} \geq p_L$; $po_{L,\alpha} \leq p_L$

Strategy: *If* $P_1 = \alpha, E = RT, else\ E = RM$

where P_t is the policy of the devolved official in time period t, S_t is the signal received by the official in time period t, E is the voter's electoral decision, and RM and RT represent remove and retain respectively.

In brief, in this equilibrium if the initial set of prior probabilities lie within the appropriate range, the official, of either high or low quality, will follow her signal in each time period and the voter will remove any official choosing the β policy in time period 1. The strategy of the voter is based on the expectation that the probability of those choosing policy β being low quality is greater than the prior probability p_L. This expectation is shown to be correct, given the strategy of the official. From the voter's viewpoint, this equilibrium out-performs the decentralised decision because the behaviour of the official in period 1 is unaffected by the impending election, whilst the voter's election strategy increases the expected quality of the period-2 official. We fully outline the non-pandering equilibrium in Appendix 3. However, the equilibrium is intuitive if the official always follows her signal: the key issue concerns the set of parameter values for which it is optimal for the low quality official to follow her signal.

As argued in the previous section, an official maximises her single period pay-off by matching her signal, so that in period 2 the residing official always matches her signal. However, the situation might be different in period 1, if the policy choice in that period affects the probability of surviving to period 2. For the high quality official this is not relevant; she always follows her signal in each time period. Given the voter's strategy, if she receives a period-1 A signal there is no potential conflict. However, even if she receives a period-1 B signal, it is irrational for her to deviate in period 1, even though this will mean that she is certain to be removed in the election. This is because when the high quality official goes against her signal she knows she is pursuing the wrong policy and her pay-off is zero. It is irrational for her to give up a pay-off of 1 in period 1 in order to get a discounted payoff of δ in period 2.

The circumstances are different for the low quality elected official. In period 1, she might pander to the electorate by following a policy that she believes to be wrong, but the electorate judges to be correct. This strategy might be rational if it increases her chance of re-election and a subsequent opportunity to leave a legacy. This is a potentially credible strategy because there is a chance that her period-1 signal is incorrect. There is therefore a chance that pandering will deliver the correct (matched) policy in period 1, whilst also providing the official a second opportunity in period 2.

Again, where the low quality official receives a period-1 A signal, there is no conflict: an A signal is always correct and, given the voter's strategy, following the A signal also ensures re-election. However, if the low quality elected official receives a B signal, then the expected values from following the signal (superscripted F) and pandering (superscripted P), given the strategy of the voter, are:

(16) $$E(\Pi_O^D)_{L,B}^F = q_L$$

(17) $$E(\Pi_O^D)_{L,B}^P = 1 - q_L + \delta z_L$$

Given the voter's strategy, for it to be rational for the low quality elected official to follow a period-1 B signal, $E(\Pi_O^D)_{L,B}^F \geq E(\Pi_O^D)_{L,B}^P$. From equations (16) and (17), this implies that

(18) $$q_L \geq 1 - q_L + \delta z_L$$

Rearranging inequality (18) and using equation (13) generates the result that for low quality official to always follow her signal, a composite variable, k, which is a function of p_A, q_L and δ, must be greater than zero:

(19) $$k(p_A, q_L, \delta) = (2q_L - 1)(q_L - \delta) - \delta p_A (1 - q_L) \geq 0$$

where $\dfrac{\partial k}{\partial p_A}, \dfrac{\partial k}{\partial \delta} < 0$ and $\dfrac{\partial k}{\partial q_L} = 4q_L - \delta(2 - p_A) - 1$

We will examine the conditions under which inequality (19) holds in more detail in Section 7. However, two general points are worth making here. First, the partial derivatives show that as the values of p_A and δ rise, the value of k falls, so that *ceteris paribus*, the more likely that the official will pander. This is easily explicable in that the only impact of increases in either p_A or δ is to raise the expected value of the elected official's possible legacy in period 2. The impact of an increase in the value of q_L is more complex. Strictly the outcome is ambiguous. An increase in q_L increases the expected value of following the B signal in period 1, because this signal is more likely to be accurate. But it also increases the expected value of the official's possibly legacy in period 2, both for this reason and also because it reduces the probability of a low quality official receiving a B signal in period 2. However, only if the value of δ were high and p_A low would we expect the value of $\frac{\partial k}{\partial q_L}$ to be negative, so that an increase in q_L reduces the probability of pandering.

Second, given the strategy of the voter to replace an official who adopts a β policy, within the permissible range of values that individual parameter can take, there are combinations of values that give pandering and others that give the non-pandering as the optimal outcome for the elected official. For example, $\delta > q_L$ is a sufficient condition for k to be negative, implying pandering, whilst $\delta = 0$ is sufficient for k to be non-negative where non-pandering is the official's optimal response.

Before considering what happens if the inequality (19) does not hold, it will prove useful to identify the expected pay-off to the voter in the non-pandering case:

$$E(\Pi_V^D)^F = z + \delta\left[ps_A \left[po_{H,A} + po_{L,A} z_L \right] + ps_B z \right] \tag{20}$$

In Appendix 2 we show that:

$$po_{H,A} = \frac{q_L p_H p_A}{p_A q_L - (1-p_A)(1-p_H)(1-q_L))} \tag{21}$$

Given the formula for $po_{H,A}$ identified in equation (21), expression (20) is clearly non-linear in p_A, p_H and q_L and more complex than equation (15), which gives the citizen's expected value under decentralised decision making with no local democratic process. However, it is possible to rank the outcomes. If equation (15) is adjusted to a 2 period model:

$$(22) \qquad E(\Pi_V^D)^F \geq E(\Pi_V^R) \text{ iff } po_{H,A} + po_{L,A} z_L \geq z$$

Using the definition of z given by equation (15), inequality (22) holds iff $po_{H,A} \geq p_H$ (and therefore also that $po_{L,A} \leq p_L$). These conditions are verified in expressions (5) and (6). Therefore where the parameter values discourage pandering, the expected value for the voter from the devolved system is greater than the decentralised and delegated scheme. That is: $E(\Pi^D{}_V)^F \geq E(\Pi^R{}_V)$.

