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Efficiency and Equity in Block Grant Design: Simulating some Alternatives for Flemish Municipalities

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ABSTRACT

The purpose of this research memorandum is to present grant allocation mechanisms which take account of both the efficiency and the equity reasons involved in grant distribution. These schemes share a number of desirable characteristics.

Efficiency considerations are incorporated by allocating part of the grant on the basis of 'standard' municipal expenditures. These expenditures reflect the demand for local public services and the impact of spillover effects on municipal outlays. Equity considerations are captured by reserving part of the grant budget for redistributive purposes. Three specifications for the equity component of our grant proposal are suggested. The basic idea behind each of them is to correct for differences in local taxbases.

We simulate the outcome of these three specific proposals and compare the results both with the existing grant allocation mechanism and with a recent policy proposal formulated by the Ministry of Internal Affairs.

EFFICIENCY AND EQUITY IN BLOCK GRANT DESIGN : SIMULATING SOME ALTERNATIVES FOR FLEMISH MUNICIPALITIES

INTRODUCTION

The purpose of this paper is to provide some insight into the implications of alternative mechanisms of distributing unconditional block grants to local authorities. These mechanisms are applied to the allocation of grants from the intermediate Flemish government to the municipalities in the Flemish region. We consider alternative grant allocation schemes that share a number of desirable characteristics derived from the literature on fiscal federalism. The allocation resulting from the application of the proposed schemes is compared with the observed grant distribution and with the allocation implied by a recent proposal formulated by the Ministry of Internal Affairs.

The paper is structured as follows. In Section 1 we describe grant distribution mechanisms which take account of the corrective role of grants from both the efficiency and equity viewpoint. A family of implementable mechanisms, each consisting of an explicit efficiency and equity component, is proposed. Within this general framework we formulate several more specific grant allocation schemes in Section 2. The efficiency component, which is common to all alternatives considered, is specified on the basis of 'standard' municipal expenditures obtained as the predictions resulting from an explanatory regression model. The allocation schemes differ from one another due to the specification of the equity component. Out of a much larger set of possibilities we consider three attractive alternatives, each of which reflects the desirability of correcting inequities in the distribution of taxbases among municipalities.

The remainder of the paper deals with the

comparison of alternative grant distribution mechanisms. In Section 3 the current allocation scheme in the Flemish region, in which municipalities are classified into fourteen cells, is briefly described. Using the cell classification we report the implications of three concrete proposals for the distribution of grants in Section 4. We compare the consequences of our proposed mechanisms with the existing system as well as with the recent proposal of the Ministry of Internal Affairs. Unfortunately, it will become obvious from the analysis that use of the cell classification does not provide much information with respect to the characteristics of the municipalities that would be most strongly affected by the introduction of the proposed grant distribution schemes. Therefore, the analysis is also replicated using an alternative classification of Flemish municipalities based on cluster analysis. We investigate the implications of our proposals for the distribution of grants over clusters of municipalities with 'similar' characteristics. This allows us to identify which types of municipalities would gain or lose under the allocation schemes we developed in comparison with both the current allocation and the allocation proposed by the Ministry of Internal Affairs. Finally, some general conclusions and policy recommendations are formulated in Section 5.

1. A FAMILY OF GRANT ALLOCATION MECHANISMS

In the second best models on fiscal federalism (see, e.g., Atkinson (1980) and Tresch (1981)) there is a consensus on two reasons for grants from higher to lower level governments. The first one relates to the externalities generated by local public good provision. These include the benefit spillovers of urban centres, externalities associated with schooling, etc. The central government's role is to correct for allocative distortions, e.g. the underprovision of public services generating positive external effects. The second reason concerns the redistributive task of the central government to correct for differences in local taxbases[1].

The above very general guidelines suggest the desirability of designing actual allocation mechanisms that reflect both efficiency and equity considerations. The most obvious way to meet this requirement is to design schemes that contain separate efficiency and equity components. As spelled out below, this is the approach taken in this paper. However, to limit the range of potential grant distribution schemes meeting these general conditions it seems desirable to require that some additional intuitive criteria be met. In a well known paper Le Grand (1975) suggests three such criteria. First, he argues that grants should be a function of the income or wealth of a community. A second criterion requires grants to be independent of any expenditure decisions of local authorities. Finally, Le Grand suggests that grants should vary directly with municipalities' own fiscal effort.

