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Conditional grants to independent regional governments: The trade-off between incentives and wasteful grant-seeking

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Abstract

The paper addresses the welfare implications of conditional grants in the presence of inefficiencies in regional production. While conditional grants may set incentives for regions to reduce inefficiencies, resources are wasted in the process of grant-seeking. We provide a theoretical model to assess the net effect on welfare. A game-theoretic context is developed to derive the optimal grant-distribution scheme. Depending on the characteristics of the collective good and of the regional government, the optimal ratio of conditional to block grants and the optimal number of recipients vary. The impact of different factors on the optimal grant-distribution scheme is derived.

Key words: conditional grants, inefficiencies, rent-seeking, fiscal federalism, opportunistic government

JEL: D 7, H 77, H 5, H 11

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1. Introduction

A substantial share of funds that are used in the provision of collective goods on the regional and local level stem from conditional grants these subordinate units receive from some supra-ordinate government or institution (e.g., Lotz, 1990; Man and Bell, 1993; Greese, 1998; Bähr, 2008; Strick, 2008; Denhardt and Denhardt, 2009: chapter 7, Zimmermann, 2009: chapter 5). Two justifications for conditional grants are discussed. The theoretical literature focuses on regional spillovers and vertical fiscal externalities. Here, conditional grants are given to certain regions in order to increase welfare in those adjacent governmental units that benefit or suffer from externalities produced by the recipient regions (e.g., Oates, 1999; Shah, 2006; Fenge and Wrede, 2007). Supra-ordinate governments and institutions frequently justify the use of conditional grants by arguing that they will increase welfare within the recipient region itself. This implies that the supra-ordinate government identifies inefficiencies in the regional or local production of collective goods. For example, the EU cohesion programs assume that at least some of the economically weak regions in the EU suffer from poor institutional quality (e.g., Bähr, 2008). The same is generally recognized to hold for the potential recipients of international development aid (e.g. Hefeker, 2006). In the US, conditional grants are arguably introduced to ensure that certain technological and organizational standards are met in the educational sector (e.g., Fisher and Papke, 2000; Cascio et al., 2008). The same holds for the funding of regional and local youth welfare policy in Germany (e.g., Greese, 1998). A number of papers recognize the justification (e.g., Schultze, 1974; Chernick, 1979; Bähr, 2008; Byrnes and Dollery, 2002, Fenge and Wrede, 2007). The empirical literature has come up with evidence for inefficiencies in local and regional collective good productions in different countries and for different collective goods (e.g., Grossman et al., 1999; Kalb, 2008; Geys et al., 2009).

By forcing the subordinate units into competing for conditional grants, the supra-ordinate government sets incentives for a more efficient production of collective goods. The subordinate units have to apply for conditional grants with each application containing a detailed description of the way that these funds are used and how they complement the overall production of the collective good. Given the large number of applications, the sum of funds applied for regularly exceeds the means that the supra-ordinate government reserved for conditional grants. Thus, some applications have to be turned down. It is precisely this competition that sets incentives for the subordinate units to propose a more efficient use of funds in order to attract grants. On the other hand, the competition for conditional grants evokes wasteful grant-seeking among potential recipients (e.g., Tullock, 1980). The amount of social waste depends on the rules according to which grants are distributed (e.g., Berry, 1993; Nitzan, 1994), but the same rules influence the potential gains in efficiency induced by these grants.

In this paper, we assume that there are inefficiencies in the production of local public services and thus the use of conditional grants may be justified. Our focus rests on the trade-off between efficiency-enhancing effects of conditional grants and the welfare losses due to grant-seeking. We provide a theoretical model to address the following question: How can the grant-distribution-scheme be designed to achieve a maximum gain in net welfare? The paper is organized as follows: Section 2 briefly reviews the relevant literature and sketches the institutional background to which our analysis applies. Section 3 presents a formal model of the grant-distribution-game and describes the characteristics of the optimal grant-distribution scheme. The central results are discussed in section 4. Section 5 concludes.

2. Related literature

A number of theoretical papers have identified asymmetric information as a source of inefficiency in collective good production on the subordinate level (e.g., Boadway et al., 1999; Dixit, 2002). Here the supra-oprdinate government is the principal who delegates a certain task to the subordinate government – the agent. Due to the asymmetric information, neither the output nor technological or organisational standards are contractible. Thus, an optimal grant-distribution scheme must manipulate the agent's goals in a way that increases their congruency with the principal's goals. The recent literature shows that personalized incentive schemes may be harmful because they crowd out the intrinsic motivation especially in public sector employees (e.g., Frey, 1998; Francois, 2000; Besley and Ghatak, 2005).

We focus on the role of grant-seeking in situation where contractibility is given. Thus, the subordinate units can credibly commit to a certain output level or to certain technological, organisational or institutional standards and the supra-ordinate granting institution can ex post verify that the commitments are met. On the other hand, we assume that forcing the subordinate units to meet certain standards or output levels is not a valid option. This assumption applies to a large array of situations where the subordinate units are formally independent like the regions in the EU, the recipient regions or countries of international development aid, the German "Länder" in the German federation.

Inefficiencies in collective good production may result from an number of factors. First, regional pressure groups (e.g., Austen-Smith, 1997) may press authorities for weak institutional standards or favourable yet inefficient solutions in collective good production. For instance, the teachers' union may press for slowing down the introduction of new media in education. Similarly, religious groups could demand that certain topics may or may not be part of the schools' syllabus. Regional trade associations may press for a lax application of environmental, labor or anticorruption standards. Second, local voters regularly lack the bird's eye view and the related knowledge about the performance of alternative technologies and organizational solutions in collective good production because they only observe a small and largely homogeneous subset of possible solutions. In this case, biased beliefs prevent the adoption of more efficient technologies and organizational forms (e.g., Oates, 1999; Belleflamme and Hindriks, 2005). Third, the local and regional authorities generally find it more difficult to find qualified personnel. Fourth, the subordinate government may entertain ideological or procedural preferences (e.g., Romer, 2003; Bischoff, 2008) that lead to inefficiencies. This may apply in a similar way to the local bureaucrats that provide the collective good. Following Besley and Ghatak (2005), procedural preferences may be especially strong when the collective good coheres around a mission, e.g. educating children, helping the ill or elderly. Here, employees are recognized to be highly motivated (e.g., Francois, 2000) but entertain strong convictions as to what technologies/methods, organisational solutions and institutional settings are appropriate to pursue the mission (e.g. Besley and Ghatak, 2005). Regional and local authorities do not apply a sufficiently heterogeneous set of technical and organisational solutions to develop a bird's eye view. Consequently, the convictions of regional and local employees may be persistently wrong. In the case of teachers, they have firm beliefs concerning the best way to teach their students but these beliefs may be contradicted by the empirical evidence e.g. from the PISA study that relied on a large sample of heterogeneous solutions.