6.2 A Pandering Equilibrium

If inequality (19) fails to hold, there is no equilibrium in pure strategies. It is no longer optimal for the low quality elected official to follow the first-period signal B if the voter's strategy is to remove any incumbent who adopts policy β. However, the rationality of this voting strategy is dependent on the voter's belief that low-quality officials are over-represented in the population of those who adopt policy β. But, if low quality officials now always pander in period 1, the opposite belief is correct. Only high quality officials now adopt policy β, and the rational voter should remove all officials who choose policy α. This would then negate the reason for pandering by the official.

In these circumstances, for a perfect Bayesian equilibrium we require mixed strategies so that the low quality official follows a period-1 B signal, and the voter removes an official adopting a period-1 β policy with probabilities that lie between zero and one. More specifically:

Incumbent Official:

Strategy: High quality official $\quad P_{H,t}^D = S_{H,t} \quad \forall_t$

Low quality official $\quad \text{If} \quad S_{L,t} = A \text{ or } t = 2: \quad P_{L,t}^D = S_{L,t}$

$\text{If} \quad S_{L,1} = B: \quad \Pr(P_{L,1}^D = \beta) = q_L$

Voter:

Belief: $po_{L,\alpha} \le p_L; \quad po_{L,\beta} = p_L$

Strategy $if\ P_1^D = \alpha, E = RT;$

$$if\ P_1^D = \beta, \Pr(E = RT) = 1 - \frac{2q_L - 1}{\delta z_L}$$

The detailed validation of the mixed strategy equilibrium is given in Appendix 3. However, the intuition is relatively straightforward. For these prior probabilities, the optimal approach for the low quality official is to mix her strategies when receiving a period-1 B signal so as to produce an expected distribution of her period-1 choices between pure strategies α and β that exactly match that of a high quality official. Such a mixed strategy entails the low quality official's choosing an α policy with a positive probability when she receives a period-1 B signal: that is, it involves a degree of pandering. The low quality official's strategy then implies that the voter cannot improve the expected quality of the period-2 official through his voting strategy.

For a low quality official to adopt such a mixed strategy, when she receives a period-1 B signal her expected value from choosing either of the pure strategies must be the same. This involves the voter mixing his strategy so that there is now a positive probability of retaining an official who chooses a period-1 β strategy.

In the mixed strategy equilibrium, the voter's expected pay-off is given as:

$$(23) \quad E(\Pi_V^D)^{MSE} = p_H + p_L\left[ps_{B,L}\left[(po_{\beta,L,B}q_L + (1 - po_{\beta,L,B})(1 - q_L)\right] + 1 - ps_{B,L}\right] + \delta z$$

where the superscript MSE represents mixed strategy equilibrium and $po_{\beta,L,B}$ is the probability that the official adopts policy β, conditional on her being of low quality and receiving a B signal. The low quality official's strategy gives $po_{\beta,L,B}$ and equation (2) the value for $ps_{B,L}$. Substituting these values into equation (23) gives:

$$(24) \quad E(\Pi_V^D)^{MSE} = p_H + p_L(1 - 2p_B(1 - q_L)) + \delta z$$

Substituting out for p_L and p_B means that equation (24) can be also expressed as:

(25) $$E(\Pi_V^D)^{MSE} = p_H + (1 - p_H)\left[2q_L + 2p_A(1 - q_L) - 1\right] + \delta z$$

where

$$\frac{\partial E(\Pi_V^D)^{MSE}}{\partial p_A}, \frac{\partial E(\Pi_V^D)^{MSE}}{\partial p_H} \; and \; \frac{\partial E(\Pi_V^D)^{MSE}}{\partial q_L} > 0$$

It is straightforward to show that when the elected official adopts a mixed strategy that includes pandering, the expected pay-off to the voter is less than with the decentralised regional administration. That is to say, in this case adding a democratic element reduces the expected pay-off to the voter. Combining equations (12), (15) and (24), produces:

(26) $$E(\Pi_V^R) > E(\Pi_V^D)^{MSE} \quad if \quad z_L > 1 - 2p_B(1 - q_L)$$

Using equations (13) and (14), expression (26) becomes:

(27) $$E(\Pi_V^R) > E(\Pi_V^D)^{MSE} \quad if \quad p_B\frac{1 - q_L}{q_L} < 2p_B(1 - q_L) \quad \rightarrow \quad if \quad \frac{1}{2} < q_L$$

which is true by construction.

The intuition behind this result is that in the mixed strategy equilibrium, voting generates no improvement in the expected quality of the period-2 official. The mixed strategy of a low quality official in period 1 is calculated so that the voter is unable to distinguish, even probabilistically, between a high and low quality official. However, this means that in period 1, the low quality official has to disregard her B signal a certain proportion of the time. This is inefficient, as the signal is informative. With the regionally delegated outcome, the official always follows her signal, which is why such an institutional arrangement has a higher expected pay-off for the voter.

