Policy Spillovers in a Regional Target-Setting Regime*

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ABSTRACT: The specific concern in this paper is the co-ordination difficulties within a target-setting regime where there are negative policy spillovers across regions and where these spillovers are not common knowledge amongst the government and the delegated agencies. We demonstrate that where one policy objective has negative spillovers, there will be a switch in expenditure towards that policy that has the externality. The expenditure switch will be largest when: the spillover is greatest and where the agency is informed. The expenditure switch is reduced if the number of informed agencies is increased. This expenditure switching is arbitrary and likely to be welfare reducing and adjustments to the targets by an uninformed government may make matters worse. The analysis is primarily done diagrammatically. *Key words*: Targets, Regional Policy, Regional Development Agencies, Spatial Spillovers. *JEL Classification*: R38

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1. *Introduction*

The present UK government has begun a radical overhaul of regional policy, as outlined in HM Treasury (2001) and HM Treasury *et al* (2003). One particular change is the decentralisation and delegation of regional policy delivery in England to Regional Development Agencies (RDAs) that are motivated and controlled through target setting (McVittie and Swales, 2004a). A major argument for decentralisation is that indigenous institutions have informational advantages over central government in the delivery of a flexible and discretionary regional policy that is sensitive to local economic conditions (HM Treasury *et al.,* (2003).[1]

The specific concern in this paper is the co-ordination difficulties within such a regime where there are policy spillovers across regions and where these spillovers are not common knowledge amongst the government and the delegated agencies. At present although the English regions are extremely open, so that spillover effects are to be expected, there is no consensus as to the size or even the sign of such effects. Past work on identifying regional policy spillovers has not focussed on the impact on non-recipient regions or the nation as a whole (Taylor, 2002). What is more, the data on some of the channels through which such spillovers might act, in particular inter-regional trade and migration, are poor (Alsopp, 2003, McVittie and Swales, 2004b).

We analyse this policy problem in a principal-agent framework, using a very simple model. In this model it is possible for both the government (the principal) and the regional agencies (the agents) to be either informed or uninformed about the nature of the inter-regional spillovers. Further, informed development agencies can either act non-cooperatively or collusively in attempting to meet the policy targets. We demonstrate that different informational states and types of agency behaviour have very different implications for the payoffs from the decentralised, delegated policy with target setting.

[1] In this paper we use the term "local" as synonymous with "regional". Local does not imply a higher level of geographic disaggregation than regional.

We emphasise the importance of the central government being informed in order to set appropriate targets.

Section 2 gives more background information on the recent changes in UK regional policy. Section 3 outlines a formal model with negative inter-regional spillovers. Section 4 presents the model solutions. Section 5 discusses policy options for the government and Section 6 is a short conclusion.

2. Background

The post-1997 Labour government introduced an innovative regional policy framework referred to as the 'new localism': the devolution or delegation of power and responsibility over regional policy to decentralised bodies (Balls, 2002). The distinction between devolution and delegation is important. In Scotland, Wales and Northern Ireland economic development has been devolved to the appropriate parliament or assembly which have a wide degree of freedom over their own development priorities, policy design and the associated allocation of resources (HM Treasury *et al*, 2003)[2]. On the other hand, in England regional policy has been decentralised and delegated. Central government allocates to English regions funds which are specifically earmarked for regional economic development. The expenditure of these funds is subject to controls set at the national level. The relevant regional institutions in England therefore have control over the manner in which regional policy is to be delivered. However, they do not control the aims or aggregate level of regional assistance.

The bodies that lead in the local delivery of this policy in England are the newly formed Regional Development Agencies (RDAs). The RDAs are non-departmental public bodies (NDPBs). An NDPB is " [a] body which has a role in the process of national government, but is not a government department or part of one, and accordingly operates to a greater or lesser extent at arms length from Ministers" (RDAUK Homepage). This gives the

[2] At the time of writing, the devolved institutions in Northern Ireland are temporarily suspended and funding currently flows through the Northern Ireland Office. Additionally, the Scottish Parliament has limited independent tax-raising powers.

RDAs a degree of independence and flexibility when dealing with the private sector which government departments might lack. The government argues that delegating responsibility over regional policy allows the RDAs to use their region specific knowledge in order to exploit the indigenous strengths, and tackle the particular weaknesses, of each area (HM Treasury *et al*, 2003). The English RDAs are allocated a significant budget which is forecast to be over £2 billion by 2005-6 (McVittie and Swales, 2004b).

Although the RDAs have been given discretion over their use of resources, they are set targets for economic development and regeneration.[3] These targets are linked to the Public Sector Agreement (PSA) targets held by the Departments that fund the activities of the English RDAs (HM Treasury *et al*, 2003). It is well known that using targets to control delegated agents has weaknesses as well as strengths (Milgrom and Roberts, 1992). We specifically investigate the effectiveness of a regional target setting regime where there are significant interregional policy spillovers. That is, where policy introduced in one region affects the economic performance of other regions, either positively or negatively. Examples of the channels through which such economic spillovers might flow include product and labour markets, migration, and informational networks (Ferguson *et al*, 2004; Fingleton, 2003).