A number of authors argue that conditional grant schemes are not welfare-enhancing because the granting governments distribute the grants not to maximize welfare but to pursue their own political goals. They provide evidence that supra-ordinate governments apply vertical grants to maximize political support (e.g., Grossman, 1994, 1996; Worthington and Dollery 1998). Especially the discretionary freedom in conditional grants is used to this end. A support-maximizing scheme of distributing conditional grants induces excessive grant-seeking and is therefore harmful to welfare. In the theoretical model provided in the upcoming section, we assume that the supra-ordinate government is benevolent and aims at maximizing overall welfare. Later in the paper, we discuss the implication of dropping this assumption and assuming opportunistic supra-ordinate governments instead.

3. The model

3.1 Agents, production function and game structure

Consider a federation consisting of N regions. The regions are in charge of providing a certain collective good X. The central government has a fixed amount of funds F to support the production of X. We assume that the regional production of X is financed solely by earmarked vertical transfers from the central government. The parameter f denotes the share of funds transferred in form of conditional grants distributed upon regional application. For reasons of simplicity, we assume that they are distributed equally among $0 < K < N$ regions. The remaining fraction*(1-f)* of F is distributed as block grant of equal size to all N regions. Block grants are earmarked for the production of X but distributed without prior application. Thus, the grant v_i for region i is given by:

$$v_i = \begin{cases} v_i^+ = \dfrac{(1-f)F}{N} + \dfrac{fF}{K} & \textit{in the case of successful application} \\ v_i^- = \dfrac{(1-f)F}{N} & \textit{else} \end{cases} \tag{1}$$

Let us assume that the central government aims at maximization of a simple utilitarian welfare function. Function $h\left[X_i\right]$ with $\partial h / \partial X_i > 0$ and $\partial^2 \mathrm{h} / \partial \mathrm{X}_\mathrm{i}^2 < 0$ represents the utility of the representative consumer in region i. We assume the representative consumers to be identical across all regions.

$$WF = \sum_{i=1}^{N} h\left[X_i\right] \tag{2}$$

The regional output depends on the resources used and the solution parameter A_i. It describes the technological and organisational solution applied in the production of X_i. The latter describes the policy solution that the region i applies in the production of X with $\partial X_i / \partial A_i > 0$ and $\partial^2 X_i / \partial A_i^2 < 0$. A higher value of A_i thus represents a solution closer to the efficient frontier. In the relevant interval for our analysis, let the output of the regional service X_i be described by the following Cobb-Douglas-production function:

$$X_i = (v_i - \lambda_i)^q \cdot \left[\alpha_i + A_i^o\right]^{1-q} \qquad 0 \le q \le 1 \tag{2}$$

Let the regional authorities in charge of regional production be risk-neutral and utility maximizing. The regional government utility $U(v_i - \lambda_i, \alpha_i)$ is a positive function of the disposable budget (v_i - λ_i) (e.g., Tullock, 1980; Wintrobe, 1997) where λ_i is the amount of resources it devotes to the application for conditional funds. In addition, the regional government is assumed to have policy preferences. Let A_i^o denote bliss solution parameter that maximizes the regional government's utility when conditional grants are absent (i.e. $f = 0$). The application of a more efficient solution $A_i > A_i^o$ causes losses in political support among pressure groups and ill-informed voters and/or losses in ideological or procedural utility among the regional government including the regional bureaucracy. However, to attract conditional grants, regional governments may be willing to apply more efficient technological or organisational solutions. Let $\alpha_i = A_i - A_i^o$ denote the change in the solution parameter that region i chooses to attract conditional grants. For reasons of simplicity, we assume that regions are identical with respect to size, utility function, A_i^o, and production function $X_i(\cdot)$.

If $f = 0$, regions do not spent any resources on grant-seeking ($\lambda_i = 0$). They will use $v_i = F/N$ on the production of X and apply $\alpha_i = 0$. For all values $f > 0$, the probability that a certain region i receives conditional grants is denoted by p_i. It depends on λ_i, on α_i and on the corresponding λ_j and α_j of all other regions $j \neq i$. The more effort the region i exerts in the process of applying for grants, the higher the probability of receiving them – other things equal. In addition, the probability is higher the more adequate A_i. Following Berry (1993), we assume that the process of grant-allocation can be modelled as if it was a lottery in which

$0 < K < N$ regions receive a grant of size *fF/K*. The probability p_N that region $i = N$ receives grants is given by:

$$p_N = \frac{\overbrace{\sum_{i=1}^{K-1} \pi_i + \pi_N + \sum_{i=2}^{K} \pi_i + \pi_N \ldots \sum_{i=N-K+1}^{N-1} \pi_i + \pi_N}^{\binom{N-1}{K-1} \text{ times}}}{\underbrace{\sum_{i=1}^{K} \pi_i + \sum_{i=2}^{K+1} \pi_i \ldots \sum_{i=N-K+1}^{N} \pi_i}_{\binom{N}{K} \text{ times}}} \tag{3}$$

with $\pi_i \equiv \pi(\lambda_i, \alpha_i) = \lambda_i^r \alpha_i^{1-r}$, $r \in [0,1]$.

The numerator of equation (3) consists of the π-value sums of all combinations of winning regions where region N is included.[1] The denominator represents all possible combinations of winning regions. The central government does not give conditional grants to regions that stick to A_i^o, or spend no resources on grant-seeking ($\lambda_i = 0$); that is hand in no application. The more region i is willing to change its policy solution, i.e. the larger α_i, the higher p_i, other things equal. In addition, p_i increases in λ_i. The parameter r reflects the relative impact of λ_i and α_i on p_i.

[insert table 1 about here]

The interaction of regional and central governments can be modelled as a sequential game consisting of four stages (see table 1): In stage 1, the central government sets f and K and distributes the lump sum grants among the N regions. In stage 2, the regional governments decide about the solution change α_i and the amount of resources they want to spend on grant-seeking. Both α_i and the grant-seeking effort λ_i depend on f and K. Given this decision, they use the received lump sum grants net of grant seeking expenditures and the solution parameter

[1] Winning the competition is understood as receiving the additional grant.

$A_i = \alpha_i + A_i^o$ to start producing X_i. At this stage, the central government is able to observe the level of α_i employed by the regions. We assume that the regional governments will not be able to change α_i ex post in case they do not receive conditional grants. In stage 3, conditional grants are distributed among *K* recipient regions chosen by the central government. Finally in stage 4, the recipient regions use these additional funds to expand the production of X_i. The central government has to solve this game by backward induction and choose the combination of *f* and *K* that maximizes overall welfare (see expression (2)) . For this purpose, it is necessary to develop the region's reaction functions to *f* and *K,* $\alpha_i = \alpha_i\left(f, K\right)$ respectively $\lambda_i = \lambda_i\left(f, K\right)$.