For this set of prior probabilities, the outcome would be more efficient if the voter could commit to always re-electing the incumbent official. Then the official would always follow her signal in period 1, with no loss to the official's expected quality in period 2. However, this outcome is not sub-game perfect and poses a moral hazard for the voter. If the official believes the voter and follows her signal, it is then in the voter's interest to remove the official if she chooses a period-1 β policy. In essence, the decentralised regional solution of Section 5 makes such a promise credible by removing the electoral process.

7. THE OPTIMAL ORGANISATIONAL MECHANISM FOR DELIVERING LOCAL PUBLIC GOODS

For the present model, we are now in a position to determine the most efficient organisational form for administering the delivery of local public goods. This is shown schematically in Table 7.1. We start by comparing the devolved and decentralised systems. From the discussion in Section 6, we know that the relative efficiency of these two systems depends solely on the nature of the equilibrium reached in the devolved case, which itself rests only on the value of the composite parameter k. More specifically, where the devolved equilibrium involves potential pandering, the decentralised (regional) system outperforms the devolved system. This occurs for negative values of the parameter k. However, if the devolved equilibrium is non-pandering, so that the official always follows her signal, the devolved outcome is relatively more efficient. This is the case where the value of k is positive.

Table 7.1: The most efficient organisational structure for the delivery of local public goods

k $E(\Pi^N_V) - E(\Pi^R_V)$	+	-
+	$E(\Pi^N_V) > E(\Pi^D_V)^F$ = National $E(\Pi^D_V)^F > E(\Pi^N_V)$ = Devolved	National
-	Devolved	Regional (Decentralised)

Notes to Table 7.1 :

k is the composite variable defined in equation (19). It is a function of parameters p_A, q_L and δ. $E(\Pi^N_V)$ is the expected pay-off to the citizen (voter) where the provision of local public goods is determined at the national level. It is defined in equation (11) and is a function of parameters p_A and n.

$E(\Pi^R_V)$ is the expected pay-off to the citizen where the provision of local public goods is determined at the regional level. It is defined in equation (15) as function of parameters p_A, p_H and q_L.

$E(\Pi^D_V)^F$ is the expected pay-off to the voter (citizen) where the provision of local public goods is determined through a non-pandering devolved mechanism. It is defined in equation (20) as function of parameters p_A, p_H, q_L and δ.

The most straightforward cases are where the value of k is negative. Here the regional organisation always dominates the devolved. Therefore the nature of the most efficient delivery of local public goods depends solely on whether the expected pay-off under the national administrative structure is greater or less than under the regional administrative arrangements. This gives the corresponding entries in the second column in Table 7.1.

However, where k is positive, the devolved (non-pandering) organisational structure dominates the regional one. This means that where the expected pay-off under the regional organisational structure is greater than under the national, the devolved organisational structure will be the most efficient. This determines the entry in the second row of the first column. However, where the national outcome has a higher expected value than the regional and the value of k is positive, the most efficient organisational structure might be devolved or national.

We wish to focus more clearly on these results by mapping the most efficient administrative arrangement to key parameter values. In particular, for a set of specific values for n, p_A and δ we show how the optimal administrative organisation depends on the prior probabilities, p_H and q_L, that is, the parameters that determine the expected efficiency of the official. The values chosen for n and p_A are 5 and 0.5 respectively and we show the results for values of δ equal to 0.3 and 0.6.

We begin by delineating the parameter values which separate pandering from non-pandering strategies for devolved governance. As argued in Section 6, expression (19) determines whether the devolved equilibrium involves pandering or not. We use this expression to generate the locus of values for δ and q_L that produce a value for k equal to zero for various values of p_A. These are presented in Figure 7.1. They mark the boundary values between those parameter combinations to the left that produce non-pandering outcomes and those to the right that produce pandering outcomes. Note that the critical values of q_L are not very sensitive to changes in the value of p_A. The value of the critical value of q_L increases with the discount factor δ. For our illustrative values of 0.3 and 0.6 for δ and a value of p_A of 0.5, the corresponding critical values of q_L are 0.6 and 0.75 respectively.

Figure 7.2 shows the optimal administrative mechanism associated with alternative combinations of the parameters p_H and q_L. In this diagram we illustrate the boundary relationships identified in Table 7.1. The parameter values that mark the boundary between where the national and the decentralised organisations are optimal are found in the following way. Substituting n = 5 and p_A = 0.5 into equation (5), the expected pay-off for the citizen under national decision taking, $E(\Pi^N{}_V)$, is 0.6875. Similarly, substituting p_A = 0.5 into equation (15), gives the expected pay-off for the citizen under a decentralised set-up, $E(\Pi^R{}_V)$, with the same parameter restrictions. Setting $E(\Pi^N{}_V) = E(\Pi^R{}_V)$ produces the following equation which gives the locus of boundary parameters:

(28) $$0.6875 = \frac{2q_L - 1 + p_H(1-q_L)}{q_L} + 0.5\frac{(1-p_H)(1-q_L)}{q_L}$$

Equation (28) can be rearranged and expressed as:

(29) $$p_H = \frac{0.5 - 0.8125q_L}{0.5(1-q_L)}$$

and is represented by the line XYZ in Figure 7.2. Points to the left of this boundary are where the national organisation is preferred to the regional: points to the right of line XYZ are where the reverse is true.

The boundary parameter values between the regional and devolved administrations is given by the two vertical lines at values of q_L equal to 0.75 and 0.6 which correspond to the values for δ of 0.3 and 0.6. Points to the right of these lines are points where, for these parameter values for n and p_A and the appropriate value of δ, the devolved institutional arrangement dominates the decentralised regional one. For points to the left of these lines the opposite holds.