The government acknowledges that: "policies developed and delivered by national, regional and local bodies must be properly co-ordinated" (HM Treasury *et al*, 2003, p.4). However, a distinction should be made between policy co-ordination along vertical and horizontal lines. The aim of vertical co-ordination is to ensure policies operating at the macroeconomic, microeconomic and regional levels complement one another. Horizontal co-ordination, on the other hand, is administered across policies operating at the same level. The government recognises the need for vertical co-ordination:

[3] The government has introduced other institutional arrangements for monitoring and controlling English RDAs, alongside targets. Whilst these other mechanisms are generally given a lower profile in government documents, their true significance is probably underestimated (McVittie and Swales, 2004b).

> The Government is committed to improve the co-ordination of policy at the regional level. This is reflected in a further specific target for the Office of the Deputy Prime Minister to promote better policy integration nationally, regionally and locally (HM Treasury *et al*, 2003, p.15).

However, whether the government sees the need for systematic horizontal co-ordination is less clear. Furthermore, even if the government is aware of regional policy spillovers, it does not say how these will be accommodated in its target setting regime.

3. A Formal Delegated-Policy Model with Negative Spillovers

The broad characteristics of the model are as follows. A finance-constrained government department (subsequently referred to as 'the government') has a social welfare function whose arguments are measures of regional welfare. For individual regions, welfare is a function of two regional policy outputs and the government delegates policy delivery to decentralised economic development agencies. Each agency is allocated a budget and known linear technologies transform efficient expenditure to policy outputs. However, one of the policy outputs generates a spatial externality. There are conventional moral hazard problems for the government. It cannot observe agency effort or misdirected expenditure, only policy outputs. It therefore sets targets for the policy outputs of the individual agencies, and there is an associated loss function if an agency fails to hit the targets.

Essentially we adopt a principal-agent approach, with the government as the principal and the development agency as the agent (Laffont and Martimort, 2002). We therefore consider the government's attempt to set targets which optimise its pay-off, which is expressed as a welfare function. We do not treat the agencies' participation constraints in a fully rigorous manner, though we assume that amongst the targets that will maximise the government's pay-off, the government will choose the set that minimise the cost to the agencies. This is consistent with the present Labour government's rule that targets should be SMART, where SMART is an acronym for *S*pecific, *M*easurable, *A*chievable,

*R*elevant and *T*imed (HM Treasury, 2003). Targets that are attained will result in a zero (minimum) loss for the agencies.

More specifically, for pedagogic reasons, the model has 2 identical regions, regions i and j.[4] The government has a Cobb-Douglas welfare function, W, in the regions' utilities, where the utility of each region has equal weight, so that:

(1) $$\log W = \sum_n \log U^n$$

where U^n is utility in region n.[5] Regional utility is itself a Cobb-Douglas function of the two policy outputs, 1 and 2:

(2) $$\log U^n = \alpha \log Q_1^n + (1-\alpha) \log Q_2^n$$

where Q^n_k is the output of policy k in region n, and α is the weight given to policy output 1.

3.1 No regional spillovers

To begin, we consider a situation where there are no spillovers. This implies that the regional policy outputs are determined as:

(3) $$Q_k^n = \gamma_k P_k^n$$

where P^n_k is the expenditure on policy k in region n, and γ_k is a fixed technical coefficient determining the transformation of expenditure into policy output k. Equation (3) is conditional on two important considerations. The first is that the policy is delivered locally. If it is delivered outwith the region, the value of γ_k is much lower. Second, the

[4] An extension to n regions is relatively straightforward.

policy is being pursued with maximum effort. As long as these two conditions hold, we assume policy can be delivered at a uniform efficiency that does not vary between the two regions.

Substituting (2) and (3) into (1) produces:

(4) $$\log W = \alpha \sum_n \log P_1^n + (1-\alpha) \sum_n \log P_2^n + 2\left[\alpha \log \gamma_1 + (1-\alpha) \log \gamma_2\right]$$

It is straightforward to show that under these circumstances, the first best outcome for the government is for the budget to be divided equally across all regions and for the distribution of expenditure between policy outputs 1 and 2 to be $\frac{\alpha}{1-\alpha}$ (see Appendix). Note that the optimal distribution of expenditures is independent of the efficiency with which these expenditures are transformed into policy outputs. This is a characteristic of the Cobb-Douglas functional form. This eases the subsequent exposition, because the first best outcome will always involve a fixed distribution of expenditures between different policy outputs. In order to get round the moral hazard problem, if the total budget for the RDA programme is B, the identical attainable output targets T_1 and T_2 set for each agency should be:

(5) $$T_1 = \frac{\alpha \gamma_1 B}{2}, \quad T_2 = \frac{(1-\alpha)\gamma_2 B}{2}$$

3.2 Regional spillovers

To incorporate regional spillovers we begin with a very simple model. First, with no loss of generality, we calibrate output so that $\gamma_1 = \gamma_2 = 1$. Second, for heuristic reasons we weight the two policy outputs equally, so that $\alpha = \frac{1}{2}$. Similarly we set the total budget,

[5] This welfare function reflects that recommended in the UK Green Book for policy evaluation (HM Treasury, 2003).

B, equal to 2. With homogeneous regions, this means that in equilibrium each will be assigned a budget equal to unity so that policy expenditure levels for an individual region can be immediately interpreted as shares. Finally, expenditure on policy 1 in one region has a negative spillover on the level of output 1 in the other region, whilst expenditure on policy 2 generates no spillover effects.

