Endogenous Institutions
in Bureaucratic Compliance Games

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ENDOGENOUS INSTITUTIONS
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ABSTRACT: We consider a set-up where two governments have either conflicting or matching preferences on the provision of differentiated (local) goods supplied by a common monopoly bureau. We develop a two-stage game. At stage-1, the two governments decide whether or not to merge into a single institution. At stage-2, all players simultaneously and independently take their decisions in terms of production and rents, with perfect knowledge of the other players' strategies. We solve the subgame perfect Nash equilibrium of this game, and show that, if the bureau immediately updates its objective function to institutional changes, then the governments always prefer merging. However, if there is an initial bureaucratic inertia in adjusting the bureau's objective function to the institutional change, then ruling politicians may prefer decentralisation to centralisation, depending on the strategic properties of the compliance game and on their own discounting.

Key words: Bureaucracy, Common agency, Repeated compliance games

JEL codes: D73

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1. Introduction

A variety of important bureaucratic relations have been analysed in the context of bilateral interactions between bureaucracy and government. The standard hypothesis is that the bureau's budget depends on the government's resource allocation decisions, which, in turn, affect the bureau's production choices.[1] Frequently, however, the actions chosen by a bureau influence several governments, which may have 'differentiated' preferences over the bureau's outputs. Such situations, often referred to as instances of 'common agency',[2] to the best of our knowledge, have not been explicitly studied in the economic literature of bureaucracy.

Within a context of bureaucratic common agency, the bargaining about budgets is a complex iterative process, in which players interact strategically. We shall represent this process by means of a simplified game with stylised institutions. We shall only distinguish between two governments (the sponsors), each demanding one of the two goods produced, and one agency (the bureau), which supplies them. In order to focus on the effects of the strategic interactions among players, we shall assume that the goods produced by the bureau are either conflicting or matching in the evaluation functions of the two governments.

We can explain our representation of the governments' preferences with some examples. Assume that the common bureau supplies goods (such as hospitals, nurseries, or sport facilities) to two distinct local governments. If the two governments are competing for attracting taxpayers in their local jurisdictions, it is likely that, as one government increases the demand for bureaucratic output, the other government will increase its demand as well. In such situations, we shall say that the two governments have *conflicting* preferences. Assume instead that a

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[1] The first generation of models of bureaucracy (see e.g. Niskanen 1971, 1975, Migue and Belanger 1974, Orzechowski 1977, Breton and Wintrobe 1975, and Peacock 1983) has ignored strategic interactions between the bureau and its sponsor. Miller's (1977) criticism has led to the development of an alternative approach (see e.g. Miller and Moe 1983, Chan and Mestelman 1988, Spencer 1980, Moene 1986, and Carlsen and Haugen 1994) in which the sponsor and bureau interact strategically.

[2] The principal-agent theory has analysed common agency problems in a variety of contracting games, see e.g. Bernheim and Whinston (1986). Our model differs from that theory, since we assume complete information.

common bureau is in charge of building and maintaining roads for both the national and the local governments.[3] If the national government entrusts the bureau with the build of a road that links two towns in the local government's jurisdiction, it is unlikely that the local government, which might well be interested in the link, will order the bureau to build another road, say, parallel to that demanded by the national government. If the demand for bureaucratic output of one government decreases when the output demanded by the other government rises, we shall say that the two governments have *matching* preferences.

Considering the matching or conflicting nature of governments' preferences for most publicly provided local goods, and given that we often observe instances of a common bureau dealing with more than one government, we address the following question: Does the observed nature of the bureau-government(s) interaction, either centralised (one government-one bureau) or decentralised (two governments-one bureau), result from an optimal institutional choice *by part of the governments*?

In order to answer this question, we consider a two-stage game. At stage-1, two initially separated governments, which are dealing with a common bureau for the public supply of two goods, decide independently and simultaneously whether or not merging into a single institution. At stage-2, the government(s) and the bureau play a repeated Nash compliance game on which basis the level of bureaucratic production is determined.[4] Similarly to Horn and Wolinksy's (1988a, 1988b) analysis about the choice of the optimal bargaining structure by firms and unions in the labour market, we aim at verifying whether and how the choice of institutions at stage-1 depends on the strategic nature of the repeated compliance game played at stage-2.

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[3] In Italy, for example, one national bureau (ANAS) builds and maintains roads for both the national and local governments.

[4] Miller (1977) firstly applies compliance games to the bureaucracy-government relation. As long as the actors' decisions are not in terms of prices and quantity, Miller interprets the outcome of the budgetary process as the result of a one-stage compliance game: the government decides the share of the resources available to production it will allocate to the bureau as budget (the sponsor's compliance), while the bureau chooses the share of the received budget it will devote to production (the bureau's compliance), keeping the residual as discretionary profits.

Under the assumptions that the governments maximise an objective function that depends on both bureaucratic production and political rents, whereas the common bureau maximises an objective function that depends on its own production and discretionary profits, our main results are the following.

From the point of view of the two governments, if at stage-2 the common bureau updates immediately its objectives to the institutional decisions taken at stage-1, then the governments always prefer merging to separation. However, assuming bureaucratic inertia, or that any bureaucratic adjustment takes time (e.g. because it just takes time for the government(s) to instruct the bureaucratic apparatus in the institutional change), and provided that the ruling politicians are sufficiently myopic in discounting their future payoffs at stage-2, it turns out that the optimal institutional choice is merging, when the governments have matching preferences, and separation, when they have conflicting preferences. As we shall see below, the intuitive explanation for these results is as follows.[5] Two incentives are at work in shaping the governments' institutional decision. On the one hand, a centralised institution serves to internalise externalities between governments, by changing the nature of the inter-government game from non-co-operative to co-operative. This internalisation of the externalities among governments always positively affects the individual government's payoff (see below). On the other hand, a merger influences the strategic interaction between the governments and the bureau. At the symmetric equilibrium, it turns out that the bureau plays the compliance game in strategic substitutes, as a lower budget raises the marginal utility of a higher bureaucratic compliance; whereas the governments play in strategic complements, as a higher bureaucratic compliance increases the governments' marginal utility from higher budgets. It follows that, under bureaucratic inertia, if preferences are matching, both the externality and strategic motives favour a merger. If preferences are conflicting, however, the governments face a trade-off that makes separation a possibility (see below). However, when the bureau's preferences adjust

[5] We thank an anonymous referee for having suggested us this interpretation.

immediately to government merging, this trade-off disappears and the externality effect unambiguously prevails in shaping the governments' choice.

From the point of view of society, whose well-being is measured by the share of resources which are not used for rent-seeking activities by both politicians and bureaucrats, it will be better off with separated (merged) governments in the case of matching (conflicting) preferences for the two goods. Since each candidate institutional equilibrium is characterised by positive rents for the players, independently of the governmental institutional choice, any governments' choice of institutions is a third best for society.

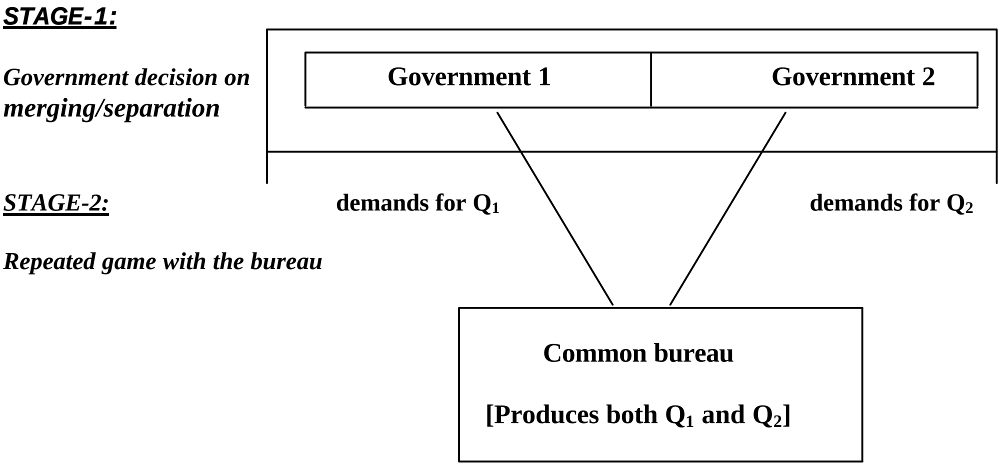
The plan of the paper is as follows. In section 2, we present the basic assumptions of the two-stage game between the governments and the common bureau. In section 3, we solve for the optimal government institutional structure, first, under the assumption that – in the repeated compliance game - the bureau updates its objective function immediately to the chosen institution, and, secondly, under bureaucratic inertia to institutional changes. In section 4, we study how the institutional choice affects society. In section 5, we consider some extensions to the model. In section 6, we conclude with final remarks.

2. The general framework

We aim at investigating whether ruling politicians prefer a decentralised institutional setting - two governments demanding two goods to a common bureau that produces them - to a centralised government dealing with the bureau. We shall assume that the governments take their institutional decisions at stage-1, anticipating the outcome of the repeated Nash compliance game with the common bureau at stage-2. The set-up analysed is depicted in Figure 1 below.