Based on the classification in Table 7.1, where $\delta = 0.6$, parameter combinations in the following sectors are associated with the three separate organisational forms: devolved, A; regional (decentralised), B and D; and national, C and E. In this case there are no parameter combinations that fall within the ambiguous sector. With a lower discount factor, $\delta = 0.3$, the same procedure produces: devolved, A and B; regional (decentralised), D; national E; and F is the ambiguous sector where national or devolved might be the optimal arrangement. Note than when the discount factor is reduced, so that benefits and costs in the future take a lower weight, the benefit from pandering is reduced and the range of parameter values concerning the official's quality over which devolved arrangements are optimal is increased.

8. COMMENT AND CONCLUSIONS

Across different countries there is a wide range of decentralised and devolved arrangements for the delivery of local public goods. The present paper shows that in a very specific model, the optimal organisational arrangements depend on the degree of economic variation between regions, the difference in quality between the regional and national officials and the time discount factor employed by regional officials. Variations in these parameters will produce variation in the most efficient organisational form. We are well aware that considerations other than simple efficiency can dominate decisions over the appropriate system of local democracy. However, we simply note that such decisions are likely to have efficiency implications.

We have used a very stripped down model of pandering. This has been to show that even where there is no variation within the electorate and elected officials have interests that are almost aligned with those of the voter, that there can be costs moving from a decentralised to a devolved administrative arrangement. However, if the assumptions underpinning this model are relaxed, then problems of pandering remain and others emerge. For example, if the voter has more information, so that there is a probability that he can verify whether the policy in any one period is correct, then pandering is reduced. However, if the official gains utility from simply being in office, the incentive to pander increases. Further, where we allow for intra-regional variation between voters there are other inefficiencies that might be associated with local representative democracy; local log-rolling might lead to excess public expenditure and the tyranny of the (local) majority.

The model is also extremely sparse in its representation of the regional system. In particular, we allow for no systematic economic differences across regions. Each region is subject to the same probability of being in one of two situations (states). Further these states are not serially correlated. However, in reality regions are likely to differ, both in terms of the variability of the shocks to which they are subject, and also in terms of differences that persist over time. Where this is the case, efficiency might be maximised where different groups of regions are subject to different devolved or decentralised arrangements. A symmetric organisational structure might be sub-optimal from a pure efficiency standpoint.

For the UK government, local democratic control has often been identified as a key component of the "New Localism" agenda. However, local electorates have been much more sceptical.[8] In so far as the present paper has practical implications, this is that efficiency considerations do not automatically favour devolution and greater electoral powers at the local level. Further, we are arguing that whilst an asymmetric decentralised/devolved system, whilst administratively untidy might be economically efficient.

Figure 4.1 – The Expected Value of National Decision Making as p_A Varies for n=5 and 10.