Scottish Enterprise, the regional development agency in Scotland, provides good examples of both types of policy. Ferguson *et al* (2004) reports simulations showing negative output and employment effects on the rest of the UK from policies supported by the agency to "Grow the global reach of Scottish companies".[6] Their aim is to stimulate Scottish exports, and they are examples of Policy 1. However, there are other policies that fulfil a primarily social, as opposed to an economic, role and which therefore are unlikely to have effects outwith the region. Such a policy is "Narrowing the gap between unemployed in the worst areas of Scotland and the Scottish average", whose main focus is to invest in human capital in order to reduce unemployment in the most deprived areas of Scotland (Scottish Enterprise, 2002). This is an example of Policy 2.

Defining the degree of spillover effects as ϕ, the outputs from regional policy *with spillover effects* in region i are:

(6) $$Q_1^i = P_1^i - \phi P_1^j$$

(7) $$Q_2^i = P_2^i$$

It is assumed that $0 < \phi < 1$. This implies that the spillover effect is strictly less than the direct effectiveness of policy 1. If this were not the case, a rational government would allocate no expenditure to policy 1.

Again, for the government the first-best solution with spillovers is for expenditure on the two polices to reflect the weights in the regional utility function (as in the maximisation

of equation 4 under a budget constraint). Here, this would be an equal division. Essentially for the government the spillovers act in a similar way to a reduction in the value of the efficiency parameter, γ_1. For each region the optimal expenditures and subsequent policy outputs are:

(8) $$P_1^i = P_1^j = P_2^i = P_2^j = \frac{1}{2}, \quad Q_1^i = Q_1^j = \frac{1-\phi}{2}, \quad Q_2^i = Q_2^j = \frac{1}{2}$$

We wish to explore how far these optimal outcomes are achievable under a target setting regime with various informational difficulties and collusive possibilities.

2.3 The target setting regime

We begin by outlining how the behaviour of the agencies is affected by the introduction of a target setting regime. The agencies will be punished for deviating from targets set by the government, where this punishment consists of adverse reputation and labour market effects. We use the same form of loss function as popularised in the literature on monetary targets (Barro and Gordon, 1983; Rogoff, 1985):

(9) $$\Lambda = \left(Q_1 - T_1\right)^2 + \left(Q_2 - T_2\right)^2$$

where Λ is the total loss and T_k is the target for policy output k. For this loss function, as the distance from the target increases, the agency suffers a higher loss, and the marginal loss increases as the agency moves further from the target.

Equation (9) implies a symmetrical target: the costs of over- and under-achievement are equal. Such an assumption is clearly appropriate for the inflation rate target set by the UK government for the Monetary Policy Committee, where the government requires a predictable, and stable, inflation rate. In a regional policy context, however, it is likely that the targets will be asymmetric, in that the government will impose no punishment for

[6] Although with shorter time periods or different models, spillovers might also be positive (Ferguson *et al*, 2004; Fingleton, 2003).

exceeding a target: in general, we expect the government to prefer more regional policy output than less.[7] However, we have not explicitly modelled development agency effort. We therefore identify the loss involved in exceeding the target as being the cost to the agency of excess effort. This means that under all circumstances where the target is achievable within its budget, the agency will prefer to hit the target with minimum effort, rather than over shoot the target.

The agency therefore chooses policy output levels that minimise its loss function, subject to the appropriate constraints. The effect of setting output targets can now be analysed by comparing the agencies' loss-minimising outputs with the first-best output levels given by equation (8). We consider a number of scenarios in which economic actors have alternative information about spillovers.

Agencies can be informed or uninformed about spillover effects. If they are uninformed, both the agencies believe the value of ϕ to be zero and interpret any under-performance in producing Q_1 to have some unobserved exogenous cause. If the agencies are informed, the true value of ϕ is common knowledge to both agencies. Similarly, the government can be either informed or uninformed about the value of ϕ, with an uniformed government again believing the value of ϕ to be zero.

For informed agencies there are two options concerning their degree of collusion or coordination in achieving targets. First, they can set their policy expenditure levels independently, in a non-cooperative manner. Second, they can collude and jointly set their expenditure levels to minimise the combined loss.

4. Model Solutions

4.1 Uninformed regional agencies

[7] There is some uncertainty here. In general one would think that over-performing development agencies would be positively valued. However, one of the present Labour government's Public Sector Agreement (PSA) targets is to reduce growth differentials between regions. This seems to imply that if high growth

Each uninformed regional agency will choose the expenditure level that minimises its loss function, on the false belief that there are no spillovers, so that it expects policy outputs to be give by equation (3), with $\gamma_1 = \gamma_2 = 1$. Slightly reordering equation (9), dropping the regional superscript, and introducing the budget constraint implies that we need to maximising the following Lagrangean with respect to P_1, P_2 and λ for region n:

(10) $$M\text{ax}\, L_{P_1,P_2,\lambda} = -\left(P_1 - T_1\right)^2 - \left(P_2 - T_2\right)^2 + \lambda\left(1 - P_1 - P_2\right)$$

If the budget constraint does not bind, so that $\lambda = 0$, the Lagrangian is maximised where:

$$P_1 = T_1, \quad P_2 = T_2$$

Where the budget constraint binds, the Lagrangian is maximised where:

$$P_1 = \frac{1 + T_1 - T_2}{2}, \quad P_2 = \frac{1 - T_1 + T_2}{2}$$

If the government wishes to maximise its welfare, it should therefore set:

(11) $$T_1 = T_2 \geq \frac{1}{2}$$

For the targets to minimize the cost to the agencies, expression (11) should be set as an equality and the *ex post* payoff to each agency will be $-\frac{\phi^2}{4}$.