3.2 Regional grant-seeking and the optimal grant-distribution scheme

Given that all regions are identical, we assume that $\pi_i = \pi_j \ \forall i,j$ holds in the Nash-equilibrium (see Berry, 1993): Thus, we will hereafter drop the subindex *i* to denote the single region to save notation. If $f = 0$, no grant competition will take place, i.e. a utility maximizing region will set $\lambda = 0$ and $\alpha = 0$. For those cases where $f > 0$, the regional government maximizes its expected utility by solving the following optimization problem:

$$\max_{\lambda,\alpha}\left\{E\left[U\left(v-\lambda,\alpha\right)\right] : v^- \geq \lambda;\ \alpha,\lambda \geq 0\right\} \tag{4}$$

We apply a Kuhn-Tucker approach to solve the maximization problem of the representative government. The corresponding Lagrange-function reads:

$$Z = pU\left(v^+ - \lambda,\alpha\right) + \left(1-p\right)U\left(v^- - \lambda,\alpha\right) - \mu\left(\lambda - v^-\right) \tag{5}$$

Using $U^+ \equiv U\left(v^+ - \lambda,\alpha\right)$ and $U^- \equiv U\left(v^- - \lambda,\alpha\right)$ the first-order conditions are given by:

$$\frac{\partial Z}{\partial \lambda} = p\left(\frac{\partial U^+}{\partial \lambda} - \frac{\partial U^-}{\partial \lambda}\right) + \frac{\partial p}{\partial \lambda}\left(U^+ - U^-\right) + \frac{\partial U^-}{\partial \lambda} - \mu \leq 0 \qquad \lambda \geq 0 \quad \lambda\frac{\partial Z}{\partial \lambda} = 0 \tag{6}$$

$$\frac{\partial Z}{\partial \lambda} = p\left(\frac{\partial U^+}{\partial \alpha} - \frac{\partial U^-}{\partial \alpha}\right) + \frac{\partial p}{\partial \alpha}\left(U^+ - U^-\right) + \frac{\partial U^-}{\partial \alpha} \leq 0 \qquad \alpha \geq 0 \quad \alpha\frac{\partial Z}{\partial \alpha} = 0 \tag{7}$$

$$\frac{\partial Z}{\partial \mu} = -\left(\lambda - v^-\right) \geq 0 \qquad \mu \geq 0 \quad \mu\frac{\partial Z}{\partial \mu} = 0 \tag{8}$$

The conditions for an inner solution of the optimization problem are:

$$\lambda \leq v^-, \lambda > 0, \alpha > 0 \tag{9}$$

An inner solution requires the regional government to change its solution parameter and spend a positive share yet less than 100% of the block-grant received in stage 2 on grant-seeking. Assuming the conditions for an inner solution to hold, inequalities (6) and (7) can be written as equations:

$$p\left(\frac{\partial U^+}{\partial \lambda} - \frac{\partial U^-}{\partial \lambda}\right) + \frac{\partial p}{\partial \lambda}\left(U^+ - U^-\right) = -\frac{\partial U^-}{\partial \lambda} \tag{10}$$

$$p\left(\frac{\partial U^+}{\partial \alpha} - \frac{\partial U^-}{\partial \alpha}\right) + \frac{\partial p}{\partial \alpha}\left(U^+ - U^-\right) = -\frac{\partial U^-}{\partial \alpha} \tag{11}$$

Solving (10) and (11) yields the Nash equilibrium values λ^* and α^*. It is reasonable to assume a quasi linear regional utility function with disposable funds serving as numéraire good and $u(\alpha)$ being the disutility of the average policy concession, with $\partial u/\partial \alpha < 0$ and $\partial^2 u/\partial \alpha^2 < 0$.

$$U(v - \lambda, \alpha) = v - \lambda + u(\alpha) \tag{12}$$

Rearranging (10) and (11) then yields:

$$\frac{\partial p}{\partial \lambda}\frac{fF}{K} = 1 \tag{13}$$

$$\frac{\partial p}{\partial \alpha}\frac{fF}{K} = -\frac{\partial u(\alpha)}{\partial \alpha} \tag{14}$$

In order to solve equations (13) and (14) for λ^* and α^* we specify $u(\alpha) = -b\alpha^z$, with $b > 0,\ z > 1$. The parameter $b > 0$ represents the relative weight of the disutility from α compared to λ From the probability definition in (3) the following Nash-equilibrium derivatives can be obtained:

$$\frac{\partial p}{\partial \lambda} = \frac{\partial \pi}{\partial \lambda}\frac{(N-K)}{N^2\pi} = r\frac{(N-K)}{N^2\lambda} \tag{15}$$

$$\frac{\partial p}{\partial \alpha} = \frac{\partial \pi}{\partial \alpha}\frac{(N-K)}{N^2\pi} = (1-r)\frac{(N-K)}{N^2\alpha} \tag{16}$$

Together with (13) and (14) this leads to

$$\lambda^* = r\frac{N-K}{N^2}\frac{fF}{K} \tag{17}$$

$$\alpha^* = \left[(1-r)\frac{N-K}{N^2}\frac{fF}{K}b^{-1}z^{-1}\right]^{\frac{1}{z}} \tag{18}$$

The grant seeking effort is lower than the lump sum grant if the following inequality holds: [2]

$$f < f_{critical} = \frac{NK}{r(N-K)+NK} \tag{19}$$

In those cases where restriction (19) applies, the grant-seeking effort is given by the limit $\lambda^* = v^- = (1-f)F/N$. It is straightforward to see that the $f_{critical}$ increases in K and decreases in r and N. An increase in r leads to a relative higher impact of grant-seeking on the probability of winning the competition. Thus we would expect that overall grant-seeking activities will increase.

[insert figure 1 about here]

[2] Where this restriction applies, the central government faces incentives to set f very large to change the policy vector and at the same time limits the grants-seeking effort due to the restriction (8). Taking this argument to the limit, it will set a value of f just below 1. This strategy is unlikely to work in the real world because of the possibility to cross-subsidize grant-seeking. Incorporating this possibility in the current model would require a number of additional ad hoc assumptions. As we will show below, restriction (19) holds for virtually all realisations of the current model. The restriction applies only to cases with extreme parameter settings. For these cases, we will hereafter assume that the central government will set f and K to the welfare-maximizing internal solution.