With this purpose, we need to specify the payoffs for both the governments (when they either merge or remain separate) and the bureau (dealing with either one or two governments). We shall denote the regime with two governments and one bureau with the superscripts ***21***, and assume it is the *status quo*. When the governments have chosen merging at stage-1, we shall denote the corresponding variables with the superscripts ***11***, as indicating one government and one bureau.

Fig. 1 The two-stage compliance game



2.1. Governments' preferences

We assume that the ruling politicians maximise a payoff that is given by the sum of their evaluation function for the production of two goods supplied the bureaucracy and the political rents obtainable from that production. In other words, the government's preferences include both a 'public interest' motive (i.e. consumers' utility from bureaucratic production) and a 'capture of the residuals' motive (i.e. diversion of public funds to political rents or to other purposes), where these two terms enter with equal weight into the governments' utility (see section 5 below for an alternative assumption).

The economic theory of bureaucracy generally assumes that, although governments are rent-seekers when playing with the electorate, they are welfare-maximisers *vis-à-vis* the bureaucracy. This view ignores the possibility that ruling politicians may be interested in (and are indeed in the position of) diverting part of the public funds available to their own purposes. However, we find the latter possibility quite realistic as long as the relationship between the government and the bureaucracy is characterised by the absence of control from the taxpayers;[6] if this is the case, the ruling politicians may act as residual claimants of the resources which are, in principle, devoted to public production. Note, however, that the concept of political rent seeking might apply not only to bribery, but to any diversion of public funds (see Fedeli, 1998 and 1999).[7]

We represent the governments' preferences for the two goods produced by the common bureau as conflicting, matching or neutral. For specifying the governments' preferences, we follow Dixit (1979) and Singh and Vives (1984), and assume that the governments' evaluation of the bureaucratic output-i, Q_i, is given by a quadratic and strictly concave function that depends also on Q_j (the other bureaucratic output). The political rents obtained from the production of Q_i are defined as $\Pi G_i = R_i - B_i$, where R_i are the (exogenous) resources available for the public production of good i, and B_i is the budget actually appropriated to the common bureau for this purpose. We shall specify the budget as $B_i=R_i g_i$. That is, given R_i, the budget is determined by the share g_i of the resources chosen by the government, as representing the government's compliance with the common bureau (see section 3 below).

We now specify the governments' payoffs in the case of both separation (*the status quo)* and merging. When we consider *two separate governments,* the government i's payoff function, i={1,2}, is

$$MG_i^{21} = \underbrace{a_i Q_i - \left[\frac{b_i Q_i^2 + 2g_{ij} Q_i Q_j}{2}\right]}_{\text{government i's utility from good i}} + \underbrace{R_i - B_i}_{\text{political rents}} \qquad (1)$$

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[6] See Shleifer and Vishny (1993, 1994), Rowley and Elgin (1985), and Forte and Power (1994) for evidence related to European countries.

[7] Alternatively, the government may be willing to divert public funds from production in order to finance other public activities or tax reductions. However, this 'public interest' interpretation of political capture, suggested us by a referee, strikes with our view that social well being is measured by the 'appropriate' use of public funds as decided and approved in the budgetary law.

g_{ij} represents the degree of conflict between good i and good j in the preferences of government i. For the sake of simplicity, we shall assume $g_{ij} = g$ for both the governments. When we consider *a single, consolidated*, government, its payoff is given by

$$MG^{11} = \sum_{i=1}^{2} MG_i^{21} = \underbrace{\sum_{i=1}^{2} \left\{ a_i Q_i - \left[\frac{b_i Q_i^2 + 2g_{ij} Q_i Q_j}{2} \right] \right\}}_{\text{government's utility from good 1 and 2}} + \underbrace{\sum_{i=1}^{2} R_i - B_i}_{\text{political rents}} \qquad (2)$$

where we assume $a_i > 0$, $b_i > 0$, $b_i b_j > 4g^2$ and $a_i b_j - a_j 2g > 0$, for i={1,2} and i≠j.[8]

These alternative government payoffs give rise to alternative linear demand structures as follows: When the two governments are *separated (S)*, in the region of the quantity space where the marginal evaluations are positive, their inverse demands for bureaucratic goods are derived from equation (1):

$$V_i^S = a_i - b_i Q_i - g Q_j \qquad (3)$$

where Q_i is one of the two goods produced by the bureau and V_i^S represents the willingness to pay for Q_i by government i, i={1,2}. When the two governments have *merged (M)* themselves into one single institution, the following system of demands of the merged government is derived from (2):

$$\begin{cases} V_i^M = a_i - b_i Q_i - 2g Q_j \\ V_j^M = a_j - b_j Q_j - 2g Q_i \end{cases} \qquad (4)$$

where V_i^M represents the willingness to pay for Q_i by a merged government, demanding also Q_j, with i≠j. In both (3) and (4), γ<0 means that the willingness to pay for Q_i increases, when the demand for Q_j rises. We denote this case as one of 'conflicting' preferences over the two goods. γ>0 means that the willingness to pay for Q_i increases, when the demand for Q_j decreases. We denote this case as one of 'matching' preferences for the two goods. Finally, γ=0 means that the willingness to pay for Q_i is independent of the demand for Q_j. In this case, we say that the preferences over the two goods are 'neutral'. Notice that, relative to (3), the demand system (4) contains the term 2γ. This term increases the conflicting/matching nature of preferences for the two goods when the governments have merged: A consolidated government internalises in its payoff the effect of the demand for good i (j) by the (former separated) government j (i).

Some examples may be useful to explain our assumptions on the governments' preferences. As mentioned in the introduction, the case of *conflicting* preferences, or $\gamma<0$, is relevant to the provision of several local public goods, when the two governments are competing for attracting taxpayers in their own jurisdiction. Alternatively, we can think that, for given resources R, the taxpayers in one jurisdiction care about the level of public good provision in the other jurisdiction because of 'envy' or 'keeping-up-with-the-Joneses' effects (which are reflected in the governments' payoffs accordingly), even in the absence of physical spill-overs between jurisdictions. For instance, assume that the common bureau produces 'education' for two distinct levels of government and that 'education' is measured, say, by the average class size.[9] Now, $\gamma<0$ implies that the demand for Q_1 (the demand for a lower average class size in jurisdiction 1) increases, if Q_2 (the demand for a lower average class size in jurisdiction 2) also increases. When the two governments merge themselves into a single institution, which still deals with the common bureau, the governments' conflicting decisions are internalised. In equation (2), the term 2γ increases the uniformity of education in the two jurisdictions: that is, the class size of one jurisdiction follows more strictly that of the other. This gives rise to the demand for a lower average class size as in (4).

The case of governments' *matching* preferences, or $\gamma>0$, for the goods produced by the common bureau may reflect those situations in which the provision of local goods generates positive physical spill-overs between jurisdictions. Consider, for example, the case of a bridge across a river that links two different jurisdictions: if the demand for maintenance and security of the bridge by part of one government increases, it is likely that the demand by part of the other

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[8] These are the necessary and sufficient conditions for the system of demands generated by (2) to be associated with a maximum, see also equation (4) below.

government will fall. Yet, if the two governments merge into a single institution, they will internalise these spill-overs: This is captured by the term 2γ>0 in equations (2) and (4).

2.2. Bureaucratic preferences and cost function

We assume that the bureau has a positive evaluation of both their production activity and discretionary profits from that activity and that, as in most of the economic literature on bureaucracy, the bureau evaluates its own outputs on the basis of the government's demands (3) and (4). As Niskanen (1971, p. 29) puts it, the idea underlying this assumption is that the political-bureaucratic market is akin to a contestable market, as far as the bureau faces potential competition from the private sector. Had the services demanded by the governments been supplied by competitive firms, the governments' demand would indicate how much of the services they would be willing to purchase at various prices. Therefore, when there is potential competition external to the bureaucratic market, the governments' marginal valuation schedules become a constraint for the bureau's choice.[10]

Given the two demand structures previously emerged, we need to consider the common bureau's payoff when it deals with either one or two governments. When the common bureau deals with two *separate* governments, we express its payoff function as the weighted sum of two terms:

$$MH^{21} = \sum_{i=1}^{2} V_i^{S} Q_i + Z \sum_{i=1}^{2} P\,H_i = \underbrace{\sum_{i=1}^{2} \left[a_i Q_i - b_i Q_i^{2} - g Q_i Q_j \right]}_{\text{bureau's evaluation of its outputs}} + \underbrace{Z \sum_{i=1}^{2} B_i (1 - h_i)}_{\text{bureau's rents}} \qquad (5)$$

where the bureau has evaluated its own outputs on the basis of (3) for i={1,2}. When the common bureau deals with a single *consolidated* government, it refers to (4). Thus, the bureau's payoff is:

[9] The average class size, particularly for primary and secondary schools, is often considered as an index of education quality: the lower is the size, the better is the quality. We thank Francesco Forte for having suggested us this example.
[10] By departing from the main tradition, Miller (1977) assumes that the bureau evaluates its output according to its own tastes, disregarding any mechanism similar to the market.

$$MH^{11} = \sum_{i=1}^{2} V_i^M Q_i + Z\sum_{i=1}^{2} P\,H_i = \underbrace{\sum_{i=1}^{2}\left[a_i Q_i - b_i Q_i^2 - 2gQ_iQ_j\right]}_{\text{bureau's evaluation of its outputs}} + \underbrace{Z\sum_{i=1}^{2} B_i(1-h_i)}_{\text{bureau's rents}} \qquad (6)$$

In both (5) and (6), the term $\Pi H_i = B_i(1-h_i)$ denotes the bureau's discretionary profits from Q_i. These are given by the share (1-h_i) of the budget $B_i = R_i g_i$ received from the government, that the bureau keeps as bureaucratic rents. The parameter $Z \geq 0$ represents the weight the bureau gives to its discretionary profits. When Z=0, the bureau aims at maximising its production only (as in Niskanen, 1971): this case will be considered in section 5.2 below. In what follows, we shall assume that Z=1.