In this case, the government maximises its welfare function by setting "demanding" targets that are unattainable *ex post*. This raises the issue of the agencies' participation constraint. Can the government maintain a credible target setting regime where targets are systematically not achieved? The strategy adopted is *ex-ante,* but not *ex-post,* optimal for the agencies. Because each agency is unaware of any spillover effects, it expects

regions over perform, that this would be unwelcome, though we have never seen this point explicitly discussed in the government literature on target setting as applied to the new localism.

output levels of $Q_1 = Q_2 = \frac{1}{2}$. However, the spillover from expenditure on policy 1 by the agency in the other region results in the output levels shown in equation (8), pushing the performance of each development agency further away from T_1 than expected and increasing its loss. Clearly in a repeated game situation we expect the agency to adapt its allocation of funds between the different policies. In Section 4.3 we investigate such a dynamic adaptation process.

4.2 Informed non-cooperative development agencies

In this case both development agencies simultaneously choose their policy expenditures, taking into account the spillover effect of policy decisions taken by the agency in the other region. The solution to this problem, the Nash equilibrium, is the point where each region chooses its optimal level of policy given the choice by the other region.

Region i maximizes the following Lagrangian:

(12) $$Max\ L_{P_1^i . P_2^i, \lambda} = -\left(P_1^i - \phi P_1^j - T_1\right)^2 - \left(P_2^i - T_2\right)^2 + \lambda\left(1 - P_1^i - P_2^i\right)$$

(13) $$\frac{\partial L}{\partial P_1^i} = -2\left(P_1^i - \phi P_1^j - T_1\right) - \lambda = 0$$

(14) $$\frac{\partial L}{\partial P_2^i} = -2\left(P_2^i - T_2\right) - \lambda = 0$$

Assuming the budget constraint binds:

(15) $$\frac{\partial L}{\partial \lambda} = 1 - P_1^i - P_2^i = 0$$

Setting (13) equal to (14) and using (15) gives::

(16) $$P_1^i = \frac{T_1 - T_2 + 1}{2} + \frac{\phi P_1^j}{2}$$

Equation (16) is region i's reaction function, which gives the optimal choice of policy expenditure by the development agency in region i, given the level of policy expenditure in region j. It is linear in (P_1^i, P_1^j) space. The budget for each agency is fixed, so that the higher is expenditure on policy 1 in region j, the more the agency in region i will shift expenditure from policy 2 to policy 1. Since the regions are identical, region j's reaction function is simply equation (16) with the i and j superscripts reversed. The reaction functions, R^i and R^j, for the development agencies in regions i and j are shown in Figure 1, for the values $T_1 = T_2 = \frac{1}{2}$.

The point where the reaction functions intersect is the Nash equilibrium. Substituting the reaction function for P^j_1 into equation (16) and solving for P^i_1 produces:

(17) $$P_1^i = P_1^j = \frac{T_1 - T_2 + 1}{2 - \phi}$$

where

(18) $$\frac{\partial P_1^i}{\partial \phi}, \frac{\partial P_1^j}{\partial \phi} = \frac{T_1 - T_2 + 1}{(2-\phi)^2} > 0 \;\; if \;\; T_1 + 1 > T_2$$

For *ex ante* attainable targets, where both policy outputs have a positive value, $1>T_1$, $T_2 >0$. This implies that the condition on the inequality in expression (18) always holds. therefore for the Nash equilibrium, the bigger the negative spillover for output 1, the greater the switch of expenditure towards that policy output.

Where the government is uninformed about the spillover effects and sets the otherwise optimal targets:

$$T_1 = T_2 = \frac{1}{2}$$

the Nash equilibrium level of P^i_1 and P^j_1 is higher, and the value of P^i_2 and P^j_2 lower, than the first-best level:

(19) $$P_1^i = P_1^j = \frac{1}{2-\phi} > \frac{1}{2} = P_1^*$$

Furthermore, the Nash equilibrium level of P_1^n increases as the spillover effect increases.