Figure 1 shows the critical values of *f* as a function of K/N for $N = 24$ and $N = 100$. In the most restrictive case where $K = 1$, the corner-solution applies for values of $f > 0.53$ with $N = 100$ and $\mathrm{r} = 0.9$. This result changes only marginally when N is reduced to 24. As K increases, the corner-solution only applies to cases where almost all central funds are distributed via conditional grants. As long as restriction (19) holds, λ^* increases in f ($\partial\lambda^*/\partial f = \lambda^*/f > 0$) and decreases in K $\Delta\lambda^*/\Delta K < 0$. It is easy to see that $\alpha^* > 0$ as soon as $f > 0$ and – which is implied by the first condition – $0 < K < N$. At the same time, α^* increases in f ($\partial\alpha^*/\partial f = (1/zf)\alpha^* > 0$) and decreases in K ($\Delta\alpha^*/\Delta K < 0$).[3]

The Nash-equilibrium derived here reveals an essential trade-off: Increasing the share of conditional grants improves overall welfare by causing all regions to apply a more appropriate solution parameter. At the same time, a concomitant increase in grant-seeking effort reduces welfare in all regions. A similar trade-off exists when the central government changes K because both α^* and λ^* decrease in K. The net effect of changes in f and K on welfare thus depends on the production function for X.

The central government aims at maximizing the overall welfare by choosing f and K.

$$\underset{f,K}{Max} \begin{Bmatrix} WF = WF\left(v, \lambda^*, A^o + \alpha^*\right) \quad s.t. \quad 0 < K < N, \quad 0 \le f \le 1, \quad \lambda^* = \lambda(f,K), \\ \alpha^* = \alpha(f,K), \quad v = v(f,K) \end{Bmatrix} \tag{20}$$

We specify the utility of the representative regional consumer by $h\left[X_i\right] = \ln\left(X_i\right)$ such that:[4]

$$WF = q\left(K\,ln\left(v^+ - \lambda^*\right) + \left(N-K\right)ln\left(v^- - \lambda^*\right)\right) + N\left(1-q\right)ln\left(\alpha^* + A^o\right) \tag{21}$$

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[3]Treating K as a real number $\partial\lambda^*/\partial K = -\lambda^* N/\left[K\left(N-K\right)\right] < 0$ and $\partial\alpha^*/\partial K = -\alpha^* N/\left[zK\left(N-K\right)\right] < 0$.

[4] This specification is necessary in order to perform simulations. The simulations were rerun using the alternative specifications $(X_i)^{1/2}$ or simply X_i instead of $\ln(X_i)$ as expression for the welfare of the regional consumer in region i. The results do not differ qualitatively across specifications.

We cannot derive general expressions for the welfare maximizing combination of f and K (hereafter (f^*,K^*)) and use these expressions to show analytically how (f^*,K^*) depends on the exogenous parameters b, A_i^o, q, F, r, z and N. Instead, simulations are used to derive the combination of K and f maximizes WF. In these simulations, we derive the welfare maximizing values (f^*,K^*) for a specific parameter constellation and show how it reacts to changes in parameters. Row 1 in table 2 shows the parameter values in the standard scenario.

[insert table 2 about here]

3.3 Simulation results

In the standard scenario, simulations yield an optimal strategy of the central government $(f^*, K^*) = (0.22, 1)$. Consequently, welfare rises to $WF^* = 26.45$ compared to the $WF_0 = 8.32$ that would emerge without conditional transfers (i. e. for $f = 0$). The regional grant-seeking effort amounts to $\lambda^* = 1.027$ and the change in the policy vector is given by $\alpha^* = 1.024$. The region that received conditional grants uses resources equal to $v^+ - \lambda^* = 7.80 + 52.8 - 1.054 = 59.546$, the remaining N-1 regions use $v^- - \lambda^* = 6.746$. The welfare for the representative regional consumer is given by 2.15 in the recipient region and 1.06 in the N-1 others (see table 3, appendix).

Starting from this standard scenario, we analyse the impact of variations in the exogenous parameters. First, we will turn to the relative weights of α in the regional utility function. The larger the corresponding parameter b, the larger the disutility the regional government witnesses when deviating from A_i^o. The larger b is, the smaller f^*, and the larger the ratio of WF^*/WF_0 (see figure 2 and table 3, appendix). f^* remains below the corner solution threshold (19) here and for all parameter variations to follow. The optimal $K^* = 1$ for all values of b and *z*. [5] The corresponding regional parameters α* and λ* decrease with *f** as *b* increases. The same pattern shows as *z* increases.

[insert figure 2 about here]

The higher A_i^o, the less severe the regional inefficiencies, the larger WF_0 and the higher are opportunity costs of grant-seeking. Consequently, *f** decreases in A_i^o, leading to a reduction in α* and λ*. Again, *K** = *1* for all values of A_i^o. The opportunity costs of grant-seeking increase in *q* while the benefits from changes in α decrease. Thus, *f** decreases in *q*. Again, *K** = *1* for all values of *q*. Only for very large values of *q, K** increases marginally. As a result, α* and λ* are reduced. In simulations where *N* and *F* increase simultaneously such that $F/N = 10$, *f** decreases in *N* while *K**= *1* in all scenarios. Consequently, α* and λ* decrease. When the amount of funds available F/N per region is increased (*N* is kept constant), the welfare-improving responsiveness of α* is initially larger than the welfare-losses to increased grant-seeking. As a consequence, *f** increases in F/N. Again, *K** = *1* for all values of F/N. As a result, α* and λ* increase. The opposite pattern emerges when *N* increases while *F* is kept constant, again with *K** = *1* for all values of *N*. An increasing value of *r* raises productivity of regional grant-seeking relative to changes in α and leads to an increase in λ^* peaking at *r = 0.86*. A further increase in *r* leads to a decrease in λ^* The effect of grant-seeking on the winning probability is then outweighed by the diametrical effect of a smaller share of conditional grants as f^* decreases in *r*.

[5] All relations between dependent variables and exogenous parameters found in the partial parameter variations can be replicated for different values of the constant parameters and in simulations with simultaneous variations in parameters. To avoid excessively long tables in the paper, we do not report all results here. They are available upon request.

3.4. Extension

So far we assumed a four stage game where the regional governments start producing X using the lump sum grant without knowledge whether they will receive the conditional grant or not but have to pre-commit to a certain solution value $A > A^o$. This implies that step-by-step production of X is actually possible. However there may be cases where the local collective good can only be produced in one large step when the full budget is known. This applies to goods where an encompassing concept is necessary before production can take place, for example buildings or the creation of new university degree programmes. In these cases, the central government cannot observe the solution parameter A_i before the conditional grant are distributed. Thus, regions that do not receive the conditional grant rationally stick to A_i^o (i.e. $\alpha_i = 0$ if $v_i = v^-$). We assume that in order not to destroy the chance to receive conditional grants in the future, regions receiving conditional grants apply their chosen α_i offered in their application. In this case the game structure only consists of 3 stages, which are given in table 4.