For the sake of simplicity, we assume that each output *i* is produced by the bureau with a separable cost function and constant marginal costs, and that there are no-fixed costs. The total production cost for the output *i* is $TC_i = c_i Q_i$, where the (exogenous) marginal and unit cost c_i>0 represents the minimum cost of producing good *i*. That is, we are assuming production efficiency in the absence of rent-seeking behaviour. The budgetary process transforms this potential (*ex ante*) efficiency into two forms of inefficiency that are generated by the bureaucratic discretionary profits and the government's political rents, respectively.[11] We interpret these rents as being a component of (to be added to) the actual unit cost of production, which increases accordingly. Note that our view of public (in)efficiency could overturn Niskanen's (1971, 1975) classic result, according to which the bureaucratic productive efficiency generates allocative inefficiency (i.e. bureaucratic over-supply at minimum costs). In principle, our view of the public firm may give rise to bureaucratic under-supply at very high social costs.[12]

3. Reformulating the game in terms of compliance: Endogenous choice of institutions

[11] We thank Francesco Forte for having suggested us this interpretation. Note that, in the present context, the total resources available for production represent the social production costs for the taxpayers.

[12] Our view of the public firm is consistent with the evidence Shleifer and Vishny (1993, 1994) present for a number of European countries. One implication is that very low levels of public production can be associated with very high social production costs. These latter may be necessary for maintaining the bureaucratic apparatus and financing the political activity

To analyse the endogenous determination of the government institutional structure in a two-stage repeated compliance game under complete information, we need to reformulate the full game in terms of the players' compliance. As in Miller (1977) and Fedeli (1998, 1999), we assume that each player has an infinite number of choices along his strategy dimension. The bureau's strategy dimension, H_i, i={1, 2}, goes from 0 to 1. Any particular strategy $h_i \in H_i$ is the share of the bureau's budget, B_i, actually devoted to the production of Q_i, whereas the remaining ($1-h_i$) is the share of the budget kept by the bureau as discretionary profits. The government's strategy dimension, G_i, i={1, 2}, ranges from 0 to 1; the strategy $g_i \in G_i$ denotes the share of resources, R_i, potentially available for the production of Q_i and actually devoted to it. We assume that R_i, i={1,2}, is exogenously given. $B_i = R_i g_i$ indicates the budget appropriated to the bureau by the government for the production of the good i, whereas $\boldsymbol{\text{Đ}G}_i = R_i(1-g_i)$ is the residual kept by the government as political rents. Each player has complete information about its opponent's payoff and players' information sets are assumed to be 'common knowledge'.

Given that the total production costs for good i are $TC_i = c_i Q_i$, it follows that $h_i g_i R_i = c_i Q_i$. Therefore, we can express the outputs in terms of the government's and bureau's compliance:

$$Q_i = \frac{h_i g_i R_i}{c_i} \qquad \text{for i=\{1, 2\}} \qquad (7)$$

By substituting equation (7) back into (1), (2), (5) and (6), we can express the payoffs for each player in terms of the players' strategies (these equations are reported in Appendix A1), on which basis we solve the two-stage compliance game among the relevant players.

Recall that the two-stage game is as follows. At stage-1, the two governments decide in their own best interest whether or not merging into a single institution, perfectly anticipating the outcome of the subsequent stage.[13] At stage-2, given the institutional structure previously

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of the government, as shown, for example, by the Italian experience between the Mid-1980s and the Early 1990s.

[13] This decision is assumed to be irreversible, that is, the costs of changing institutions are prohibitively high.

emerged, the players engage in a repeated compliance game over production and rents. The solution to this two-stage game is a subgame perfect Nash equilibrium. We solve it by backward induction, starting from stage-2.

3.1. Stage 2: The Nash compliance game under full adjustment

At stage-2, the players play an infinitely repeated game on which basis bureaucratic productions and the players' rents are determined. Under full adjustment, if at stage-1 separation has been chosen, in the compliance game the government i={1, 2} maximises (1) and the bureau (5); if merging has been chosen instead, the centralised government maximises (2) and the common bureau (6). In both cases, the players' payoffs are the same at each round of the second-stage game.

Two governments and a common bureau under full adjustment

Each government maximises (1), i={1,2}, and the bureau maximises (5) by choosing its own compliance, taking the other players' compliance as given. The solution of this Nash game is reported in Appendix A2. In this section, we only sketch the symmetric equilibrium results.

In the first round of the repeated game, at an interior equilibrium, the compliance levels for the two governments and the common bureau are:

$$g_1^{21} = g_2^{21} = \frac{a^2 - c^2}{4(b+g)\mathrm{R}} \qquad \text{and} \qquad h_1^{21} = h_2^{21} = \frac{2c}{a+c} \tag{8}$$

Substituting (8) into (1), we obtain the value function of the government-i's payoff in the first round of the repeated game:

$$MG_i^{21} = \underbrace{\left[\frac{(a-c)[b(3a+c)+2g(a+c)]}{8(b+g)^2}\right]}_{\text{gains from output}} + \underbrace{\left[R - \left(\frac{a^2-c^2}{4(b+g)}\right)\right]}_{\text{gains from political rents}} = \left\{R + b\left[\frac{(a-\mathrm{c})^2}{8(b+g)^2}\right]\right\} \tag{9}$$

As mentioned, the first round of the game at stage-2 represents the constituent game of an infinitely repeated game between the governments and the bureau. Assuming that all the players discount their future payoffs with a common and constant discount factor $0<d<1$,[14] the present discounted value of the government i's payoff, i={1, 2}, when the two governments have decided to remain separate at stage-1, is:

$$PVG_i^{21} = \sum_{i=0}^{\infty} d^t MG_i^{21} = \frac{1}{1-d}\left[R + b\left(\frac{(a-c)^2}{8(b+g)^2}\right)\right] \tag{10}$$

One government and one bureau under full adjustment

If at stage-1 the two separated governments have merged, at stage-2 the merged government maximises (2) and the bureau (6). The symmetric solution to the Nash compliance game is:

$$\begin{aligned} &g_1^{11} = g_2^{11} = \frac{a^2-c^2}{4(b+2g)\mathrm{R}} = g_1^{21}A, \qquad \text{where} \qquad \mathrm{A} \equiv \left[\frac{(b+g)}{(b+2g)}\right] \\ &h_1^{11} = h_2^{11} = h_1^{21} = h_2^{21} = \frac{2c}{a+c} \end{aligned} \tag{11}$$

where the equilibrium compliance levels have been expressed in terms of the *status quo* (or separation regime). Comparing (8) with (11) it turns out that, when the governments have conflicting (matching) preferences, they devote a higher (lower) share of the resources to the bureau under centralisation than under decentralisation, i.e. $A \gtrless 1$ if $\gamma \lessgtr 0$. The compliance level of the bureau is unaffected by the institutional structure. One implication is that the bureau's rents are higher with centralisation (decentralisation), when $\gamma<0$ ($\gamma>0$). We shall return to the intuitive explanation for these results in section 3.3. below.

In each round of the repeated game, the value function of the consolidated government's payoff is

$$MG^{11} = \underbrace{2\left[\frac{(a-c)(3a+c)}{8(b+2g)}\right]}_{\text{gains from output}} + \underbrace{2\left[R - \left(\frac{a^2-c^2}{4(b+2g)}\right)\right]}_{\text{gains from political rents}} = 2\left\{R + \left[\frac{(a-c)^2}{8(b+2g)}\right]\right\} \tag{12}$$

[14] It would be reasonable to assume that the bureau is more patient than the governments, which implies it discounts its future payoffs less heavily. However, because our focus is on

This represents the 'steady-state' solution when the bureau has immediately updated its own objective function to the governments' choice of institutions. From (12) the present discounted value of the consolidated government's payoff is

$$PVG^{11} = \sum_{t=0}^{\infty} d^t MG^{11} = \frac{1}{1-d}\left\{2\left[R + \left(\frac{(a-c)^2}{8(b+2g)}\right)\right]\right\} \quad (13)$$

In order to choose the optimal form of institution, each government can equivalently compare either (9) and (12) or (10) and (13). This occurs at stage-1 of the game, to which we now turn.