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[1] It is fair to say that the role of grants-in-aid is still very incompletely understood. Therefore questions on the optimal design of central governments grants have remained largely unanswered : see especially Tresch (1981), p. 625-631. Gramlich (1977) reviews the empirical literature.

Note that Le Grand's second and third condition may well be inconsistent (see, e.g. Tresch (1981, p. 627)). While the second criterion conforms to the federalist ideal of non-interference of the grantor government and to the non-manipulability of the grants received, the third criterion fails on both accounts. Distributing grants according to own fiscal efforts may induce local governments to increase taxes and outlays and hence the overall level of the budget may be affected. In order to avoid this undesirable potential side-effect we focus in this paper on grant distribution mechanisms that are completely independent of both the expenditure and the taxing decisions of the local authorities.

With the above ideas in mind we consider a family of grant allocation schemes that are simple linear functions of their efficiency and equity components and that are not directly manipulable by the municipalities. We discuss both components in turn.

The efficiency component is defined on the basis of what we call 'standard' expenditures. For each municipality these reflect the typical expenditures of municipalities with similar social and economic characteristics. To be more precise, standard expenditures are derived as the predictions resulting from an empirical model explaining local government expenditures on the basis of a set of relevant determinants derived from the literature. The explanatory variables include spillover effects and a number of determinants of the demand for public outlays by local residents. Allocating grants partially on the basis of standard expenditures may therefore be interpreted as a crude reflection of the first corrective role of grants, viz. to correct inefficiencies.

The equity component should capture the central government's redistributive preferences regarding inequities in the distribution of income among local governments. To meet the condition of non-manipulability it should be defined to

take account of the differences in local taxbases without incorporating variables under the control of the local authorities. For example, actual tax rates are to be excluded.

The previous discussion leads us to specify a family of grant allocation mechanisms of the form :

$$\text{Grant}_i = \alpha \text{ Standexp}_i + \beta \text{ Redistribution}_i \qquad (1)$$

where

Grant_i is the proposed grant per capita for the municipality i

Standexp_i are the standard expenditures per capita for municipality i

Redistribution_i is the value of the explicit redistributional component for municipality i, also on a per capita basis.

In principle, the parameters α and β can be chosen by the central government according to their preferences with respect to the efficiency-equity trade-off, and depending on the overall budget available. The detailed specification of the efficiency and equity components and the determination of the parameters for the empirical application will be discussed in Section 2 below.

Apart from the desirable characteristics previously mentioned, the above family of grant design proposals has an additionnal interesting feature. Indeed, note that the resulting grants are a continuous and positive monotonic function of their components. As indicated in Section 3, one of the major problems with the current system is precisely its discontinuity. Note also that our proposals treat all municipalities on an equal basis and hence an elementary notion of horizontal equity is respected. Under the current grant allocation system some parts of the budget are a priori reserved for distribution among some priviliged sets of

municipalities (see Section 3 for details).

2. IMPLEMENTING GRANT ALLOCATION MECHANISMS

In this section we specify in more detail the grant allocation mechanisms that will be empirically analyzed in this paper. We consecutively discuss the specification of standard expenditures for any given municipality, propose three alternative specifications for the redistributional component, and explain the determination of the parameters α and β in the simulation exercise that follows.

2.1. Determination of standard expenditures

Cross section models of municipal expenditures reveal a considerable spread in actual outlays. In the literature at least five factors have been found to account for the observed variations. First, local authorities differ from one another in residents needs. A second dimension is related to the income and wealth tax base of resident individuals and enterprises and thus to the budgetary and taxing capacity of a local government. Third, benefit spillovers of urban centres may create substantial surplus outlays. Examples are local schools, libraries, municipal hospitals, cultural heritages, etc. Fourth, the transmission of voter preferences in the political decision making process may be distorted due to , e.g., the existence of pressure groups and reelection considerations of politicians. This modulation of voters demands for local public goods may well result in above optimal expenditures. Finally, the implementation of political decisions can be influenced by bureaucratic inefficiencies, budgetmaximizing behavior, etc.

The model we have estimated takes account of the

most important factors considered in the literature on local public goods demand[2]. Indeed, expenditures are explained by variables indicating residents needs, wealth, and benefit spillovers. The political and bureaucratic factors are not considered here mainly due to the unavailability of the relevant data. To be specific, in our model per capita municipal expenditures (Exp) are explained by the following list of need variables : the share of the elderly in the population (Old), the share of people receiving income grants (Poor), the share of industrial workers in the active population (Industry), the number of privately owned houses (Houses), and the population density (Density). The wealth variable is defined as the imputed tax base for homeownership (Wealth). The index for spillover functions (Spillover) is defined as the ratio of the active population not living in the municipality to the total active population. Our model is linear in the parameters and all variables were transformed in logarithms prior to estimation.