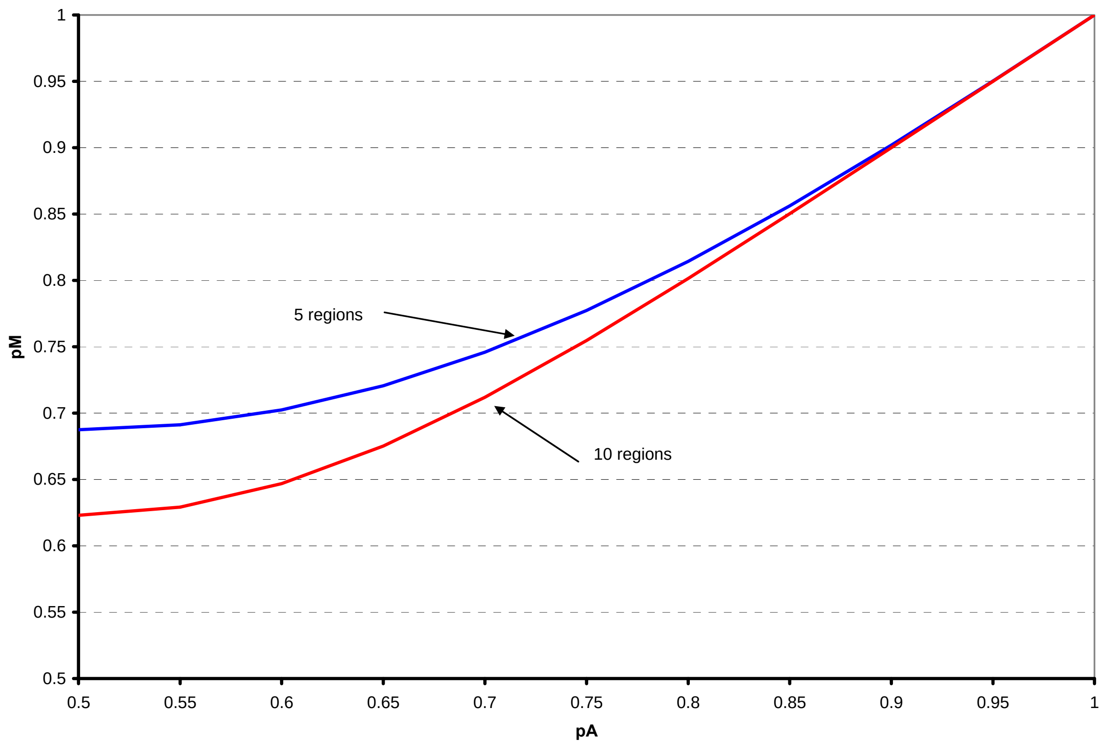


Figure 7.1 – Pandering Boundary (δ, q_L) Parameters for Various Values of p_A

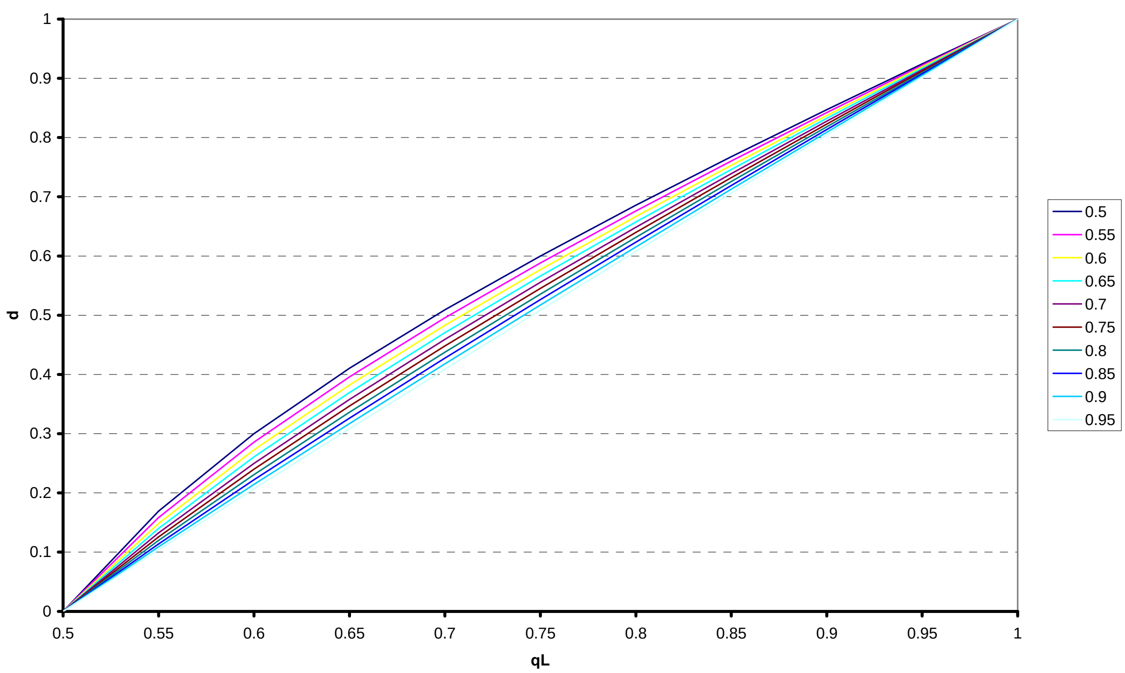
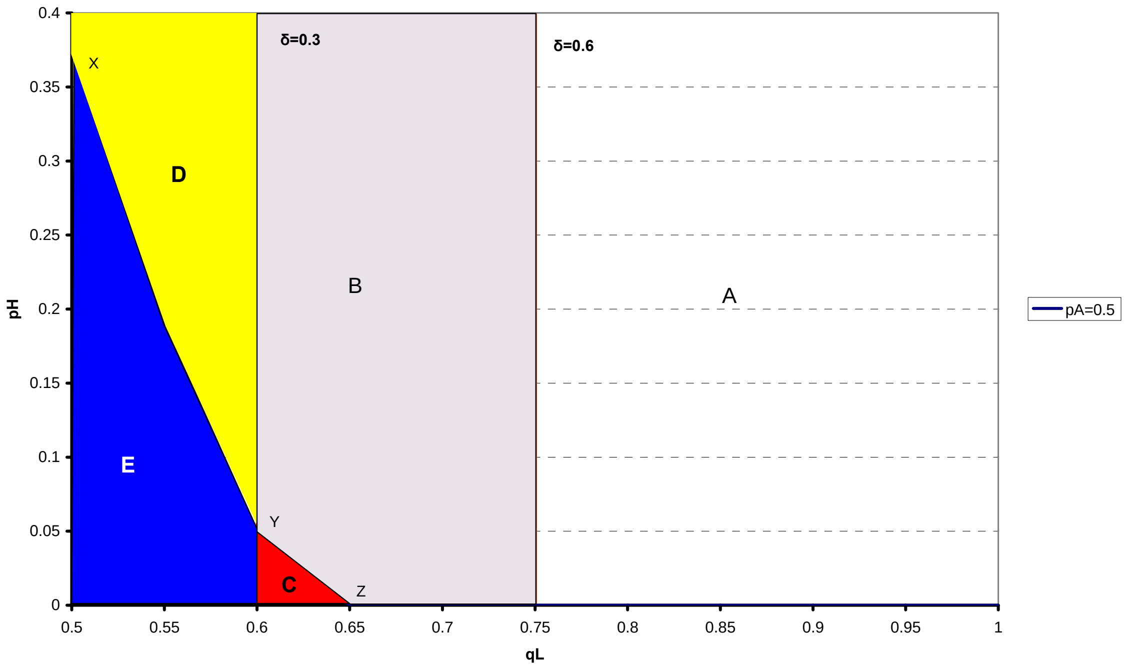


Figure 7.2 – Governance Type Boundary Parameters



APPENDIX 1: RECENT CHANGES IN DECENTRALISED AND DEVOLVED GOVERNANCE IN THE UK

Although often characterised as a centralised state with a strong parliament and a strong national party political system, decentralisation within the United Kingdom was already well established prior to the election of the Labour government in 1997. From the Home Rulers of the late nineteenth century, the plans for devolution to Ireland (and the existence of a separate parliament in Stormont until 1972) and the creation of the Scottish, Welsh and Northern Irish offices the United Kingdom has extensive experience of decentralising government. The change from decentralisation to devolution came in 1997 with the election of Labour government with a specific manifesto pledge to create legislative bodies in Scotland, Wales and Northern Ireland and regional assemblies in England. The establishment of the Scottish Parliament and Welsh Assembly and the granting of full devolved powers to the Northern Ireland Assembly in 1999 created a system of asymmetric devolution to replace the asymmetric system of decentralisation. Mitchell (2006) has termed the relationships between dominant England and the other parts of the United Kingdom as a 'state of unions', the transformation in 1999 was from decentralised control to devolved legitimacy.