3.1.2 Stage-1: The optimal choice of government institutions under full adjustment

At stage-1, each government decides independently whether or not merging is in its own best interest, anticipating the outcome at stage-2. Under merging, we assume that each of the two (former) separate governments obtain one half of the consolidated government's payoff, equation (13).[15] We shall denote this latter payoff with the term PVG_i^{11}, i={1, 2}.

government choices, we assume a common discount factor.

[15] We do not consider alternative schemes, such as split-up-the-surplus (i.e. split up the additional payoff, if any, obtained under merging relative to separation), nor any bargaining between the governments over the division of the joint payoff.

Recall that we have assumed that the *status quo* regime is that with two separate governments.[16] We now assume that, in the case of disagreement on merging (i.e. when only one government would like to merge), each government gains the *status quo* payoff (10). We can represent stage-1 in the strategic form of Table 1 below.

On the basis of Tab. 1, merging is a (weakly) dominant strategy for each government, if and only if the payoff from the merge is larger than that from remaining separate at each round of the infinitely repeated compliance game.

Table 1: The endogenous choice of government institutions at stage-1

		Government 2	
		Merging	Separation
Government 1	Merging	PVG_1^{11}, PVG_2^{11}	PVG_1^{21}, PVG_2^{21}
	Separation	PVG_1^{21}, PVG_2^{21}	PVG_1^{21}, PVG_2^{21}

Given that,

$$(PVG^{11}/2) - PVG_i^{21} = \frac{1}{1-d}\left\{\underbrace{\left[g\,\frac{(a^2-c^2)}{4(b+2g)(b+g)}\right]}_{\text{difference in gains from political rents}} - \underbrace{\left[g\,\frac{(a-c)[a(2b+g)+c(2b+3g)]}{8(b+2g)(b+g)^2}\right]}_{\text{difference in gains from output}}\right\} \qquad (14)$$

$$= \frac{1}{1-d}\left\{g^2\left[\frac{(a-c)^2}{8(b+2g)(b+g)^2}\right]\right\} > 0$$

it follows that merging is the symmetric Nash equilibrium of the two-stage compliance game: The individual government's payoff is always higher under merging than under separation. We shall return to the interpretation of these results in section 3.3. below. The analysis of this section is summarised as follows

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[16] Note that this result holds true, had the *status quo* regime been centralisation. In this case, merging would become a strictly dominant strategy, and the consolidated government would have no incentives to split itself up into two.

Proposition 1.1: Optimal institutional choice for the two governments under full bureaucratic adjustment *If the bureau immediately updates its objective function to any institutional choice decided by the governments at stage-1, then merging is the optimal choice for each government.*

3.2. Endogenous choice of institutions under bureaucratic inertia

In the previous section, we have assumed that the bureau immediately conforms its objective function to the government institutional changes. However, it is often observed that bureaucratic adjustment to policy-induced changes takes time. Moreover, a commonly held view among economists and public administration scholars is that bureaucracies tend to resist to policy-induced innovations (or that they slowly adapt to them), especially to those implying the performance of new tasks.[17]

Therefore, we now introduce bureaucratic inertia in the model. We offer two possible interpretations for it. Firstly, bureaucratic inertia may depend on the fact that it takes time to inform and instruct the bureaucrats in the new government institutional structure (which implies that the bureau's objective function does not change immediately and accordingly to the government institutional decision): The bureau realises the changes in the government structure with a lag. Second, bureaucratic inertia may depend on some inherent technological inertia of the bureaucratic organisation in changing its procedures and objectives.[18]

We treat bureaucratic inertia as exogenous. Its effect are captured by reformulating the game as follows. As before, at stage-1, the two governments choose whether or not merging, and this decision is irreversible. At stage-2, however, the repeated game changes. In the first round, the bureau chooses its compliance level by maximising the objective function of the *status*

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[17] See, for example, Niskanen (1971, 1975) and Wilson (1989, pp. 221-6). Political scientists perceive bureaucracies as more dynamic entities, see, for example, Moe (1984), Scholz and Wei (1986), and Wood and Waterman (1994).

[18] "An agency that litigates, for example, may find it difficult to increase litigations instantly because these depend on prior activities for completion (e.g. preliminary investigations and enforcement)...bureaucratic inertia can make it difficult for political leaders to change agency activities...technological factors generally produce a lag between the times of stimulus transmission and response initiation...", see Wood and Waterman (1994, pp. 82-3).

quo, equation (5), irrespective of the stage-1 government institutional choice. The governments maximise either (1), if they have remained separate, or (2) if they have merged. From the second round onwards, full adjustment takes place: the bureau maximises (5), when facing two separate governments, and (6), when dealing with a single consolidated government. Thus, bureaucratic inertia is relevant when the two governments have chosen merging at stage-1, but the bureau sticks to the objective function of the *status quo*. We shall indicate this mismatch by *SR*, i.e. the Short Run lag in the bureau's adjustment.[19]

3.2.1. Stage 2: The repeated compliance game with bureaucratic inertia

Under bureaucratic inertia, the first round of the repeated game at stage-2 makes the difference. The compliance equilibrium levels in this case are the following:

$$
\begin{aligned}
&g_1^{SR} = g_2^{SR} = \frac{(a-c)(ab+bc+2gc)}{4R(b+g)^2} = g^{21}B, \quad \text{where} \quad B = \frac{b(a+c)+2g\,c}{(a+c)(b+g)} \\
&h_1^{SR} = h_2^{SR} = \frac{2c(b+g)}{(a+c)b+2gc} = h^{11}C, \quad \text{where} \quad C = \frac{(b+g)(a+c)}{(a+c)b+2gc}
\end{aligned}
\tag{15}
$$

Comparing (15) and (8), it turns out that, with bureaucratic inertia, the bureau chooses a higher (lower) compliance, when the governments have matching (conflicting) preferences relative to its choice under full adjustment (see section 3.3 below for an intuitive explanation).

By substituting (15) into (2), the consolidated government's first round payoff is:

$$
\begin{aligned}
MG^{SR} &= \underbrace{2\left[\frac{(a-c)[b(3a+c)+2g(a+c)]}{8(b+g)^2}\right]}_{\text{gains from output}} + \underbrace{2\left[R - \frac{(a-c)(ab+bc+2gc)}{4(b+g)^2}\right]}_{\text{gains from political rents}} = \\
&= 2\left\{\mathrm{R} + \left[\frac{(a-c)^2(b+2g)}{8(b+g)^2}\right]\right\}
\end{aligned}
\tag{16}
$$

After the first round of stage-2 repeated game, there is full bureaucratic adjustment. Therefore, from the second round onwards, the payoff of the merged government is given by (12). The

[19] The results of this section depend on the *status quo* regime in that, had we assumed the alternative *status quo* of one government and one bureau, merging would be the strictly dominant strategy (see also footnote 16 above). In this case, clearly, bureaucratic inertia would not matter.

present discounted value of the merged government's payoff with short-run bureaucratic inertia becomes:

$$PVG^{SR} = MG^{SR} + \sum_{t=1}^{\infty} d^{t} MG^{11} = 2\left\{\left\{R + \left[\frac{(a-c)^2(b+2g)}{8(b+g)^2}\right]\right\} + \frac{d}{1-d}\left\{R + \left[\frac{(a-c)^2}{8(b+2g)}\right]\right\}\right\} \quad (17)$$

3.2.2. Stage-1: The optimal government's choice of institution with bureaucratic inertia

With bureaucratic inertia, each government prefers merging to the *status quo* if half the payoff in (17) is larger than the present discounted value of its payoff under separation, (10):

$$(PVG^{SR}/2) - PVG_i^{21} = \underbrace{g\left[\frac{a - c}{2(b+g)}\right]^2}_{\text{difference in short-run payoffs}} + \underbrace{g^2\left(\frac{d}{1-d}\right)\left[\frac{(a-c)^2}{8(b+2g)(b+g)^2}\right]}_{\text{difference in long-run payoffs}} \quad (18)$$

where the right hand side of equation (18) decomposes the difference between payoffs in two components: The short run – i.e. the difference in first-round payoffs $\left((MG^{SR}/2) - MG_i^{21}\right)$ - and the long run – i.e. the discounted difference in payoffs from the second round onwards, $\frac{d}{1-d}\left((MG^{11}/2) - MG_i^{21}\right)$.

It can be shown that, depending on the sign of equation (18), the governments choose a merger with matching preferences ($g > 0$), since the short-run and long-run incentives to merging reinforce each other for all d : Bureaucratic inertia makes each government more willing to merge than it would be otherwise, given that $MG^{SR} - MG^{11} > 0$ for $g > 0$.

However, when the ruling politicians are sufficiently myopic in the compliance game (i.e. $d \to 0$), there is an incentive to separation with conflicting preferences ($\gamma<0$): The first and the second right-hand-side terms in (18) push in different directions, Depending on a critical value of the government's discount factor, d^*, namely if $d < d^*$, each government would choose separation, since the short-run incentive to separation dominates the long-run incentive to merging. The critical value of the government's discount factor depends on the values taken by the other parameters in equation (18). For example, assuming $b = 2$ which implies $-1 < g < 1$, d^* must be as in table 2 below.