[insert table 4 about here]

The regional governments will maximize their expected utility according to the problem given in equation (4), but now non-recipient regions face a different utility: $U^- \equiv U\left(v^- - \lambda, 0\right)$. At the same time, the grant seeking expenditure are lost irreversibly. The Lagrange function (5) then changes to

$$Z = pU\left(v^+ - \lambda, \alpha\right) + \left(1 - p\right)U\left(v^- - \lambda, 0\right) - \mu\left(\lambda - v^-\right) \tag{22}$$

Using the same specifications as in the former sections, the first order conditions lead to:

$$\alpha'^{*} = \left[\frac{1}{b} \frac{(N-K)(1-r)}{(N-K)(1-r)+zNK} \frac{fF}{K} \right]^{\frac{1}{z}} \tag{23}$$

$$\lambda'^{*} = r \frac{N-K}{N^2} \frac{fF}{K} \left[\frac{zNK}{(N-K)(1-r)+zNK} \right] \tag{24}$$

Note that for equal exogenous parameters and equal *f* and *K* the optimum value λ'^{*} is lower than λ^{*} and α'^{*} exceeds α^{*}:

$$\frac{\alpha'^{*}}{\alpha^{*}} = \left[\frac{zN^2}{(N-K)(1-r)+zNK} \right]^{\frac{1}{z}} > 1, \qquad \frac{\lambda'^{*}}{\lambda^{*}} = \left[\frac{zNK}{(N-K)(1-r)+zNK} \right] < 1 \tag{25}$$

The inner solution threshold for *f* then becomes:

$$f' < f'_{critical} = \left[\frac{r}{1-r} \frac{N-K}{N} \frac{1}{K} \left(\frac{zNK}{(N-K)(1-r)+zNK} \right) + 1 \right]^{-1} \tag{26}$$

Using simulations it can be shown that the results for $f'_{critical}$ are similar to the results in figure 1.[6] The simulations for the welfare optimization problem of the central government are run using the standard parameter constellation as a starting point (see table 2, row 2). Simulations yield an optimal strategy of the central government *(f*, K*) = (0.49, 16)* and $WF^* = 18.75$ compared to the $WF_0 = 8.32$. The regional grant-seeking effort amounts to $\lambda^* = 0.051$ and the change in the policy vector is given by $\alpha^* = 0.276$. The 16 recipient regions have resources equal to $v^+ - \lambda^* = 4.80 + 6.80 - 0.051 = 11.09$, the remaining *8* regions use $v^- - \lambda^* = 4.29$. The welfare for the representative regional consumer is given by *0.89* in the recipient regions and *0.005* in the others. Compared to the results in reported for the basic model specification, we observe a higher share of conditional grants being distributed among a large number of recipients. As a result WF^*, λ^* α^* and the difference

[6] Simulation results are available on request.

between v^+ and v^- is much smaller. Due to the difference in solutions applied, however, the inequality in welfare of the representative regional consumer is larger.

With respect to K^*, we observe an essential difference between the optimal grant-distribution schemes across model specifications. While it is optimal to give conditional grants only to one region, grants are optimally spread between a large number of recipients in the modified model. Here, $K^* = 1$ is never optimal. It can be observed that the optimal ratio K^*/N varies between 54.2% and 79.2% (i.e. K^* = 13 to 19 when N = 24). In the modified scenario, K^* increases with respect to q, F, N and z and decreases with respect to b, A^0, and r. The patterns described in section 3.3 hold for the modified model presented here (see table 5 and figure 3, appendix).[7] For a given parameter setting, the welfare gains from the optimal grant-distribution scheme in the basic specification exceeds the gains achievable for the modified model.

4. Discussion

The sections above show that conditional grants may be a suitable means of reducing inefficiencies in regional and local collective good production even when they evoke wasteful grant-seeking. The optimal grant-distribution scheme is determined by the preferences of the regional authorities (described by A_i^o , b, z), the number of regions N, the regional production function (described by q), the total funds F , and the relative importance of resources spent on the application for grants as opposed to the efficiency-increasing changes in technology and organisational solutions offered therein (described by r). A larger share of conditional grants is optimal the larger the inefficiencies, the more budget-seeking the regional authorities are, the smaller the number of regions, the more funds are available in total and the more strongly

[7] Note that K is an integer which leads to discontinuities in the trends of f^*, λ^* and α^* on the one and the exogenous parameters on the other side. Within each interval of the varied parameter, where K^* is constant, f^*, λ^* and α^* follow a similar pattern as in the basic scenario. For some parameter variations such as A^0 the dependent variables reveal a slightly different behaviour for extreme parameter settings.

the distribution of grants depends on the technological and organisational changes. In addition, we show that the optimal grant-distribution scheme depends on whether the collective good can be produced in a stepwise procedure and extended when more funds are available (case 1, section 3.1-3.3) or whether the full amount needs to be produced in one step (case 2, section 3.4). In case 1, it is optimal to concentrate conditional grants to one region while a wide dispersion of conditional grants is optimal in case 2. Compared to case 2, the optimal share of conditional grants in case 1 is lower but nevertheless induces higher changes in technology and organisational structure and higher net welfare gains.

The rationale behind these distinctly different solutions is the following: In case 1, all regions – regardless of their later success in the grant-distribution process – have to pre-commit to certain improvements in the technological or organisational solution. Thus, high incentives for efficiency improvements need to be combined with a limited inequality in funding ex post. This is best achieved by combining a substantial block grant with one large extra grant to a single region. In case 2, efficiency gains can only be expected for regions receiving conditional grants. Thus, these must be spread widely among regions. To keep up incentives in this case, a substantial share of funds is conditional. Keeping the block grant to non-recipient regions low has much lower opportunity costs in case 2 because these regions apply inefficient technological and organisational solutions. These results also indicate that a benevolent central government must distribute funds as described in the 4-stage game whenever this is possible.

Our model focuses on the trade-off between efficiency-gains induced by conditional grants and the welfare-losses due to wasteful grant-seeking. Given this focus, it ignores the fact that many conditional grants are matching grants and require co-financing by regular regional revenues (e.g., Fenge and Wrede, 2007). By redirecting funds to subsidized goods, they have additional welfare implications that are not captured in our model. If inefficiencies only occur in the production of *X*, and the other goods do not produce fiscal externalities or spillovers, our model overstates the gains from conditional grants and suggests inefficiently high values of *f* respectively low values for *K*. Apart from that, there is no reason to assume that the general conclusions of the model and the way the optimal grant-distribution scheme reacts to variations in central parameters do not hold.[8]

The applicability of conditional grants depends on a number of preconditions (e.g., Chernick, 1979; Ferris and Winkler, 1991). First, the central government must be able to verify that grantees follow certain organisational and technological standards of production. Second, there must be implicit or explicit sanctions for those grantees that do not follow the standards proposed in the application or provide a lower quality of goods and services. In many cases, the threat to be banned from future application rounds is a very effective instrument to ensure compliance. These preconditions are not met if the distribution of information between regional and central government is highly asymmetric. In this case, opportunistic regional governments can apply A_i^o regardless of the solutions initially stated in the application without having to fear sanctions (e.g., Boadway et al., 1999; Gilbert and Rocaboy, 2004). Consequently, conditional grants do not have any impact on the solutions applied in collective good production. Given that they nevertheless evoke wasteful grant-seeking, their welfare effects are negative.