The UK Parliament at Westminster retains control over policies with significant spatial spillovers, such as defence and income redistribution (social security transfers, pensions etc.) for all parts of the UK. However responsibility for a range of other policies – for example health, education and industrial development – has been devolved to the territorial legislatures, but with differing degrees of legislative powers and competency. The funding arrangements are nominally unchanged.[9] Given that the administrative mechanisms of government were already in place in Northern Ireland, Scotland, and Wales, the key difference is that relevant policy decisions previously taken at Westminster and implemented through the secretaries of state, are now made by the territorial legislatures and delivered by the territorial executive. The crucial difference is that what were, for Northern Ireland, Scotland, and Wales previously primarily administrative decisions - taken at a distance – are now political decision taken locally.

Perhaps the most innovative constitutional development has been the development of plans for regional government in England. This has meant movement to a decentralised, delegated model with Regional Development Agencies, Regional Government Offices and Regional Chambers - typically in conjunction with a myriad of other local agencies - implementing policy. It was the government's plan (vision even) that these regional institutions would be under the control of regional elected assemblies. But this idea has proved unpopular and is unlikely to be implemented in the foreseeable future. The North East – the region thought most in favour - decisively rejected an elected assembly in a referendum in 2004 and plans for other referenda across England have been abandoned. Only in London, where the Greater London Authority of a mayor and elected assembly oversees co-ordination for services with large spillovers between the London boroughs, has elected devolution been achieved.

APPENDIX 2: IMPLICATIONS OF ASSUMPTIONS CONCERNING LOW QUALITY OFFICIALS

In this Appendix we verify expressions (4), (5) and (6) in the text.

Expression (4)

(A2.1) $$ps_B = p_H p_B + p_L ps_{B,L}$$

Using equation (1) in the text, and given that $1 \geq q_L \geq:0$:

(A2.2) $$ps_B = (1 - p_L) p_B + p_L \frac{p_B}{q_L} = p_B \left[1 + p_L \left[\frac{1 - q_L}{q_L} \right] \right] \geq p_B$$

Using (A2.2) and the fact that both the probabilities of the regional types and of their signals are both comprehensive:

(A2.3) $$ps_B = 1 - ps_A \geq p_B = 1 - p_A$$

Rearranging (A2.3) gives:

(A2.4) $$ps_A \leq p_A$$

Expressions (A2.2) and (A2.4) verify expression (4) in the text.

Expression (5)

The probability that the official is of low quality, given that her signal is B, can be calculated from Bayes' theorem:

(A2.5) $$\frac{ps_{B,L}\,p_L}{ps_B} = po_{L,B}$$

Substituting the values of $ps_{B.L}$ and ps_B given by equations (1) and (A2.2) into equation (A2.5), and noting that given that $q_L + p_L(1-q_L) \leq 1$ produces:

(A2.6) $$po_{L,B} = \frac{p_L}{q_L + p_L(1-q_L)} \geq p_L$$

Using (A2.6) and the fact that both the unconditional and conditional probabilities of the official's type are comprehensive gives:

(A2.7) $$po_{L,B} = 1 - po_{H,B} \geq p_L = 1 - p_H$$

Rearranging expression (A2.7) produces

(A2.8) $$po_{H,B} \leq p_H$$

Expressions (A2.6) and (A2.8) validate expression (5) in the text.

Expression (6)

The probability that the official is of low quality, given that her signal is A, can be calculated from Bayes' theorem:

(A2.9) $$\frac{ps_{A,L}\,p_L}{ps_A} = po_{L,A}$$

However given that the conditional and unconditional probabilities of the signal type are comprehensive:

(A2.10) $$p_L\left[\frac{1-ps_{B,L}}{1-ps_B}\right]=po_{L,A}$$

Given the restrictions on the probabilities of signal types:

(A2.11) $$p_L \geq po_{L,A} \quad iff \quad 1-ps_B \geq 1-ps_{B,L} \quad \rightarrow \quad iff \quad ps_B \leq ps_{B,L}\,,$$

Using equation (A2.1) and equation (1) in the text and given that the probabilities on the official's quality are comprehensive:

(A212) $$ps_B=(1-p_L)p_B+p_L\frac{p_B}{q_L}=\frac{p_B}{q_L}((1-p_L)q_L+p_L)=ps_{B,L}((1-p_L)q_L+p_L)$$

With the parameter restrictions:

(A2.13) $$1 \geq (1-p_L)q_L+p_L \geq 0$$

This implies that, from (A2.12) and (A2.11):

(A2.14) $$ps_B \leq ps_{B,L} \quad \rightarrow \quad p_L \geq po_{L,A}$$

Using (A2.14) and the fact that both the unconditional and conditional probabilities of the official's type are comprehensive gives:

(A2.15) $$p_L=1-p_H \geq po_{L,A}=1-po_{H,A}$$

Rearranging expression (A2.15) generates the inequality:

(A2.16) $$po_{H,A} \geq p_H$$

Expressions (A2.14) and (A2.16) verify expression (6) in the text.