Tab. 2 Values of the government's discount factor below which separation is preferred with conflicting preferences, or $-1 < g < 0$ with $b = 2$

g	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1
d^*	0.31	0.5	0.63	0.73	0.8	0.86	0.9	0.94	0.97

Tab. 2 shows that, for the selected parameters, the higher is the degree of complementarity between the goods ($g \to -1$), the lower is the critical d^* that induces the governments to choose separation as the institutional equilibrium with conflicting preferences.

Equation (18) also establishes that, in both cases, the institutional choice is only driven by the short run gains associated to political rents. The reason is as follows. In the first round of the compliance game, the bureau produces the output of the *status quo*, $Q_i^{SR} = h_i^{SR} g_i^{SR} R/c = Q_i^{21} = h_i^{21} g_i^{21} R/c = (a - c)/[2(b + g)]$, irrespective of the stage-1 choice of institution.[20] However, when the preferences are matching, each government chooses a lower compliance level, cf. (11) and (15). Thus, the political rents are higher with matching than with conflicting preferences. Yet, given the constant level of output, it must be the case that the bureau adjusts itself by lowering its discretionary profits.

The results of this section are summarised in the following proposition.

Proposition 1.2: Optimal government's institutional choice under bureaucratic inertia
If, at stage-2, the bureau adjusts its objectives to the government institutional changes with a lag of one period, each government chooses merging when it has matching preferences. However, provided that the ruling politicians are sufficiently myopic, they choose separation when they have conflicting preferences over bureaucratic production. In both cases, each government's choice depends on its rent-seeking incentives only.

[20] This result is consistent with the empirical political science literature that uses bureaucratic output variations as a measure of the bureau's responsiveness to political changes. See, for example, Scholz and Wei (1986) and Wood and Waterman (1994).

There is an interesting analogy between our result and that obtained by Buchanan and Lee (1981). Buchanan and Lee show why a rational, revenue-maximising government would generate an inverse relationship between tax rates and tax revenues (i.e. the 'bad side' of the Laffer curve). They argue that, if the government's political time horizon is shorter than the period of time required by the private sector for responding to a tax-rate change (i.e. if the government is myopic), then the government has an interest in pushing the tax rate beyond that rate yielding the maximum revenue in the 'long run' (i.e. when the taxpayers have adjusted their behaviour to the new tax rate fully and completely.)[21] Similarly, here, short-run rent-seeking considerations may induce each government to prefer separation rather than merging, when it has conflicting preferences over the outputs. Moreover, it may be the case that this choice makes society worse off. We shall analyse this point in detail in section 4 below. Now, however, we turn to a diagrammatic analysis of the previous two propositions.

3.3. The merging decision: a diagrammatic analysis and interpretation

Propositions 1.1 and 1.2 have shown, respectively, that the two governments unambiguously prefer merging to separation when the bureau adjusts its preferences instantly, whereas - with bureaucratic inertia - they prefer merging with matching preferences and separation with conflicting preferences, if they are sufficiently short sighted. The economic intuition for these results may be explained with the help of two diagrams that represent the first-round of the stage-2 game. These are Figure 2a for matching preferences (or $g > 0$) and Figure 2b for conflicting preferences (or $g < 0$) below.

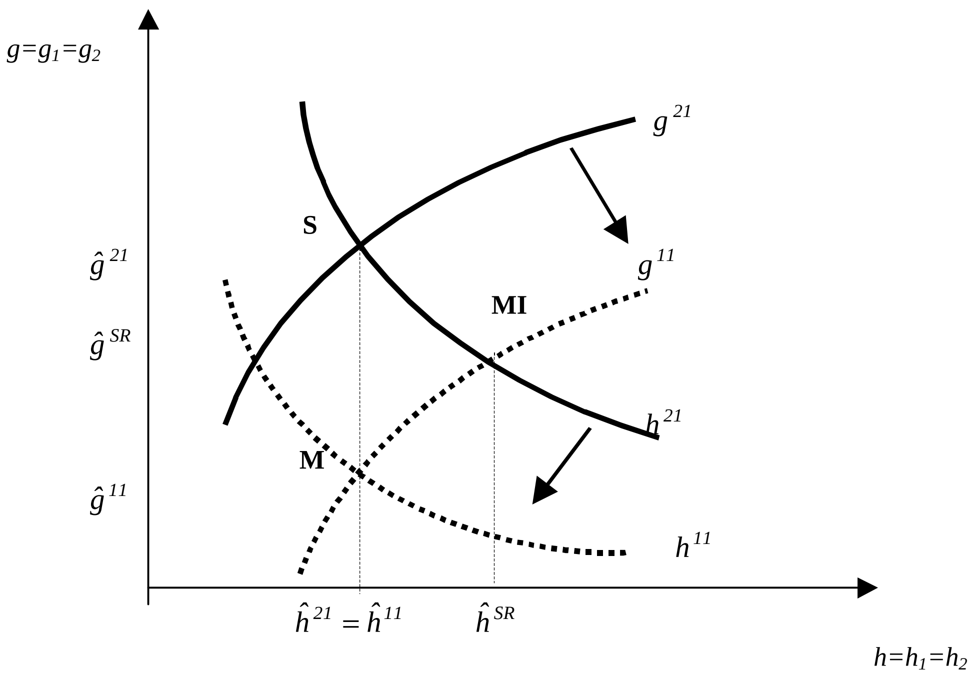
Figures 2a and 2b represent the players' best reply functions in the government-bureau compliance space, under the assumption of a symmetric game (or $g_1 = g_2 \text{ and } \mathrm{h}_1 = h_2$), in either institutional setting (i.e. separation **S**, merging with full bureaucratic adjustment **M**, merging with bureaucratic inertia **MI**). Note that the bureau plays the compliance game in strategic substitutes

- as a higher budget reduces the marginal utility of increasing bureaucratic compliance - whereas the government plays in strategic complements - as a higher bureau compliance increases the marginal utility of a higher budget. The relevant equations can be found in Appendix A.3.

In order to understand these diagrams, it is useful to consider the mechanism underlying the governments' merging decision. Two incentives are at work in this model. On the one hand, the institutional merging serves to internalise externalities between the governments since it changes the nature of the inter-governmental game from non co-operative to co-operative. If the preferences are matching (conflicting), a higher production imposes a negative (positive) externality from one government to the other. Therefore, the budgets tend to be too high (low) without co-operation between the governments. After the merger, the new government decreases (increases) appropriations for a given level of bureaucratic compliance. This, in turn, internalises the externalities, which always has a positive effect on the government's welfare. Diagrammatically, this effect is represented by the shift in the government's best reply function from the thick line to the broken line in Figure 2: after the merger, if preferences are matching

Figure 2 The symmetric compliance game in the neighbourhood of the equilibria

Figure 2.a: Matching preferences (g>0)



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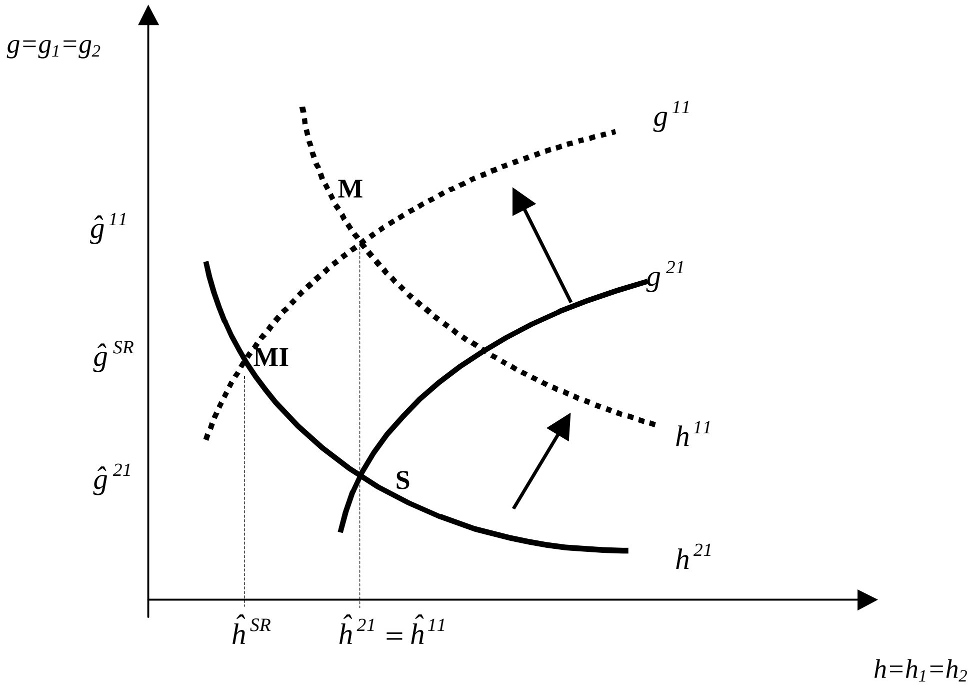
21 Therefore, Buchanan and Lee (1981) assume that the Laffer curve gives rise to a well defined revenue maximum at a finite tax rate. However, this is not always the case, as shown in Malcomson (1986).