To restrict the application of the regression model we excluded outliers for which the implied model may not be appropriate. Various methods to detect outliers are available[3]. We used the method of studentized deleted residuals. More details are provided in Appendix A. The resulting 9 outliers were deleted from the sample and the model was reestimated on the remaining 299 observations. This drastic remedy to the outlierproblem seems to be warranted since we want to avoid too strong policy implications for individual cases.

The resulting OLS regression results based on 1985 data for 299 Flemish municipalities were as follows :

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[2] See e.g. Bergstrom (1973), Borcherding (1972), Pommerehne (1978).

[3] See Belsley (1980) and Atkinson (1985).

$$
\begin{aligned}
Exp = \; & \underset{(.31)^{**}}{4.80}\ Constant + \underset{(.02)^{**}}{.12}\ Houses + \underset{(.32)}{.41}\ Old + \underset{(.12)^{*}}{.30}\ Industry \\
& + \underset{(12.17)^{**}}{32.68}\ Spillover + \underset{(23.84)^{*}}{48.85}\ Density + \underset{(.03)^{**}}{.37}\ Wealth + \underset{(.03)^{**}}{.07}\ Poor \\
& R^2 = .66 \\
& SER = .15 \qquad\qquad (2) \\
& N = 299
\end{aligned}
$$

where standard errors are between brackets and the * and the ** indicate significance at respectively the 95% and the 99% level. A comparison of the estimated equation with the regression based on the full sample (see Appendix A) shows that the deletion of the nine outliers results in an improvement of both the R-squared and the standard error of the regression.

In order to see whether the model conforms to the assumptions under which OLS provides a Best Linear Unbiased Estimator (BLUE) we checked both for normality of the residuals and for homoskedasticity. The normal probability plots and the results of White's test for heteroscedasticity[4] reported in Appendix B suggest that none of the standard OLS assumptions could be rejected.

As previously indicated, the predictions generated by regression equation (2) will be interpreted as the standard expenditures of a municipality. They reflect the typical expenditures for a municipality with a given set of characteristics, as measured by the values of the explanatory variables in the regression.

2.2. Specification of the equity component

Consistent with the general remarks made in Section 1 with respect to the positive nature of the grants and the exclusion of current tax rates, we consider - out of an almost infinite number of possibilities - three proposals

[4] For a discussion see Amemyia (1985).

which have in common their non-manipulability and their relative simplicity. The latter consideration may be important in the phase of policy implementation because simple formulas may be more appealing to policy makers.

A first proposal is to redistribute grants inversely proportional to the share of the local taxbase in the overall taxbase, where both income and wealth taxes are taken into account. The proposal, denoted Red1, defines the equity component for municipality i on the basis of the following expression :

$$\text{Red1}_i = 1 \,/\, [\text{Share Income Tax}_i + \text{Share Wealth Tax}_i] \qquad (3)$$

where

$$\text{Share Income Tax}_i = \frac{(\text{Revenue of 1\% Income Tax}_i)}{\Sigma_i(\text{Revenue of 1\% Income Tax}_i)}$$

Share Wealth Tax is defined in an analoguous way.
The interpretation of this proposal is straightforward. It redistributes towards municipalities with relatively small local taxbases.

A second alternative proposal is to redistribute according to the gap between the standard expenditures and the concept of 'standard tax revenues'. The latter are defined as the tax revenues a municipality would generate if it applied the average tax rates observed for the region as a whole. This proposal (Red2) implies a redistributive component for a given municipality that directly varies with the municipal budget deficit that is to be expected for municipalities with the same characteristics and applying average tax rates. It can be written as :

$$\text{Red2}_i = \text{Standexp}_i - \text{Standard Tax Revenue}_i \qquad (4)$$

where Standard Tax Revenue$_i$ = (Revenue of 1% Income Tax in i * Average Income Tax Rate) + (Revenue of 1% Wealth Tax in i * Average Wealth Tax Rate).