Value $po_{H,A}$

From the fact that the conditional probabilities are comprehensive;

(A2.17) $$po_{H,A} = 1 - po_{L,A}$$

Using equation (A2.2), (A2.10) and equation (1) in the text:

(A2.18) $$po_{L,A} = p_L\left[\frac{q_L - p_B}{q_L - p_B(q_L + p_L(1-q_L))}\right]$$

Substituting equation (A2.18) into (A2.17) and rearranging gives:

(A2.19) $$po_{H,A} = \frac{q_L - p_B(q_L + p_L(1-q_L)) - p_L(q_L - p_B)}{q_L - p_B(q_L + p_L(1-q_L))} = \frac{q_L(1-p_L)(1-p_B)}{q_L - p_B(q_L + p_L(1-q_L))}$$

APPENDIX 3: THE DEVOLVED EQUILIBRIA

Non-pandering equilibrium

We tackle the devolved non-pandering equilibrium in three steps. First, we show that given the voter's strategy, there is a range of parameters (prior probabilities) for which the official's non-pandering strategy maximises her pay off. Second, we demonstrate that if the official adopts this strategy, Bayesian updating of the initial priors supports the voter's beliefs. Finally, we confirm that given the voter's beliefs, the voter's strategy maximises his pay off.

The first step of the strategy is shown in detail in the text and the parameter constraint is shown in expression (19). The second step is to verify the rationality of the voter's beliefs. From expressions (5) and (6) we know that the probability that an official is of low quality conditional on her receiving a B signal is greater than the prior probability of low quality, and that the reverse is the case for an official receiving an A signal. Therefore where the official, independent of her quality, adopts a strategy of always following her signal in period 1, the voter's expectations are verified.

Step three is to show that the voter's strategy is optimal given his expectations. This implies that the voter's expected period-2 pay-off from removing a non-pandering incumbent who adopts policy β in period 1, $E(\Pi 2_V^D)_{RM,\beta}^F$ must be greater than the voter's expected period-2 pay-off from retaining her, $E(\Pi 2_V^D)_{RT,\beta}^F$, so that:

(A3.1) $$E(\Pi 2_V^D)_{RM,\beta}^F \geq E(\Pi 2_V^D)_{RT,\beta}^F .$$

The values for the expected pay-offs are given by:

(A3.2) $$E(\Pi 2_V^D)_{RM,\beta}^F = z = (1-p_L) + p_L z_L = 1 - p_L(1-z_L)$$

(A3.3) $$E(\Pi 2_V^D)_{RT,\beta}^F = (1 - po_{L,B}) + po_{L,B} z_L = 1 - po_{L,B}(1 - z_L)$$

Using equations (A3.2) and (A3.3), and recognising the restrictions placed on parameter values, produces:

(A3.4) $$E(\Pi 2_V^D)_{RM,\beta}^F \geq E(\Pi 2_V^D)_{RT,\beta}^F \; iff \;\; po_{L,B} \geq p_L$$

However, again from expression (6), we know that inequality (A3.4) is satisfied where the official follows a non-pandering strategy. Using a similar argument,

(A3.5) $$E(\Pi 2_V^D)_{RT,\alpha}^F \geq E(\Pi 2_V^D)_{RM,\alpha}^F \; iff \;\; po_{L,\alpha} \leq p_L$$

Therefore each of the three steps required for the perfect Bayesian Nash equilibrium holds.

Pandering equilibrium

We begin again with the official's decision. In period 2, both high and low quality officials always follow their signal. Further, if she is of high quality, or if the signal is A, the official will always follow her signal in period 1, independently of the voter's strategy. Our concern is therefore only with the period-1 decision of the low-quality official.

Where the low quality official receives a period-1 B signal, the expected values for following the signal or pandering are given by equations (A3.6) and (A3.7):

(A3.6) $$E(\Pi_O^D)_{L,B}^F = q_L + \delta p v_{RT,\beta} z_L$$

(A3.7) $$E(\Pi_O^D)_{L,B}^P = 1 - q_L + \delta p v_{RT,\alpha} z_L$$

Using equations (A3.6) and (A3.7), the condition under which the official is indifferent between following her signal or pandering is given as:

(A3.8) $$\Delta pv_{RT}^{M} = pv_{RT,\alpha} - pv_{RT,\alpha} = \frac{2q_L - 1}{\delta z_L}$$

where the M superscript indicates that this is the value for a mixed strategy equilibrium and $pv_{RT,\chi}$ is the probability of retaining an official adopting an χ period-1 policy, $\chi = \alpha$ or β. Given the restrictions placed on parameter values and the fact that inequality (19) in the text does not hold in this case:

(A3.9) $$1 > \frac{2q_L - 1}{\delta z_L} > 0$$

Recall that the voter's strategy is:

$$pv_{RT,\alpha}^{M} = 1; \quad pv_{RT,\beta}^{M} = 1 - \frac{2q_L - 1}{\delta z_L}$$

He plays a pure strategy when the official chooses policy α: he always retains the incumbent official. However, when the policy choice is β, the voter plays a mixed strategy, retaining the official with a probability of. $1 - \frac{2q_L - 1}{\delta z_L}$. Therefore expressions (A.3.8) and (A3.9) imply that the low quality official's mixed strategy on receiving a period-1 B signal is optimal, given the voter's mixed strategy when the official adopts a period-1 β strategy.

The next step is to show that the voter's expectations are consistent with Bayesian updating of the priors, given the official's strategy. Using Bayes theorem:

(A3.10) $$po_{L,\beta} = \frac{po_{\beta,L}\, p_L}{p_\beta}$$

$po_{\beta,L}$ reflects the mixed strategy of the low quality official and, using equation (1) in the text, is given as:

(A3.11) $$po_{\beta,L} = ps_{\beta,L}\, po_{\beta,L,B} = \frac{p_B}{q_L} q_L = p_B$$

Further, using equation (A3.11):

(A3.12) $$p_\beta = p_H\, p_B + p_L\, po_{\beta,L} = p_B(p_H + p_L) = p_B$$

Substituting equations (A3.11 and (A3,12) into (A3.10) gives:

(A3.13) $$po_{L,\beta} = p_L$$

This is therefore consistent with one element of the voter's beliefs.