Figure 2.b: Conflicting preferences (g<0)



as in Fig. 2.a (or conflicting as in Fig.2.b), the government's best reply function shifts downwards (upwards) as it chooses a more (less) aggressive strategy relative to that chosen by a single separated government at the symmetric equilibrium. In other words, the merger implies a lower (higher) government compliance for a given bureau's strategy.

On the other hand, a merger influences the strategic interaction between the governments and the bureau as follows. When the bureau's preferences adjust immediately to government institutional decisions, the bureau's best reply function shifts inwards (outwards), as the governments merge, if preferences are matching (conflicting) (see the broken line for the bureau's best reply functions in Figure 2.a and 2.b). The combination of the direct effect of the merge (shifting the two player's best reply functions) and the strategic effect (i.e. the movement along each player's best reply function) makes the bureau's compliance independent of the number of governments in equilibrium (compare points S and M in Figure 2, and see equations 8 and 11 above). As a result, the strategic effect becomes neutral: the merging decision only depends on the 'internalisation of externality' effect that explains why each government always chooses merging in Proposition 1.1.

In the case of bureaucratic inertia, the bureau's best reply function is unchanged by the merger. Therefore, the effect of the strategic interaction amongst governments and bureaucracy is only given by the strategic response of the bureau, or by the bureau's movement along its best reply function (i.e. the movement from point S-separation- to point MI-merger with inertia - in Figure 2.a and 2.b). If the preferences are matching (conflicting), the government becomes 'tougher' ('weaker') after the merge, and the bureau's strategic response is to increase (to reduce) its own compliance (see also equation 15). Overall, both the externality and strategic motives favour a merger if preferences are matching. If preferences are conflicting, however, the governments face a trade-off that makes separation a possibility. As long as bureaucratic inertia lasts for one period only, with conflicting preferences, the short-run incentives for separation dominate the long-run incentives for merging, if and only if the government is sufficiently myopic, from which Proposition 1.2 follows.

4. Society's well-being

In this paper, we have assumed that, in the absence of rent-seeking activities, production efficiency would occur (see section 2.1 above). Therefore, we can think that the first-best solution for society is given by $g_i h_i$ =1, for i={1,2}.[22] This solution implies that each output is produced at minimum social costs for the taxpayers. Under this assumption (that the higher the compliance levels, the lower the rent-seeking activities, the closer the equilibrium to the first best), the government-bureau interaction never generates a first-best solution for society. We now consider how close to the first best the various institutional regimes are. We shall denote society's well-being from each round of the compliance game with $SW_i = g_i h_i$, for i={1, 2}, and

[22] Assuming that social welfare is the governments' evaluation of outputs does not change the results of this section.

the present discounted value of society's payoff with PVS_i.[23] Table 3 below reports society's payoffs under different institutional regimes.

Notice that $SW_i^{21} = SW_i^{SR}$: Society's well-being is the same in the first-round game, whether there are two governments or one government and bureaucratic inertia. By comparing present discounted values in the three regimes (the third column of Tab. 3), it turns out that society is better off, when there is a merged (two separate) government(s), provided that the governments' preferences are conflicting (matching). That is, $sign\,(PVS^{11} - PVS^{21}) = sign\,(PVS^{SR} - PVS^{21}) = sign\,(-g)$. In either case, total bureaucratic and political rents are lower and production efficiency is higher.

These findings are summarised as follows:

Proposition 2: Society's well-being *If society's well-being is measured by the proportion of resources devoted to production rather than to rent-seeking activities, then society is better off when the governments merge (remain separate), if they have conflicting (matching) preferences.*

Tab.3 Society's well being

Regimes	First-round payoff	Present discounted value
2 governments	$SW_i^{21} \equiv g_i^{21} h_i^{21} = \left[\dfrac{c(a-c)}{2R(b+g)}\right]$	$PVS_i^{21} = \sum_{t=0}^{\infty} d^t\, SW_i^{21} = \dfrac{c(a-c)}{2R(1-d)(b+g)}$
1 government no inertia	$SW^{11} \equiv g_i^{11} h_i^{11} = \left[\dfrac{c(a-c)}{2R(b+2g)}\right]$	$PVS_i^{11} = \sum_{t=0}^{\infty} d^t\, SW_i^{11} = \dfrac{c(a-c)}{2R(1-d)(b+2g)}$
1 government with inertia	$SW_i^{SR} \equiv g_i^{SR} h_i^{SR} = \left[\dfrac{c(a-c)}{2R(b+g)}\right]$	$PVS_i^{SR} = SW_i^{SR} + \sum_{i=1}^{\infty} d^t SW_i^{11} = \dfrac{c(a-c)(b-gd+2g)}{2R(1-d)(b+g)(b+2g)}$

If we now compare the governments' gains from merging with their effects on society, it turns out that, in the presence of bureaucratic inertia and government myopia, there is a clear

[23] We assume that $SW_i = g_i h_i$, i={1, 2} is monotonically increasing in $g_i h_i$, with a minimum at $g_i h_i = 0$ and a maximum at $g_i h_i = 1$.

conflict of interests: The governments choose separation (merging) with conflicting (matching) preferences, whereas merging (separation) would be in society's best interest.[24] The reason for this result is that the aggregate level of rents is lower in the latter case, although it turns out that a higher share of the reduced rents is captured by the bureau. Therefore, the governments' rent-seeking incentives in the second-stage game can lead to a choice of institutions in the stage-1 of the game which is a third best for society.

5. Extensions

So far, we have assumed that the bureau gives equal weight in its utility function to the utility it derives from production and discretionary profits. However, Niskanen (1971) has depicted bureaucratic behaviour as one of budget maximisation given the sponsor's demand for output. This is often presented as a model of 'bilateral monopoly', although the government actually leaves unexploited its monopsony power and simply chooses its demand on which basis the monopoly bureau determines the outputs. In the next sections, we shall explore the implications of this behavioural assumption for the merging decision of the governments. We shall also consider the implications of alternative assumptions (on the bureau's and governments' preferences) for the governments' institutional choice in the context of the compliance games.

5.1 Endogenous institutions in a Niskanen's game

In this section, we consider the following game. As assumed previously, at stage 1, the governments choose merging or separation. At stage 2, rather than choosing its compliance with the government(s), the bureau chooses the outputs – Q_i and Q_j - subject to the constraint given by the demands for outputs as formulated by the government(s) in either equation (3) or (4) above. Regarding the bureau's and governments' payoffs, we assume that neither is interested in rent-seeking activities. Namely, the bureau's objective function is given by either equations (5) or (6) above with Z=0, while the governments' objective function is given by a 'social welfare

[24] In the absence of bureaucratic inertia, the governments' choice of merging is the most

function' as represented by equations (1) and (2) in the absence of political rents. (This assumption implies that, once expressed in terms of compliance levels, there would be a potential for g=1.)[25] The game just described generalises Niskanen (1971) in that it allows for an institutional stage and for the monopoly bureau producing differentiated rather than independent products: Niskanen's game is derived as a special case for γ=0 here.

With symmetric demands and cost functions, we can derive the following expressions for equilibrium outputs: $Q^{21} = \frac{a}{2(b+g)}$, $Q^{11} = \frac{a}{2(b+2g)}$ for the case of government separation (corresponding to bureaucratic inertia as well here) and of merging, respectively. Note that these output levels are higher than in the corresponding compliance game, as we would expect in the absence of rent-seeking behaviour. Substituting these expressions back into the objective function of the governments, it is easy to show that $sign\ \ of(MG^{11}/2) - MG^{21} = sign\ \ of(-g)$. In other words, each government chooses separation when its preferences are conflicting and merging when their are matching. The intuitive explanation is as follows: as long as the governments only care about the outputs, they will choose the institution that generates the highest output level, given that $sign\ \ of(\ \ Q^{11} - Q^{21}) = sign\ \ of(-g)$.

What can we learn from this exercise? Recall that, in the compliance game, the governments choose merging without bureaucratic inertia. However, if we consider the utility they derive from the outputs (see the second square brackets in equation (14) above), it turns out that they would choose merging with matching preferences and separation with conflicting preferences, exactly as in the game just described. Therefore, this analysis confirms Proposition 1.2: rent-seeking behaviour by part of the governments not only affects public good provision in equilibrium, but also influences the choice of government institution.

5.2 Endogenous institutions, compliance and bureaucratic preferences

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favourable to society, if and only if the governments have conflicting preferences.