Finally, a third proposal considered in this paper (Red3) consists of distributing grants inversely proportional to the standard tax revenues themselves. Specifically :

$$Red3_i = 1/(\text{Standard Tax Revenue}_i) \qquad (5)$$

Note that this third proposal is closely related to the first one in the sense that they both redistribute grants inversely proportional to some concept of local taxbase. On the other hand the interpretation of the second proposal may be slightly different. The standard expenditures can be seen as some target level of local government outlays deemed essential to the production of local public goods. The proposal then bridges the gap between this target level and the potential local taxbase. This proposal might result as a consequence of the government's desire to guarantee a minimum level of local public goods to all citizens. Note in general that all three redistributional components may be compatible with a wide range of equity objectives - utilitarian or non-utilitarian.

2.3. Determination of the parameters of the grant distribution mechanisms

The parameters α and β which reflect the relative weight of the efficiency and equity components in the general grant distribution mechanism (1) have to be determined in practice on the basis of the strength of the government's redistributive preferences and the size of the overall grant budget to be allocated.

With respect to the latter, we assumed the budget to be allocated to be equal to the actual 1985 budget. This allows us to directly compare the effects of our proposals with the observed allocation for 1985, the year to which our

data refer. Regarding the former, the relative weight to be given to the redistributive component was determined using the preferences revealed in a recent policy proposal. A proposal formulated by the Ministry of Internal Affairs explicitly suggests to reserve 30% of the overall grant budget for redistributive purposes. In order to facilitate the comparison of our results with those implied by this latter proposal we have incorporated these revealed preferences into our calculations. However, to illustrate the sensitivity of the resulting grants with respect to the redistributional assumptions we also calculated a 0%, a 50%, a 70% and a 100% share of the equity component in the overall grant budget.

Specifically, let the overall grant budget be given by B. Suppose that a fraction δ of this budget is reserved for the redistributive component, while a fraction $(1-\delta)$ is to be allocated on the basis of the standard expenditures. The parameter α is then determined by

$$(1-\delta)\ B = \alpha\ \Sigma_i\ \text{Standexp}_i \tag{6}$$

from which it follows that

$$\alpha = ((1-\delta)B)/(\Sigma_i\ \text{Standexp}_i). \tag{7}$$

The parameter β is determined in an analogous way. Note, however, that its value will differ depending on the specification of the equity component. For redistributive component Redj (j=1,2,3) the corresponding parameter β_j is found as the solution of

$$\delta\ B = \beta_j\ \Sigma_i\ \text{Redj}_i$$

where the Redj's have been defined by equations (3), (4) and (5).

As an example, consider the case where δ = 0,3.

Application of the above procedure leads to the following three proposals :

Proposal 1 $Grant1_i = 0.163\ Standexp_i + 28089.964\ Red1_i$ (8)

Proposal 2 $Grant2_i = 0.163\ Standexp_i + 0.117\ Red2_i$ (9)

Proposal 3 $Grant3_i = 0.163\ Standexp_i + 105490733886.456\ Red3_i$ (10)

where the Redj (j=1,2,3) are defined as in (3), (4), and (5) respectively.

3. THE CURRENT GRANT ALLOCATION SYSTEM

In order to compare the simulated results following from our alternative proposals with the observed grant allocation system it is useful to summarize the current system. The distribution of the grants is the responsability of the government of the Flemish region[5]. The local governments are classified into fourteen different classes according to two criteria : the number of inhabitants and the active population in the municipality relative to its population. The overall grant budget is distributed over the cells mainly on the basis of past expenditure levels and population density. However, it is important to note that the urban centres situated in cells 13 and 14 have a special status in the allocation mechanism as a large share of the overall budget is a priori reserved for distribution among them. Moreover, the municipalities along the coast are also treated in a special way. They have an additional weight in the grant distribution, independent of the cell they happen to belong to.

[5] For details see Vanneste (1986).

After the overall grant has been allocated to the fourteen cells they are further distributed to the individual municipalities according to a variety of criteria, some of which intend to capture differences in needs, in fiscal capacity and in spillover effects. Interestingly, the criteria to distribute the overall cell grant to the individual members differ substantially from one cell to another.

One of the major drawbacks of the current grant distribution system is the lack of continuity and monotonicity implied by the cell classification. For example, relatively minor changes in population may move a municipality into a different cell with sometimes drastic implications for the grant to be received. Also note that the actual outlays determine to some extent the grant distribution. The determination of the grants can therefore be partly affected by the local authorities themselves.

In Table 1 we present the observed average per capita grant in each cell for 1985 based on all 308 municipalities. Note that cell XIV consists of only two observations, viz. the cities of Antwerp and Ghent. Not surprisingly, both turned out to be outliers in the regression analysis previously reported. Cell XIV will therefore be discarded in the remainder of this paper. This implies that our analysis will have nothing to say about the grants allocated to the two largest Flemish cities.