The third condition for the applicability of conditional funds refers to the central government's motivation. So far, we assumed that the central government maximizes welfare and takes grant-seeking as necessary costs of introducing efficiency gains. If, however, the central government is not benevolent, it may even cause net losses in welfare when being allowed to introduce conditional grants. First, the central government may concentrate conditional grants to so-called swing regions in order to maximize political support for their

8 In cases where the other regionally provided goods are subject to inefficiencies, fiscal externalities or spillovers, it is not possible to make generalizable statements concerning the welfare-implications.

own re-election campaign (i.e. Dixit, A. and Londregan, J., 1996; Dahlberg, M. and Johansson, E., 2002). Second, it may allocate grants primarily to those regions where the incumbent belongs to the same party. In these cases, gains in regional efficiency are no longer the primary concern. If the prioritized recipients know this, they will offer smaller changes in technological and organisational solutions. In the context of our model, this means region-specific functions for π_i and a large value for r. Welfare gains are expected to be smaller. Third, the central government may be interested in extracting rents (e.g. McChesney, 1997; Page, 2005). In this case, it will operate with a value of $r \approx 1$ and set $f > f^*$ and $K < K^*$. If rent-extraction is the only aim, f finds its limit only in expression (15) respectively (26). In the scenario of section 3.2 and 3.3, the inner solution threshold for f is given by $f_{critical} = 0.537$. Choosing $f = 0.5$ and $r = 0.9$ the solution change becomes $\alpha = 0.69$ $(\alpha^*(f^*, K^*) = 0.38)$ and the grant-seeking expenditures extend to $\lambda = 4.31$ ($\lambda^*(f^*, K^*) = 1.29$).[9] This causes massive net welfare losses due to grant seeking compared to a solution without conditional grants $(\Delta WF / WF_0 = -1.39)$. For the modified scenario in section 3.4 the results are even more severe as the central government will not only employ $f = 0.5$ ($f_{critical} = 0.55$) but also $K = 1$. Here, the winner's solution change $\alpha = 3.31$ exceeds the solution change when net welfare is maximized ($\alpha^*(f^*, K^*) = 0.12$), but net welfare with conditional grants is lower than without conditional grants ($\Delta WF / WF_0 = -3.03$) due to excessive grant-seeking activities $\lambda = 4.12$ $(\lambda^*(f^*, K^*) = 0.08)$ among all N regions.

Given that welfare-improving effect of limiting the social costs of grant-seeking, the following question arises: Is it possible to limit grant-seeking expenditures through institutional rules? Good institutional rules lead to a small value for parameter r in the model presented here. With respect to the mere costs of preparing applications, the central government may well limit the effort, e.g. by limiting the length of the application to a few

[9] The other parameters are left at the standard scenario values (see table 2).

pages and limiting the number of applications per region. However, if the projects are complex, limiting application length makes it more difficult to judge the quality of the proposed project. Moreover, the application is not the only effort-consuming activity in the process of grant-seeking. In addition, regions may invest in public relations to improve their image or exert public pressure on the central government to press them for grants (e.g., Tullock, 1993). These activities are beyond the control of the central government and they are very difficult to restrict unless the latter can credibly commit to ignore them. A credible commitment to a small value of r is possible if the selection procedure is double-blind or outsourced to a neutral institution. The Australian Commonwealth Grant Commission can be interpreted as an attempt to keep r low (e.g., Worthington and Dollery, 1998). Another effective way to limit wasteful grant-seeking is to install an administration fee for every application. While it leaves the total grant-seeking expenditures λ^* unaltered, it can restrict the degree to which they represent social waste.

5. Conclusion

This paper addresses the welfare-effects of conditional project grants when there are inefficiencies in regional collective good production. Conditional grants can improve efficiency but they also evoke wasteful grant-seeking. We use a game-theoretic framework to derive the welfare-maximizing grant-distribution scheme for the central government. This optimal scheme involves some share of funds to be distributed as conditional grants regardless of the regional characteristics. Conditional grants are effective and thus should be used intensively if the regional governments are budget-maximizers with loose preferences for specific technological or organisational solutions in collective good production. A number of other factors are found to co-determine the efficient grant-distribution scheme. Most importantly, the central government should distribute block grants and conditional grants in two consecutive steps whenever this is possible. Thereby, they can force all regional authorities to pre-commit to more efficient technological and organisational solutions n in collective good production before conditional grants are distributed. In order to restrict the costs of grant-seeking, it can set an application fee or make a binding commitment to make grant-seeking expenditures that go beyond the necessary costs of preparing the application ineffective.

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Appendix

Table 1: 4-stage game structure

Stage	Activity
1	The central government sets f and K and gives the lump sum grants to the regional governments.
2	The regional governments choose λ (grant seeking) and α (solution change) given f and K and start the production of X using $v_i^- - \lambda_i$ and α_i .
3	The central government observes the technological standard used by the regions in step 2 and then distributes the conditional grants fF/K among the K winning regions of the competition.
4	The recipient regions produce more X using funds from the received conditional grants.

Table 2: Standard parameter values (reference scenario), the 3-stage game refers to section 3.4.

	Standard parameter values							Simulation results						
	N	F	q	b	A^0	z	r	f^*	K^*	α^*	λ^*	WF^*	WF_0	K^*/N
4-Stage game	24	240	0,500	0,500	0,200	2,000	0,500	0,220	1	1,027	1,054	26,45	8,32	0,04
3-Stage game	24	240	0,500	0,500	0,200	2,000	0,500	0,490	16	0,276	0,051	14,24	8,32	0,67

Table 3: Selected simulation results, 4-stage game[10]