4.3 Uninformed, dynamically adjusting development agencies

Imagine the agencies are uninformed concerning the spillovers, but interpret any failure to meet the target for policy 1 as resulting from some unobserved exogenous disturbance. In a repeated game with fixed targets, an equilibrium with policy outcomes identical to the Nash will be reached through dynamic iteration. In this case, equation (6) should be replaced with equations (20) and (21):

(20) $$E\left(Q_{1,t}^i\right) = P_{1,t}^i - K_{t-1}^i$$

(21) $$K_{t-1}^i = \phi P_{1,t-1}^j$$

where $E(Q^i_{1,t})$ is the expected value of $Q^i_{1,t}$, and K_{t-1} is an influence on the attainment of output 1 in region i which is treated as exogenous by the agency in region i. However, this "exogenous" factor is in fact the negative spillover from region j, given by equation (21). If in each round the agencies attempt to adjust to take account of changes in the exogenous factor in the previous round, we have a lagged reaction function, so that:

(22) $$P_{1,t}^i = \frac{T_1 - T_2 + 1}{2} + \frac{\phi P_{1,t-1}^j}{2}$$

Given that the regions are symmetrical, so that $P^i_{1,t} = P^j_{1,t}$, the lagged reaction function (22) becomes a linear first-order difference equation:

(23) $$P_{1,t}^{i} = \frac{T_1 - T_2 + 1}{2} + \frac{\phi P_{1,t-1}^{i}}{2}$$

Equilibrium is found where $P^{i}_{1,t} = P^{i}_{1,t-1}$, which produces an outcome identical to the Nash equilibrium given in equation (17). Figure 2 gives the period-by-period adjustment, again where $T_1 = T_2 = \frac{1}{2}$.

4.4 The Collusive Solution

In the Nash equilibrium, each agency fails to internalise the negative spillover effect its policy has on the other region's economy. This is inefficient from two perspectives. First, unless the government adjusts the targets appropriately, the actions of the agencies are sub-optimal from an economic welfare viewpoint. When negative spillovers are present, the agencies allocate more expenditure to policy 1 and less to policy 2 than the first-best levels. Furthermore, as the size of the spillover effect increases, the level of P_1 increases, moving it further and further away from the social optimum. Secondly, the actions of the agencies are sub-optimal in terms of minimising their joint losses. The non-collusive equilibrium is not Pareto efficient from the point of view of the agencies taken together, and the two agencies could reallocate expenditure between policies in a way that makes them both better off.

In the Nash equilibrium agencies do not collude when deciding expenditures on different policies. What happens when agencies collude? In this case, the agencies set the levels of P_1 and P_2 that minimise their *joint* loss functions. This is equivalent to each region taking account of the spillover effect by setting the effectiveness of expenditure on policy 1, γ_1, to $1-\phi$ and solving. Again, dropping the superscripts::

(24) $$Max\ L_{P_1,P_2,\lambda} = -\left((1-\phi)P_1 - T_1\right)^2 - \left(P_2 - T_2\right)^2 + \lambda\left(1 - P_1 - P_2\right)$$

(25) $$\frac{\partial L}{\partial P_1} = -2(1-\phi)\left((1-\phi)P_1 - T_1\right) - \lambda = 0$$

(26) $$\frac{\partial L}{\partial P_2} = -2\left(P_2 - T_2\right) - \lambda = 0$$

Assuming the targets are set so that the budget constraint holds:

(27) $$\frac{\partial L}{\partial \lambda} = 1 - P_1 - P_2 = 0$$

Solving for P_1:

(28) $$P_1 = \frac{(1-\phi)T_1 - T_2 + 1}{2(1-\phi) + \phi^2}$$

This is the optimal level of expenditure on policy 1 from the point of view of the agencies taken together, given a set of targets for policies 1 and 2.

By reducing the loss borne by the agencies, collusion pulls the policy outcomes closer to the targets. It is straightforward to show that where the government is ignorant of the level of spillovers, and therefore sets $T_1 = T_2 = \frac{1}{2}$, and the collusive, non-cooperative and uninformed values are given the superscripts C, N and U respectively:

(29) $$P_1^N > P_1^C > P_1^U = \frac{1}{2}$$

Also in this case if the ratio of the non-cooperative to collusive expenditure on sector 1 is labelled as R, so that $R = \frac{P_1^N}{P_1^C}$, $\frac{\partial R}{\partial \phi} > 0$.

5. Policy Options for Government

If the government is informed of the size of the spillover effects it can induce the optimal symmetrical expenditures on the policies 1 and 2 through setting asymmetrical targets. These are determined by solving equation (17) or (28) for the value $P^n_1 = \frac{1}{2}$ and ensuring that in equilibrium the agency is just on its budget constraint. The appropriate targets are:

$$T_1 = \frac{1-\phi}{2}, \quad T_2 = \frac{1}{2} \ . \tag{30}$$

Of course, these are the outputs given in equation (8). These targets are only optimal with informed agencies. Where agencies are uninformed, these targets will not be met as the agencies will devote too little effort to output 1. However, even here, as demonstrated Section 4.3, with unchanged targets, agencies adjust their policy output over time, and the optimal policy outputs will be attained eventually with targets as set in (30). The adjustment path will be sub-optimal, although a changing set of targets could be devised to generate the optimal adjustment path.

Table 1 shows the pay-offs to the government (the value of the welfare function) and to the regional agencies (the value of the loss function) under various assumptions about the information that they hold. In this numerical example, the value of ϕ is assumed to be $\frac{1}{2}$.