In this section, we describe how our results remain robust to alternative assumptions on the bureau's and governments' objective function in the context of a compliance game.[26]

First, we consider the case in which, as in section 5.1., the bureau does not seek discretionary profits, which implies setting Z=0 in equations (5) and (6). We leave all the other assumptions of Section 3 above on the governments' preferences and the compliance game unchanged. It can be shown that the only difference with the solution described in Section 3 is that the bureau now plays the compliance game 'less aggressively'. That is, the bureau chooses a higher level of compliance for any given government's budget than in the case Z=1. *Ceteris paribus*, the bureau's best reply function would shift upwards in either regime in Figure 2 above (not shown). As a result, both the players' compliance levels and, thus, the output levels would be higher at an equilibrium with Z=0 rather than with Z=1 in either institutional regime. However, the institutional ranking for the government would not change, in the case of both full adjustment and bureaucratic inertia.[27] The results of Proposition 1 would also remain unchanged, had we assumed that the bureau shares the same preferences as the governments (and society) for its own outputs, although it is also interested in bureaucratic rents.[28] It can be shown that, at equilibrium, the bureau chooses full compliance (or h=1) in either regime, whereas the governments' compliance depends on its preferences. However, the government institutional choices are merging with full bureaucratic adjustment or with inertia and matching preferences, and separation with inertia and conflicting preferences, exactly as in our basic case.

6. Conclusions

In this paper, we have considered the incentives two governments face for remaining separate or for merging into a single institution, when they deal with a common bureau that produces

[25] It can be shown that, in this game, the identical solution is obtained, if (with g=1) the bureau chooses its compliance level h rather than the outputs Q.

[26] The derivation of the results of this section is available from the authors on request.

[27] It can be shown that the governments' indirect utility is the same as in equations (9), (12) and (16) above up to a constant of proportionality.

[28] This extension was suggested to us by an anonymous referee.

differentiated outputs. We have modelled such incentives by considering a two-stage game: At stage-1, the governments choose whether or not merging; at stage-2, they play a repeated Nash compliance game with the bureau. We have shown that, if, at stage-2, the bureau updates immediately its objective function to institutional changes, then the governments always prefer a merger at stage-1. However, if there is some bureaucratic inertia in changing objectives, and provided that the government's time-horizon is effectively short (for example, because of a positive probability that the incumbent government will not be re-elected), then the governments' short-run rent-seeking incentive dominates. This incentive will induce separation when the governments have conflicting preferences, and merging otherwise. This government's choice clashes with the long-run interests of society, if, as we have assumed, society prefers those institutions generating the lowest amount of rent-seeking activities.

One testable implication of our paper is that, if there is evidence of bureaucratic inertia and government's short termism, it is more likely that we shall observe a common bureau supplying differentiated goods to a single level of government, when these goods are perceived as matching in government preferences (for example, roads building or bridge maintenance). We would also expect that a common bureau will supply differentiated goods to two different governments, when these goods are conflicting in governments' preferences (for example, education, nurseries, sport facilities). Bureaucratic inertia may be measured by the extent to which bureaucratic outputs change just after government merging, whereas the government's short termism may be proxied by its degree of partisanship.

In this paper, bureaucratic inertia has been treated as exogenous. However, our analysis suggests that the governments may have an incentive to induce or to generate inertia endogenously (e.g. by slowing down information transmission to the bureau). An obvious improvement of the model would be to provide an explicit microeconomic foundation for the bureau's inertia, for example, by modelling incomplete information.

Our results have been derived under specific assumptions for the player’s objective functions. Although some of these assumptions are standard in the economics of bureaucracy, a further step in this research would be that of assessing the robustness of our analysis to more general functional forms representing such preferences. Moreover, although we believe that our assumptions on the governments’ and bureau’s preferences are reasonable, it would be extremely valuable to provide explicit microeconomic foundations for such preferences, for example by specifying explicitly a consumer-voter model that determines endogenously both the government in power and its structure (as, for example, in Besley and Coate’s, 1997, citizen-candidate model) and the bureaucracy. Another possible development of this paper is related to the fact that politicians can decide not only on their own institutional structure, but also on how the public bureau is structured, see Moe (1984, p. 761). For example, governments may prefer to deal with two separate bureaus rather than with a common agency.[29] We leave this analysis for future work.

References

Besley, T. and Coate, S. (1997). ‘An economic model of representative democracy’, *Quarterly Journal of Economics* 112: 85-114.

Bernheim, B.D. and Whinston, M.D. (1986). ‘Common agency’. *Econometrica* 54: 923-942.

Breton, A. and Wintrobe, R. (1975). ‘The equilibrium size of a budget-maximizing bureau: a note on Niskanen's theory of bureaucracy’. *Journal of Political Economy* 83: 195-207.

Buchanan, J.M. and Lee, D.R. (1982). ‘Politics, time and the Laffer curve’. *Journal of Political Economy* 90: 816-9.

Carlsen, F. and Haugen, K. (1994). ‘Markov perfect equilibrium in multi-period games between sponsor and bureau’. *Public Choice* 79: 257-280.

Chan, K. and Mestelman, S. (1988). ‘Institutions, efficiency and the strategic behaviour of sponsors and bureaus’. *Journal of Public Economics* 37: 91-102.

Daems, A. (1990). ‘Budgeting the non-profit organization: An agency theoretic approach’*. FEW n. 451*, University of Tilburg, Department of Economics, Tilburg.

[29] For example, Dunsire (1987) pp. 122-3 reports ten cases of ‘bureau-shuffling’ (i.e. six cases of mergers and four cases of demergers) for UK central government’s agencies between 1971 and 1984.

Dixit, A. K. (1979). ‘A model of duopoly suggesting a theory of entry barriers’. *Bell Journal of Economics* 10: 20-32.

Dunsire, A. (1987). ‘Testing theories: the contribution of bureaumetrics’. In J.E. Lane (ed.), *Bureaucracy and Public Choice*. London: Sage.

Fedeli, S. (1998). ‘Politicians and public managers: strategic interactions and the settlement of residual claims to public resources’, Università di Roma ‘La Sapienza’, Dipartimento di Economia Pubblica, *mimeo*.

Fedeli, S. (1999). ‘Competing bureaus and politicians: A compliance approach to the diversion of public funds’. *Public Choice* 100: 253-270.

Forte, F. and Powers C.H. (1994). ‘Applying game theory to the protection of public funds: Some introductory notes’. *European Journal of Law and Economics* 1: 193-212.

Horn, H. and Wolinsky, A. (1988a), ‘Worker substitutability and patterns of unionisation’. *Economic Journal* 98: 484-497.

Horn, H. and Wolinsky, A. (1988b), ‘Bilateral monopolies and incentives for merger’*. RAND Journal of Economics* 19: 408-419.

Malcomson, J.M. (1986). ‘Some analytics of the Laffer curve’. *Journal of Public Economics*, 29, pp. 263-79.

Migue, J. and Belanger, G. (1974). ‘Toward a general theory of managerial discretion’. *Public Choice* 17: 27-43.

Miller, G. J. (1977). ‘Bureaucratic compliance as a game on the unit square’. *Public Choice* 29: 37-51.

Miller, G. J. and Moe, T. M. (1983). ‘Bureaucrats, legislators and the size of government’. *American Political Science Review* 87: 297-322.

Moe, T.M. (1984). ‘The new economics of organization’. *American Political Science Review* 88: 739-77.

Moene, K. (1986). ‘Types of bureaucratic interaction’. *Journal of Public Economics* 29: 333-346.

Niskanen, W. (1971). *Bureaucracy and Representative Government*. Chicago: Aldine-Atherton.

Niskanen, W. (1975). ‘Bureaucrats and politicians’. *Journal of Law and Economics* 18: 617-643.

Orzechowski, W. (1977). ‘Economic model of bureaucracy: Survey extensions and evidence’. In T. E. Borcherding (ed.), *Budgets and Bureaucrats: The Sources of Government Growth*. Durham: Duke University Press.

Peacock, A.T. (1983). ‘Public X-inefficiency: Informational and institutional constraints’. In H. Hanusch (ed.), *Anatomy of Government Deficiencies*. Springer Verlag: Heidelberg.

Rowley, C. and Elgin R. (1985). Toward a theory of bureaucratic behaviour. In D. Greenaway and G.K. Shaw (eds.), *Public Choice, Public Finance and Public Policy: Essays in Honour of Alan Peacock.* Oxford:Blackwell Ltd.

Shleifer, A. and Vishny, R.W. (1993). ‘Corruption’. *Quarterly Journal of Economics* 108: 599-618.

Shleifer, A. and Vishny R.W. (1994). ‘Politicians and firms’. *Quarterly Journal of Economics* 109: 995-1025.

Singh, N. and Vives, X. (1984). ‘Price and quantity competition in a differentiated duopoly’. *RAND Journal of Economics* 15: 546-554.

Spencer, B. (1980). ‘Outside information and the degree of monopoly power of a public bureau’. *Southern Economic Journal* 47: 229-233.

Wilson, J.Q. (1989). *Bureaucracy*. New York: BasicBooks.

Wood, B.D. and Waterman, R.W. (1994). *Bureaucratic Dynamics*. Boulder: Westview Press.