Using the same approach:

(A3.14) $$po_{L,\alpha} = \frac{po_{\alpha,L}\, p_L}{p_\alpha}$$

where:

(A3.15) $$po_{\alpha,L} = ps_{A,L} + ps_{B,L}\, po_{\alpha,L,B} = 1 - \frac{p_B}{q_L} + \frac{p_B}{q_L}(1 - q_L) = p_A$$

so that:

(A3.16) $$p_{\alpha} = p_H p_A + p_L po_{\alpha,L} = p_A(p_H + p_L) = p_A$$

Substituting equations (A3.15) and (A3.16) into equation (A3.14) produces:

(A3.17) $$po_{L,\alpha} = p_L$$

Therefore both elements of the voter's beliefs are consistent with Bayesian updating, given the official's strategy.

The final step is to show that the voter's strategy is optimal, given his beliefs. The expected value in period 2 of removing the incumbent official is always z. The expected value for retaining an incumbent adopting policy χ is given as:

(A3.18) $$E(\Pi 2_V^D)_{RT,\chi} = p_{H,\chi} z_H + p_{L,\chi} z_L \qquad \chi = \alpha, \beta$$

Therefore, using equation (15) in the text, which defines the parameter z:

(A3.19) $$E(\Pi 2_V^D)_{RT,\chi} - E(\Pi 2_V^D)_{RE,\chi} = (p_{H,\chi} - p_H) z_H + (p_{L,\chi} - p_L) z_L \qquad \chi = \alpha, \beta$$

Given that both sets of probabilities sum to unity, equation (A3.19) can be re-expressed as:

(A3.20) $$E(\Pi 2_V^D)_{RT,\chi} - E(\Pi 2_V^D)_{RE,\chi} = (p_L - p_{L,\chi})(z_H - z_L) \qquad \chi = \alpha, \beta$$

Given that $1 \geq q_L \geq 0$, from equations (12) and (13) in the text:

(A3.21) $$z_H - z_L = ps_{B,L}(1 - q_L) \geq 0$$

This implies that if an official adopts policy χ in period 1, it is rational for the voter to retain the official if $p_L \geq p_{L,\chi}$ and mix his strategy between retaining and retaining the official where $p_L = p_{L,\chi}$. Therefore given the voter's expectations concerning $p_{L,\alpha}$ and $p_{L,\beta}$, it is rational for the voter to retain all officials who choose a period-1 α strategy and to remove an official who chooses a β strategy with a probability $1-\frac{2q_L-1}{\delta z_L}$. The mixed strategies by the elected official and voter are a Bayesian equilibrium.

APPENDIX 4:VARIABLES NEEDED TO CALCULATE $E(\Pi^{D}_{V})^{F}$

In calculating $E(\Pi^{D}_{V})^{F}$, we require values of $po_{L,A}$ $po_{H,A}$ ps_{A} and ps_{A} in terms of the prior probabilities p_{A}, p_{H} and q_{L}.

From equation (A2.18):

(A4.1) $$po_{L,A} = \frac{(1-p_H)(q_L-(1-p_A))}{p_A q_L - (1-p_A)(1-p_H)(1-q_L)}$$

From equation (A2.19):

(A4.2) $$po_{H,A} = \frac{q_L p_H p_A}{p_A q_L - (1-p_A)(1-p_H)(1-q_L)}$$

From equation (A2.2):

(A4.3) $$ps_B = \frac{(1-p_A)(1-p_H(1-q_L))}{q_L}$$

From equation (A2.3)

(A4.4) $$ps_A = \frac{p_A-(1-q_L)(1-p_H(1-q_A))}{q_L}$$

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NOTES

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[1] Appendix 1 gives more detail on these decentralised and devolved powers for the UK.

[2] An example from regional development could be that there are two policy options: encouraging new firm formation (α) and attracting foreign direct investment (β). These policies might be optimal in regions dominated by small (A) and large (B) plants respectively.

[3] These relationships are formally verified in Appendix 2.

[4] We use the terms "local" and "regional" interchangeably, simply to fight repetition.

[5] The value of δ clearly affects the expected values of decisions taken under the national and regional organisational forms when these are computed over a two period time span. However, in these cases the undiscounted values in the two separate time period are the same, and the value of δ doesn't influence these. However, in the devolved case the value of δ plays a role in determining whether the official panders or not and therefore affects the value of the voter's expected pay-off in a more fundamental manner.

[6] Where there are equal numbers of regions of type A and B, the national politician chooses policy α. The assertion that the high quality official always acts in the interest of the electorate, even where the electorate is mistaken about its own interests, is discussed in greater detail in the next section.

[7] Other alternatives exist, such as direct decision making through referenda. However, local representative democracy is the standard regional democratic mechanism and applies to the UK devolved regions.

[8] Whilst the vote for the Scottish Parliament was unambiguously in favour, that for the Welsh Assembly was marginal, the Regional Assembly for the Northern Region was rejected and the Northern Ireland Assembly is currently in abeyance.

[99] The Barnett formula that had been used to calculate pre-devolution Scottish Office spending was retained to determine the devolved budget of the Scottish Parliament, though the actual implications of devolution for the funding of the public sector in Scotland is contested (Christie and Swales, 2005, Midwinter, 2004).