If the agencies are uninformed, then both an informed and uniformed government will set the same targets, $\frac{1}{2}, \frac{1}{2}$. In attempting to hit these targets, the agencies divide the funds equally between the two policies, thereby maximising the government's welfare function at 0.125. The main problem in this case is that the agencies fail to hit the targets that they believed to be attainable *ex ante*. They suffer a combined "loss" of –0.125. Further we expect an adjustment to the agencies' budget allocation were the target setting procedure repeated. If the government does not change the targets, subsequent adjustments by the development agencies move the economy towards the uninformed, non-cooperative

outcome, as shown in Section 4.3. This reduces the pay-off to the government and, in this case, improves the position of the development agencies. Whilst they still fail to hit the targets, their loss is reduced.

If the agencies are informed, or become informed through the repeated playing of the game, then it is better for all players if the government is also informed. The pay-offs to all players are higher where the government is informed, because the government can then set optimal targets for the agencies. In the absence of these optimal targets, the government sets unobtainable targets, which are costly for the agencies, and the agencies respond with policy outputs that are sub-optimal from the government's perspective. For example, with the Cobb-Douglas welfare function, if the agencies do not cooperate in allocating their expenditure between policies, the pay-off to the government is 9% less than the optimal, simply as a result of poor policy co-ordination.

If the government is uninformed but the agencies informed, then in the Cobb-Douglas case, the government's co-ordination difficulties are reduced if the agencies collude. Reducing the agencies' losses moves the policy outcome closer to the targets, and here this outcome is closer to the government's constrained welfare maximum.

At this point, a number of practical issues should be raised. First, the model we have considered is very straightforward in that there is only one source of uncertainty for the government, which is the value of the spillover parameter ϕ. However, there is likely to be uncertainty about the efficiency parameters, $\gamma_1$and γ_2, too. One way of enforcing the efficient policy delivery is through benchmark competition: the effectiveness of individual agencies is measured against one another. However, collusion between agencies, which in this case improves the policy outcomes where informed agencies face an uninformed government, reduces the power of benchmark competition.

Second, the informational asymmetries that underpin the arguments for a delegated and decentralised regional policy typically refer to policy delivery; because local agencies have a more intimate knowledge of their own regional economies they should be able to

devise more appropriate policy interventions. However, it might be difficult for local agencies to recognize and quantify spillover effects: their identification needs knowledge of the operation of other agencies in other regional economies. If the government has information on the size of spillovers, they should share this with the regional agencies. Such information is credible because it is irrational for the government to lie. However, if the agencies have information on spillovers and the government does not, in a cheap-talk game it is not in the interests of the agencies to tell the truth about the size of the spillovers. They will wish to overestimate negative spillovers in order to be set easy targets. Of course, the government knows this and therefore fails to believe the development agencies. Even if solutions exist to this kind of problem, they rule out full transparency (Gibbons, 1992).

Third, up to now we have considered only negative spillovers. However, a model with positive inter-regional spillovers generates qualitatively different results. In particular, if the regional agencies are informed but the government is not, the agencies' budget constraints will not bind. The agencies will therefore just hit their targets, but the government will be unaware that any spillovers exist.

Finally, the paper focuses on the most straightforward case - policy coordination amongst two symmetrical regions. In fact England has nine RDAs, which represent regions of very different sizes, economic problems and *per capita* aid. The heterogeneity of the English regions and their problems is one of the main arguments for the new localism. However, this is likely to make optimal target setting even more problematic if the size (and even sign) of the spillover parameter can vary between regions.

6. Conclusions

Regional policy spillovers pose serious difficulties within a target setting regime. The existence of spillovers changes the trade-off between different policy outputs. Further, the impact on the behaviour of regional development agencies, given a set of targets, will depends on whether the agencies are aware of the spillovers, and if so, how far the

agencies collude. Finally negative spillovers are likely to lead to unattainable targets being set which impose costs on the development agencies and might breach their participation constraints. The most problematic situations occur where the government is uninformed. However, the thrust of the UK policy of the new localism is based on the belief that the relevant information is concentrated at the regional level. This has clear dangers for policies that generate spillovers.

First, even if policy delivery is more efficiently done at the local level, the development agencies are likely to have difficulty detecting spillovers, particularly where these operate through general market mechanisms. Second, even if the agencies are informed about the size and nature of the spillovers, if the government is uninformed, the outcome will be sub-optimal. Whilst the agencies can, through collusion, get closer to the targets, if the targets are incorrectly set, this does not guarantee more effective policy. Third, it is difficult for the development agencies to credibly inform the government about the negative spillovers. For the new localism framework to deal effectively with spillovers it needs to incorporate active central information gathering and coordination presence, even in an otherwise decentralised system.

APPENDIX

(A1) $$Max\ L_{P_1^n, P_2^n, B^n, \lambda^n,, \lambda^T} = \alpha \sum_n \log P_1^n + (1-\alpha) \sum_n \log P_2^n + 2\left[\alpha \log \gamma_1 + (1-\alpha) \log \gamma_2\right]$$
$$- \sum_n \lambda^n (B^n - P_1^n - P_2^n) - \lambda^T (B - \sum_n B^n)$$

where n = i,j.

The first order conditions are:

(A2) $$\frac{\partial L}{\partial P_1^n} = \frac{\alpha}{P_1^n} - \lambda^n = 0$$

(A3) $$\frac{\partial L}{\partial P_2^n} = \frac{1-\alpha}{P_2^n} - \lambda^n = 0$$

(A4) $$\frac{\partial L}{\partial \lambda^n} = B^n - P_1^n - P_2^n$$

(A5) $$\frac{\partial L}{\partial B^n} = -\lambda^n + \lambda^T$$

(A6) $$\frac{\partial L}{\partial \lambda^T} = B^T - \sum_n B^n = 0$$

Equations (A2) to (A6) again all for n equals i,j.