Appendices

A.1 Reformulating the game in terms of compliance

We reformulate the players' payoffs (1), (2), (5) and (6) in terms of their compliance levels. Recall that the bureau's strategy $h_i \in H_i$ goes from 0 to 1 and represents the share of the bureau's budget, B_i, actually devoted to the production of Q_i, whereas the remaining ($1-h_i$) is the share of the budget kept by the bureau as discretionary profits. The government(s) strategy $g_i \in G_i$ denotes the share of resources, R_i, potentially available for the production of Q_i and actually devoted to it. We assume that R_i is exogenous, i={1, 2}. Thus, $B_i = R_i g_i$ indicates the budget appropriated to the bureau by the government for the production of the good i and $\Pi G_i = R_i(1-g_i)$ is the amount of resources kept by the government as political rents. Each player has complete information about its opponent's payoff and the players' information sets are assumed to be 'common knowledge'. Assuming that the total costs of production are given by $TC_i = c_i Q_i$, we can write $Q_i = (h_i g_i R_i / c_i)$, with i={1, 2}. Therefore, we can express the arguments of all the payoff functions in terms of the parameters and strategic variables. Thus, the individual payoff in terms of compliance for the two *separate* governments i={1,2}, is obtained from equation (1):

$$MG^{21}{}_i = a_i\left(\frac{g_i h_i R_i}{c_i}\right) - \frac{b_i}{2}\left(\frac{g_i h_i R_i}{c_i}\right)^2 - g\left(\frac{g_i h_i R_i}{c_i}\right)\left(\frac{g_j h_j R_j}{c_j}\right) + R_i(1-g_i) \qquad \text{(A.1)}$$

whereas the *centralised* government's payoff in terms of compliance is obtained from equation (2):

$$\begin{aligned} MG^{11} = {} & a_1\left(\frac{g_1 h_1 R_1}{c_1}\right) + a_2\left(\frac{g_2 h_2 R_2}{c_2}\right) - \frac{b_1}{2}\left(\frac{g_1 h_1 R_1}{c_1}\right)^2 - \frac{b_2}{2}\left(\frac{g_2 h_2 R_2}{c_2}\right)^2 + \\ & - 2g\left(\frac{g_1 h_1 R_1}{c_1}\right)\left(\frac{g_2 h_2 R_2}{c_2}\right) + R_1(1-g_1) + R_2(1-g_2) \end{aligned} \qquad \text{(A.2)}$$

Turning to the common bureau, when it deals with two *separate* governments, the bureau's payoff is obtained from equation (5) (with Z=1).

$$\begin{aligned} MH^{21} = {} & a_1\left(\frac{g_1 h_1 R_1}{c_1}\right) + a_2\left(\frac{g_2 h_2 R_2}{c_2}\right) - b_1\left(\frac{g_1 h_1 R_1}{c_1}\right)^2 - b_2\left(\frac{g_2 h_2 R_2}{c_2}\right)^2 + \\ & - 2g\left(\frac{g_1 h_1 R_1}{c_1}\right)\left(\frac{g_2 h_2 R_2}{c_2}\right) + R_1 g_1(1-h_1) + R_2 g_2(1-h_2) \end{aligned} \qquad \text{(A.3)}$$

Instead, when the bureau deals with a single*, consolidated,* government, its payoff , from (6), is (with Z=1)

$$\begin{aligned} MH^{11} = {} & a_1\left(\frac{g_1 h_1 R_1}{c_1}\right) + a_2\left(\frac{g_2 h_2 R_2}{c_2}\right) - b_1\left(\frac{g_1 h_1 R_1}{c_1}\right)^2 - b_2\left(\frac{g_2 h_2 R_2}{c_2}\right)^2 + \\ & - 4g\left(\frac{g_1 h_1 R_1}{c_1}\right)\left(\frac{g_2 h_2 R_2}{c_2}\right) + R_1 g_1(1-h_1) + R_2 g_2(1-h_2) \end{aligned} \qquad \text{(A.4)}$$

In all of these cases, the government(s) chooses g_i, whereas the bureau decides on h_i.

A.2 Stage-2 repeated-compliance game under full adjustment

The two-stage game is solved by backward induction starting from stage-2.

2 Governments - 1 Bureau

Suppose the governments have chosen separation at stage-1. Then, at stage-2, in each round of the repeated game, each government i maximises (A.1) with respect to g_i, whereas the bureau maximises (A.3) with respect to h_i, i={1,2}. In so doing, each player takes the other players' strategies as given. Solving the first-order conditions for each choice variable, and assuming symmetric preferences, costs and resources ($\alpha_i=\alpha$, $\beta_i=\beta$, $c_i=c$, $R_i = R$ for i=1,2), with $\alpha>c$, we obtain:

$$g^R{}_i = \frac{ah_i c - gh_i h_j g_j R - c^2}{bh_i{}^2 \mathrm{R}} \tag{A.5}$$

$$h^R{}_i = \frac{ac - 2gh_j g_j R - c^2}{2bg_i \mathrm{R}} \tag{A.6}$$

where $g^R{}_i$ is the government i's best reply function, and $h_i{}^R$ represents the best reply-function of the common bureau to government *i*. Solving (A.5) and (A.6) with respect to $h_i{}^R$ and $g_i{}^R$, we find equation (8) in the main text.

The strategic properties of the compliance game at the symmetric equilibrium (8) are as follows. Equation (A.5) shows that the government i's perception of the compliance game is influenced by the sign of g : in choosing g_i, the government i views the compliance game with the bureau (choosing h_i) as one in strategic *complements*: sign($\partial^2 Mg_i / \partial g_i \partial h_i$)=sign($ga + gc + 2cb$)>0. At equilibrium, this corresponds to an upwards sloping government best reply function in the (h_i, g_i) strategy space. With respect to h_j and to g_j, the government i plays in strategic substitutes (complements) if it has matching (conflicting) preferences: $\partial^2 Mg_i / \partial g_i \partial h_j$ <0 and $\partial^2 Mg_i / \partial g_i \partial g_j$ <0 for γ>0. This corresponds to a downwards (upwards) sloping best reply function in the relevant strategy space. Turning to the bureau, when choosing its compliance level with respect to i (or j), it always views the game with government i (or j) as one in strategic substitutes: $\partial^2 Mh_i / \partial h_i \partial g_i$ <0. However, it plays with government j (or i) in strategic substitutes if γ>0, and in strategic complements if γ<0: sign($\partial^2 Mh_i / \partial h_i \partial g_j$)=sign($\gamma$).

1 *Government - 1 Bureau*

Suppose now that the governments have chosen merging at stage-1. Then, at stage-2 the merged government chooses g_1 and g_2 by maximising (A.2), simultaneously with the choice of h_1 and h_2 by the bureau, which now maximises (A.4). The solution to the first-order conditions gives the following best reply functions in the constituent game:

$$g^R{}_i = \frac{ah_i c - 2gh_i h_j g_j R - c^2}{bh_i{}^2 \mathrm{R}} \tag{A.7}$$

$$h^{R}{}_{i} = \frac{ac - 4gh_j g_j R - c^2}{2bg_i \mathrm{R}} \tag{A.8}$$

from which the symmetric Nash equilibrium solutions are given by equation (11) in the main text. The strategic properties of the model here are similar to those derived in the two governments one bureau regime. However, with respect to the choice of a separate government, now, evaluated at the equilibrium (11), the merged government chooses a lower (higher) level of g_i, when the preferences are matching, $\gamma>0$ (conflicting, $\gamma<0$), in which case the political rents for the merged government are higher (lower) than those obtained by each of the two separate governments.

The solution under bureaucratic inertia is similar, and is not reported here.

Appendix A.3: Best reply functions in the first-round of Stage-2 game

Using (A.5) and (A.7), and assuming that $g_1 = g_2$ and $\mathrm{h}_1 = h_2$, the best reply functions considered in section 3.3. and Figure 2 are as follows. For the government

$$g^{12} = \left[\frac{c}{R(b+g)}\right]\left[\frac{a\mathrm{h} - \mathrm{c}}{\mathrm{h}^2}\right] \tag{A.9}$$

$$g^{11} = \left[\frac{c}{R(b+2g)}\right]\left[\frac{a\mathrm{h} - \mathrm{c}}{\mathrm{h}^2}\right] \tag{A.10}$$

(A.9) and (A.10) are the government's best reply under separation and merging, respectively. Differentiating and evaluating at either (8), (11), (15), it turns out that each best reply function is upwards sloping in the neighbourhood of the symmetric equilibrium. Using (A.6) and (A.8), and assuming that $g_1 = g_2$ and $\mathrm{h}_1 = h_2$, the (inverse) bureau's best reply functions are as follows

$$g^{12} = \left[\frac{c(a - \mathrm{c})}{2R(b+g)}\right]\left[\frac{1}{\mathrm{h}}\right] \tag{A.11}$$

$$g^{11} = \left[\frac{c(a - \mathrm{c})}{2R(b+2g)}\right]\left[\frac{1}{\mathrm{h}}\right] \tag{A.12}$$

(A.11) is the bureau's (inverse) best reply function under separation and under merging with bureaucratic inertia; (A.12) is the best reply function under merging and full adjustment. Note that the bureau's best reply functions are downward sloping in the (g, h) space.