Table 1 : Current Cell Classification of the Flemish municipalities and the average grant per capita

<table>
<tr><th rowspan="2"></th><th colspan="4">Active population relative to population</th></tr>
<tr><th>< 0.2</th><th>0.2<0.3</th><th>0.3<0.4</th><th>0.4<0.5 >0.5</th></tr>
<tr><td>Population <5000</td><td>Cell 1
2870</td><td colspan="3">Cell 2
3092</td></tr>
<tr><td>5000-10000</td><td>Cell 3
2555</td><td>Cell 4
2636</td><td colspan="2">Cell 5
2695</td></tr>
<tr><td>10000-20000</td><td>Cell 6
2689</td><td>Cell 7
3030</td><td>Cell 8
3314</td><td>Cell 9
3789</td></tr>
<tr><td>20000-50000</td><td colspan="2">Cell 10
3651</td><td>Cell 11
3840</td><td>Cell 12
4638</td></tr>
<tr><td>50000-150000</td><td colspan="4">Cell 13
6699</td></tr>
<tr><td>>150000</td><td colspan="4">Cell 14
20815</td></tr>
</table>

The cell classification will be used in the next section to report the implications of the three proposed grant allocation mechanisms and to compare the results with the current system. However, the cell classification alone does not allow us to indicate what type of municipalities will most strongly be affected by the introduction of alternative systems. We will therefore also discuss the results using another classification scheme that singles out municipalities with similar characteristics. A cluster analysis performed by CADEPS (1989) grouped the municipalities on the basis of about fifty variables summarizing in detail their socio-economic characteristics. It resulted in eight clusters of 'similar' municipalities[6].

The detailed content of the clusters is available

[6] See Cadeps (1989) for details of the analysis.

on request. One group (cluster 3) consisted of only one observation, viz. the city of Antwerp. It will be discarded in the remainder of the paper as it turned out to be an outlier. The remaining seven clusters can be briefly characterised as follows :

- Cluster 1 : small, densely crowded municipalities in the neighbourhood of Antwerp and Brussels.
- Cluster 2 : small, rich and residential municipalities in the neighbourhood of Antwerp, Brussels and Gent.
- Cluster 4 : large municipalities fulfilling the role of a regional urban centre.
- Cluster 5 : municipalities with a strong touristic attraction situated along the coast.
- Cluster 6 : residual cluster largely consisting of small rural municipalities.
- Cluster 7 : small, low income rural municipalities.
- Cluster 8 : municipalities with a young population experiencing a high degree of unemployment.

4. COMPARING ALTERNATIVE GRANT ALLOCATIONS

In this section we compare the simulated outcomes for our three proposed grant allocation mechanisms with the current system and with the allocation implied by a recent policy proposal of the Ministry of Internal Affairs. For reasons previously explained, the results will be reported both for the cell classification upon which the current system is based, and for the classification of municipalities in clusters with similar characteristics. The results with respect to all 299 individual municipalities can be found in an appendix which is available on request.

4.1. Results for the cell classification

Consider the cell classification. To fix ideas, Table 2 first gives some descriptive statistics. The first two columns contain for each cell the average per capita grant and the standard expenditures per capita. Based on this information we calculated a 'self financing ratio' which is presented in the third column. It expresses the amount of standard expenditures not financed by grants. The last column reports the policy proposal. Note that in the remainder of the analysis averages have been calculated over the aggregates and not over the individual observations. E.g., the average observed grant for cell 1 (2923) has been calculated as the ratio of the sum of the observed grants in cell 1 over the sum of the population in cell 1.

Table 2 : Some descriptive statistics for the cell classification and the policy proposal

Cell	Number of cases	Observed grant	Standard expenditures per capita	Self financing ratio	Policy proposal
Cell 1	7	2923	10709	0.73	2804
Cell 2	5	3849	14557	0.74	2634
Cell 3	54	2558	12488	0.80	2783
Cell 4	34	2634	13676	0.81	2821
Cell 5	11	2652	13855	0.81	2725
Cell 6	49	2679	14088	0.81	2861
Cell 7	46	3047	14785	0.79	3004
Cell 8	21	3294	15067	0.78	3108
Cell 9	6	3848	16991	0.77	2991
Cell 10	29	3646	16719	0.78	3603
Cell 11	20	3842	17132	0.78	3931
Cell 12	8	4661	19259	0.76	4179
Cell 13	9	7016	21847	0.68	7005
Flanders	299	3780	16265	0.77	3780

Note first that despite the substantial variance of standard expenditures over the cells the current grant allocation system implies a very moderate variation in the self financing ratio. Only the cells corresponding to the

municipalities with very small populations (cells 1 and 2) and the cell consisting of cities with more than 50000 inhabitants (cell 13) seem to finance a somewhat larger share of their standard expenditures by grants. Furthermore, observe that, with the exception of cells 1, 2 and 9, the average grant per capita increases monotonically over the cell numbers.