From equations (A2) and (A3):

(A7) $$\frac{P_1^n}{P_2^n} = \frac{\alpha}{1-\alpha}$$

From equations (A2), (A3) and (A5):

(A8) $$P_1^i = P_1^j, \quad P_2^i = P_2^j$$

From (A4), (A6) and (A8):

(A9) $$B^i = B^j = \frac{B}{2}$$

The first best solution for the government is therefore that the budget is divided equally between regions i and j and that in each region expenditure between policy outputs 1 and

2 is divided in the ratio given by the weights in the utility function. Note that this is independent of the values of the efficiency parameters, γ_1 and γ_2.

REFERENCES

Allsopp, C. (2003), *Review of Statistics for Economic Policymaking: First Report to the Chancellor of the Exchequer, the Governor of the Bank of England and the National Statistician*, HMSO, London

Balls, E. (2002), *The New Localism: Speech by the Chief Economic Adviser, Ed Balls, to the CIPFA Annual Conference in Brighton*, 12 June 2002, http://www.hm-treasury.gov.uk/newsroom_and_speeches/press/2002/press_55_02.cfm.

Barro, R. and Gordon, D. (1983), 'Rules, Discretion and Reputation in a Model of Monetary Policy', *Journal of Monetary Economics*, vol. 12, pp. 101-21.

Ferguson, L., Learmonth, D., McGregor, P. G., McLellan, D., Swales, J. K. and Turner, K. (2004), "The National Impact of Regional Policy: Policy Simulation with Labour Market Constraints in a Two-Regional Computable General Equilibrium Model", Strathclyde Discussion Papers in Economics, 04-19, Department of Economics, University of Strathclyde.

Fingleton, B. (2003), 'Some Alternative Geo-Economics for Europe's Regions', Paper presented at the Regional Science Association, British and Irish Section, 20th-22nd August, St Andrews, Scotland.

Gibbons, R. (1992), *A Primer in Game Theory*, Harvester/Wheatsheaf, New York.

HM Treasury (2001), *Productivity in the UK: 3 – The Regional Dimension*, The Stationery Office, London.

HM Treasury (2003), *The Green Book: Appraisal and Evaluation in Central Government. Treasury Guidance*, The Stationery Office, London.

HM Treasury, Department of Trade and Industry, and Office of the Deputy Prime Minister (2003), *A Modern Regional Policy for the United Kingdom*, The Stationery Office, London.

Laffont, J. and Martimort, D. (2002), *The Theory of Incentives: The Principal-Agent Model*, Princeton University Press, Princeton, N.J.

McVittie, E. and Swales, J. K. (2004a) "'Constrained Discretion' in UK Monetary and Regional Policy", Strathclyde Discussion Papers in Economics, 04-06, Department of Economics, University of Strathclyde.

McVittie, E. and Swales, J. K. (2004b), "The Information Requirements for an Effective Regional Policy: A Critique of the Allsopp Report", Strathclyde Discussion Papers in Economics, 04-19, Department of Economics, University of Strathclyde.

Milgrom, P. and Roberts, J. (1992), *Economics, Organisation and Management*, Prentice Hall International, Inc., Englewood Cliffs, New Jersey.

RDAUK Homepage (2001), http://www.rdauk.org/rdauk-rdas/DisplayArticle.asp?ID=135.

Rogoff, K. (1985), 'The Optimal Degree of Commitment to an Intermediate Monetary Target', *The Quarterly Journal of Economics*, vol. 100, pp. 1169-89.

Scottish Enterprise (2002), *Operating Plan 2002-2003*, Scottish Enterprise, Glasgow.

Taylor, J. (2002), "The Evaluation of UK Regional Policy: How Much Progress Has Been Made?", in Johansson, B., Karlsson, C. and R.R. Stough (eds), *Regional Policies and Comparative Advantage*, Edward-Elgar, Cheltenham, UK.

Table 1: Values for government welfare and agency loss under various assumptions about information and agency collusion (government pay-off shown first, combined agencies' pay-off second).

Government	Regional Agencies		
	Uninformed	Informed	
		Non-cooperative	Collusive
Uninformed	0.125, -0.125	0.111, -0.111	0.120, -0.10
Informed	0.125, -0.125	0.125, 0	0.125, 0

Figure 1: The reaction functions, R_1 and R_2 and Nash equilibrium, NE, for regions 1 and 2, where $T_1 = T_2 = \frac{1}{2}$