Parameter varied	Variation	*f**	*K**	*α**	*λ**	*WF**	WF_0	*WF* recipient	*WF* non-recipient.	*K*/N*
b	0,100	0,230	1	2,347	1,102	34,98	8,32	2,53	1,41	0,04
	0,250	0,220	1	1,452	1,054	30,02	8,32	2,29	1,21	0,04
	0,500	0,220	1	1,027	1,054	26,45	8,32	2,15	1,06	0,04
	0,750	0,210	1	0,819	1,006	24,45	8,32	2,03	0,97	0,04
	0,900	0,210	1	0,748	1,006	23,58	8,32	2,00	0,94	0,04
A^0	0,300	0,210	1	1,003	1,006	27,40	13,18	2,16	1,10	0,04
	0,750	0,160	1	0,876	0,767	31,12	24,18	2,16	1,26	0,04
	1,500	0,110	1	0,726	0,527	35,81	32,50	2,17	1,46	0,04
	2,250	0,090	1	0,657	0,431	39,35	37,36	2,24	1,61	0,04
	2,700	0,070	1	0,579	0,335	41,10	39,55	2,22	1,69	0,04
q	0,100	0,550	1	1,623	2,635	14,90	-29,24	1,03	0,60	0,04
	0,250	0,400	1	1,384	1,917	17,53	-15,15	1,50	0,70	0,04
	0,500	0,220	1	1,027	1,054	26,45	8,32	2,15	1,06	0,04
	0,750	0,100	1	0,692	0,479	38,89	31,79	2,58	1,58	0,04
	0,900	0,040	1	0,438	0,192	47,97	45,87	2,61	1,97	0,04
N,	40	0,210	1	1,012	1,024	43,69	13,86	2,35	1,06	0,03
F = 10N	64	0,200	1	0,992	0,984	69,44	22,18	2,54	1,06	0,02
	104	0,200	1	0,995	0,990	112,24	36,04	2,77	1,06	0,01
	144	0,200	1	0,997	0,993	154,97	49,91	2,93	1,06	0,01
	168	0,200	1	0,997	0,994	180,58	58,22	3,01	1,06	0,01
F,	240	0,220	1	1,027	1,054	26,45	8,32	2,15	1,06	0,04
N = 24	600	0,230	1	1,660	2,755	42,20	19,31	2,83	1,71	0,04
	1200	0,230	1	2,347	5,510	54,29	27,63	3,33	2,22	0,04
	1800	0,230	1	2,875	8,266	61,42	32,50	3,63	2,51	0,04
	2160	0,230	1	3,149	9,919	64,63	34,68	3,76	2,65	0,04
N,	40	0,200	1	0,765	0,585	29,32	3,65	1,96	0,70	0,03
F = 240	64	0,190	1	0,592	0,351	25,62	-9,21	1,82	0,38	0,02
	104	0,180	1	0,454	0,206	6,70	-40,21	1,69	0,05	0,01
	144	0,170	1	0,375	0,141	-22,43	-79,10	1,59	-0,17	0,01
	168	0,160	1	0,337	0,114	-43,46	-105,23	1,53	-0,27	0,01
r	0,100	0,310	1	1,635	0,297	31,19	8,32	2,50	1,25	0,04
	0,250	0,270	1	1,393	0,647	29,52	8,32	2,37	1,18	0,04
	0,500	0,220	1	1,027	1,054	26,45	8,32	2,15	1,06	0,04
	0,750	0,180	1	0,657	1,294	22,32	8,32	1,88	0,89	0,04
	0,900	0,150	1	0,379	1,294	18,04	8,32	1,61	0,71	0,04
z	1,175	0,310	1	2,202	1,485	32,13	8,32	2,63	1,28	0,04
	1,475	0,270	1	1,464	1,294	28,86	8,32	2,38	1,15	0,04
	1,975	0,220	1	1,034	1,054	26,52	8,32	2,15	1,06	0,04
	2,475	0,190	1	0,883	0,910	25,63	8,32	2,02	1,03	0,04
	2,775	0,170	1	0,825	0,815	25,39	8,32	1,95	1,02	0,04

[10] As noted above detailed simulation results are available upon request. Parameters which are not varied are left at their standard values (see table 2).

Table 4: 3-stage game structure

Stage	Activity
1	The central government sets f and K.
2	The regional governments choose λ (grant seeking) and α (solution change) given f and K.
3	X is produced.

Table 5: Selected simulation results, 3-stage game[11]

Parameter varied	Variation	*f**	*K**	*α**	*λ**	*WF**	WF_0	*WF* recipient	*WF* non-recipient.	*K*/N*
b	0,100	0,610	18	0,530	0,042	18,75	8,32	1,085	-0,130	0,75
	0,250	0,540	17	0,361	0,046	16,00	8,32	0.961	-0,047	0,71
	0,500	0,490	16	0,276	0,051	14,24	8,32	0,888	0,005	0,67
	0,750	0,470	16	0,221	0,049	13,35	8,32	0,822	0,025	0,67
	0,900	0,460	16	0,199	0,048	12,97	8,32	0,794	0,034	0,67
A^0	0,300	0,450	16	0,264	0,047	17,41	13,18	0,965	0,246	0,67
	0,750	0,290	14	0,271	0,043	25,89	24,18	1,254	0,833	0,58
	1,500	0,200	13	0,254	0,035	33,26	32,50	1,509	1,240	0,54
	2,250	0,160	13	0,227	0,028	37,82	37,36	1,667	1,468	0,54
	2,700	0,140	13	0,213	0,024	39,91	39,55	1,741	1,571	0,54
q	0,100	0,840	15	0,409	0,104	-15,32	-29,24	-0,177	-1,408	0,63
	0,250	0,700	16	0,330	0,073	-4,74	-15,15	0,173	-0,939	0,67
	0,500	0,490	16	0,276	0,051	14,24	8,32	0,888	0,005	0,67
	0,750	0,320	17	0,196	0,027	34,20	31,79	1,587	1,032	0,71
	0,900	0,180	17	0,147	0,015	46,62	45,87	2,030	1,731	0,71
N,	40	0,450	26	0,216	0,030	21,93	13,86	-0,567	-0,971	0,65
F = 10N	64	0,430	41	0,171	0,019	32,76	22,18	-0,591	-0,950	0,64
	104	0,390	64	0,138	0,012	49,85	36,04	-0,626	-0,930	0,62
	144	0,360	86	0,119	0,008	66,28	49,91	-0,644	-0,917	0,60
	168	0,350	100	0,109	0,007	75,94	58,22	-0,650	0,910	0,60
F,	240	0,490	16	0,276	0,051	14,24	8,32	-0,523	-0,994	0,67
N = 24	600	0,550	17	0,407	0,117	27,62	19,31	0,021	-0,598	0,71
	1200	0,610	18	0,530	0,211	38,07	27,63	0,430	-0,303	0,75
	1800	0,620	18	0,655	0,322	44,29	32,50	0,694	-0,119	0,75
	2160	0,620	18	0,718	0,386	47,12	34,68	0,815	-0,038	0,75
N,	40	0,410	25	0,171	0,018	10,11	3,65	-0,857	-1,199	0,63
F = 240	64	0,350	38	0,109	0,007	-2,55	-9,21	-1,148	-1,401	0,59
	104	0,270	58	0,065	0,002	-33,69	-40,21	-1,434	-1,614	0,56
	144	0,230	77	0,047	0,001	-72,84	-79,10	-1,621	-1,765	0,53
	168	0,210	88	0,039	0,001	-99,12	-105,23	-1,706	-1,831	0,52
r	0,100	0,550	17	0,345	0,009	15,76	8,32	0,949	-0,054	0,71
	0,250	0,540	17	0,312	0,023	15,27	8,32	0,916	-0,044	0,71
	0,500	0,490	16	0,276	0,051	14,24	8,32	0,888	-0,005	0,67
	0,750	0,450	16	0,187	0,070	12,74	8,32	0,776	0,041	0,67
	0,900	0,370	15	0,122	0,083	11,19	8,32	0,681	0,109	0,63
z	1,175	0,400	10	0,521	0,114	13,21	8,32	1,207	0,082	0,42
	1,475	0,440	13	0,327	0,077	13,37	8,32	0,986	0,050	0,54
	1,975	0,490	16	0,273	0,051	14,20	8,32	0,885	0,005	0,67
	2,475	0,530	18	0,271	0,037	15,18	8,32	0,855	-0,035	0,75
	2,775	0,560	19	0,275	0,031	15,75	8,32	0,847	-0,067	0,79

[11] As noted above detailed simulation results are available upon request. Parameters which are not varied are left at their standard values (see table 2).

Figure 1: Threshold values for *f* (inner solution threshold)

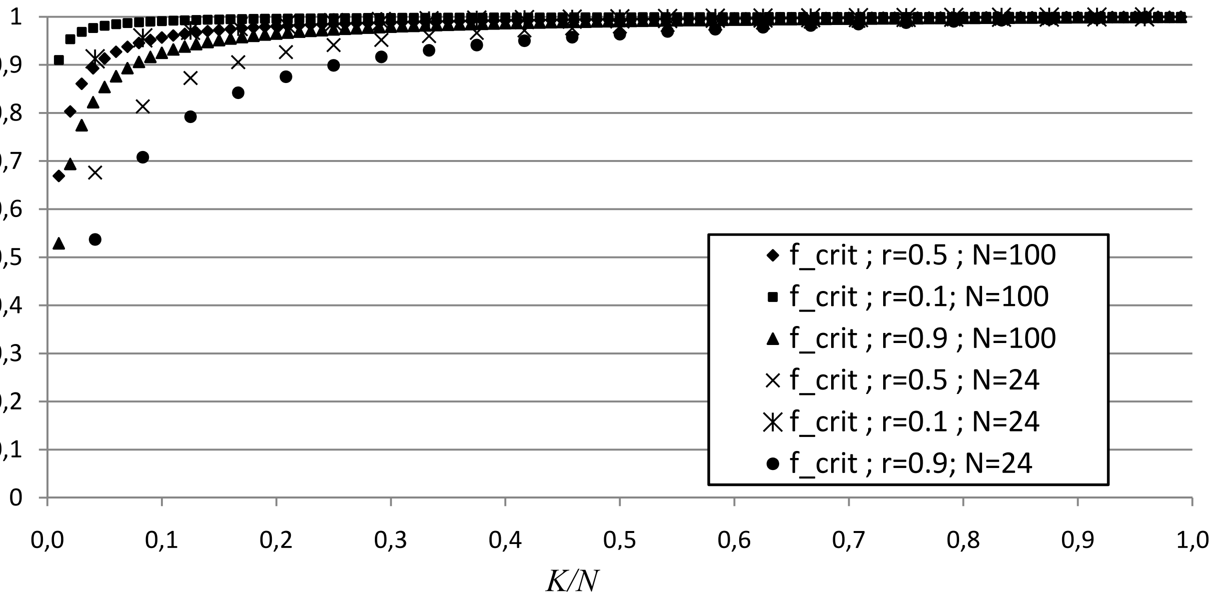

Figure 2: Simulation results for *b* (4-stage game). The right axis refers to λ and *f*.

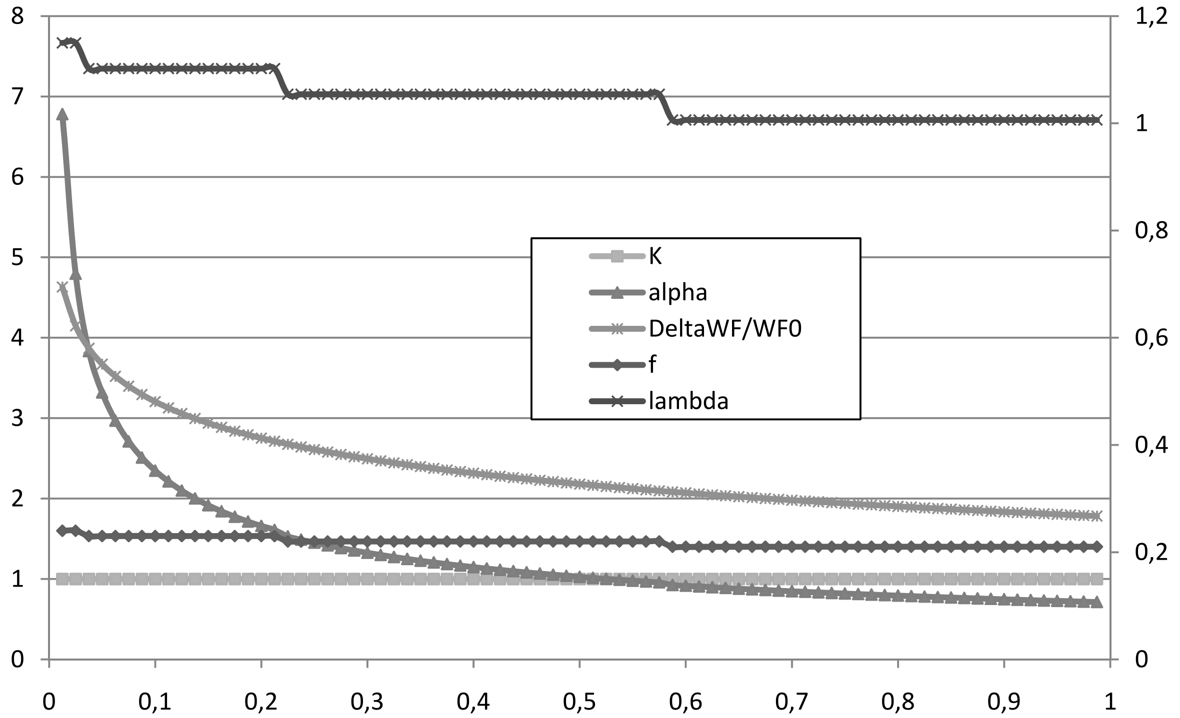

Figure 3: Simulation results at variation of *b* (3-stage game). The right axis refers to *K*.