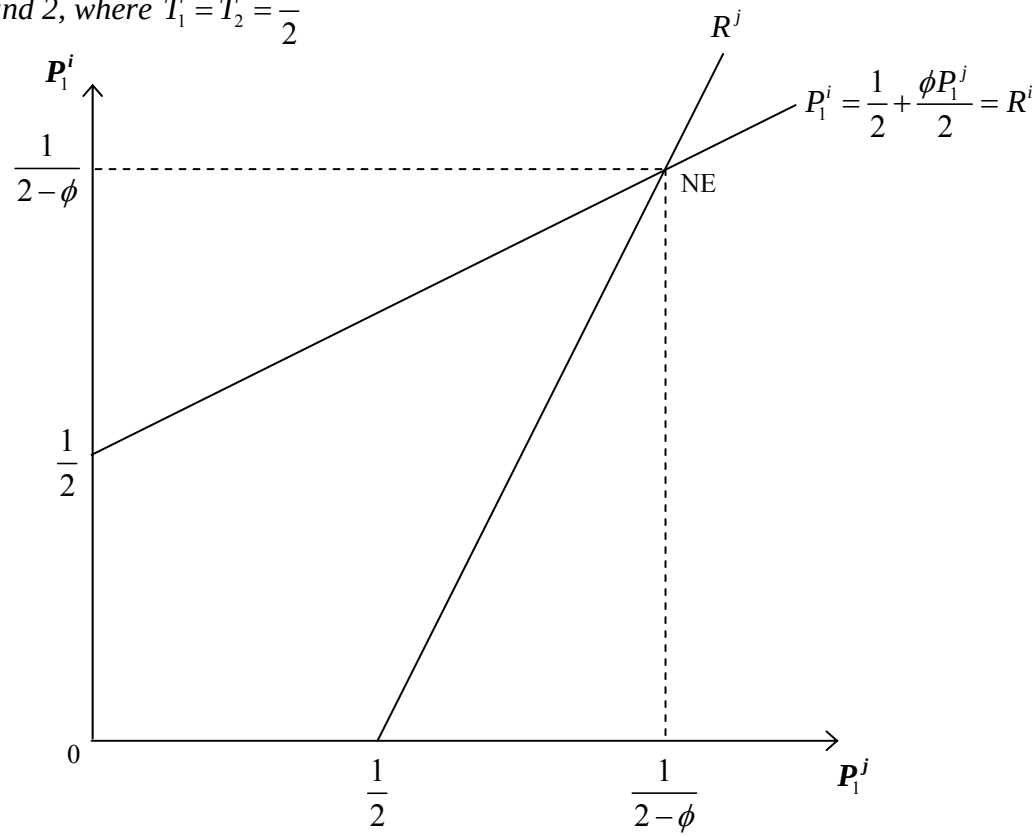
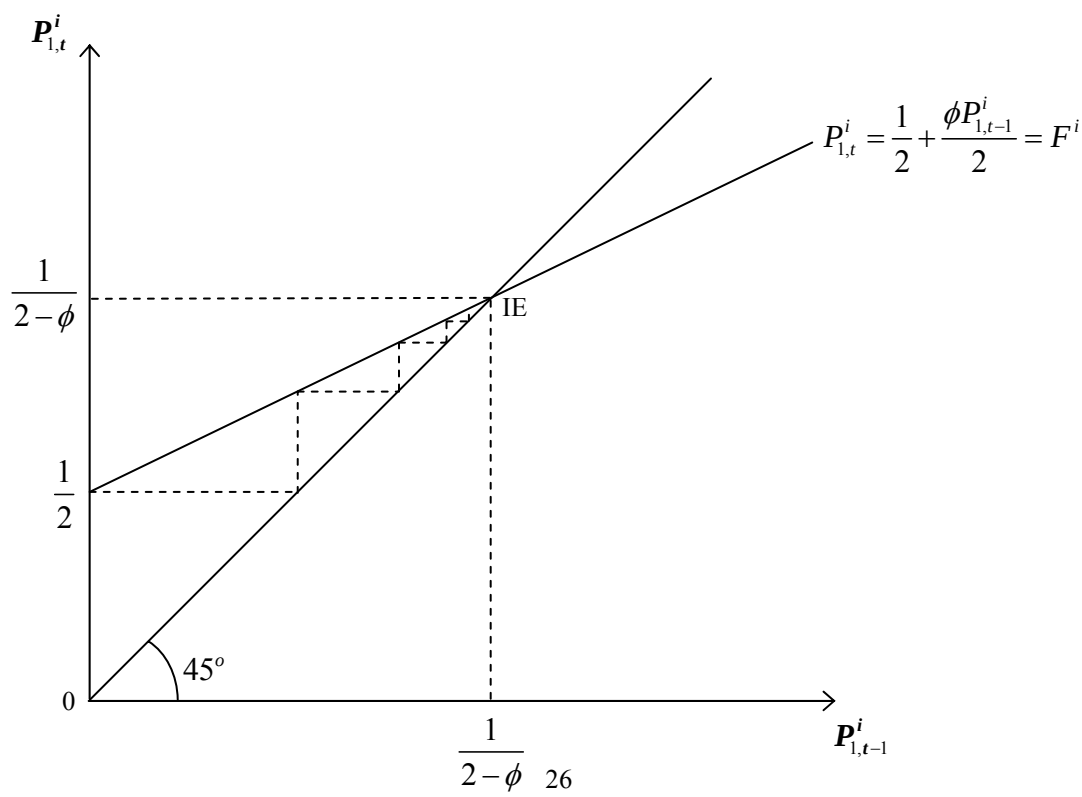
Figure 2: The phase line and iterated equilibrium, IE, for region i, F_i, where $T_1 = T_2 = \frac{1}{2}$