The results for our three grant proposals are presented in respectively Table 3.A, Table 3.B and Table 3.C. Each table contains the average proposed grant per capita for all cells for the range of policy parameters, related to budget shares, as specified above. Note that since the three proposals have the same efficiency component it is obvious that a 100% share of this component in the budget yields identical results.

The comparison of the proposals with each other leads to the following conclusions. First, observe that for the first and the third proposal the sensitivity analysis results in a large range of grants per cell while for the second proposal a small range is implied. Second, for the three proposals the average grants per capita increase almost monotonically over the cell numbers for a 100%/0% share distribution, suggesting among others that the larger municipalities would receive larger per capita grants. But for the first and third proposal increasing the equity component reverses this result. Indeed, from a 70%/30% distribution onwards the first and third proposal result in almost monotonically decreasing grants over the cell numbers. Third, increasing the weight of the redistibutional component for the first and third proposal results in a strong redistibution from cells 9 to 13 in favour of cells 1 to 8. The second proposal implies, with exception for cells 8 and 9, exactly the reverse. For the second proposal however the redistribution is rather small. As a preliminary conclusion it appears that the first and third proposal redistribute in favour of the municipalities with relatively small populations

while the larger municipalities benefit under the second proposal. Furthermore, the analysis of the average grants reveals a strong similarity between the first and third proposal at the aggregate level.

Comparing the three proposals to the current grants they all seem to redistribute in the same direction. Cells 1 to 9 would on average receive more, cells 1 and 2 even significantly more under the first and third proposal. Cells 10 to 13 would receive less, although under the second proposal only cell 13 would loose significantly. Thus, in comparison with the current system, the main implication of our proposals is that they tend to redistribute towards the lower range of municipalities in terms of population and active population. But note that for moderate shares of the redistributional component a grant allocation is implied that remains consistent with the overall pattern of the current system.

A final observation with respect to Tables 3.A, 3.B and 3.C concerns the recent policy proposal formulated by the Ministry of Internal Affairs. The latter seems to stay close to the current system. There is some redistribution in favour of the mid range, viz. cells 3 to 6. Note that the implied redistributional pattern seems to combine the effects of our proposals, namely redistributing to the lower range (proposal 1 and 3) and redistributing towards the larger municipalities (proposal 2). Note furthermore that our grant distribution has a larger variance.

Table 3.A : Grants per capita for proposal 1 (local taxbase share)

Cell	100/0	70/30	50/50	30/70	0/100*
Cell 1	2489	9126	13551	17975	24613
Cell 2	3384	7230	9794	12358	16204
Cell 3	2903	4647	5810	6973	8718
Cell 4	3179	4638	5611	6583	8043
Cell 5	3220	4252	4940	5628	6660
Cell 6	3274	3609	3832	4055	4389
Cell 7	3437	3783	4014	4244	4591
Cell 8	3502	3685	3806	3928	4111
Cell 9	3949	3919	3900	3880	3850
Cell 10	3886	3338	2972	2607	2058
Cell 11	3982	3333	2899	2466	1817
Cell 12	4539	3697	3135	2574	1732
Cell 13	5078	3747	2859	1972	640
Flanders	3780	3780	3780	3780	3780

* The first integer refers to the budget share of the efficiency component, the second to the budget share of the equity component.

Table 3.B : Grants per capita for proposal 2 (gap)

Cell	100/0	70/30	50/50	30/70	0/100
Cell 1	2489	2474	2464	2454	2440
Cell 2	3384	3175	3036	2897	2689
Cell 3	2903	2815	2757	2698	2611
Cell 4	3179	3105	3056	3007	2933
Cell 5	3220	3153	3108	3063	2995
Cell 6	3274	3201	3152	3103	3029
Cell 7	3437	3410	3393	3375	3349
Cell 8	3502	3514	3521	3529	3541
Cell 9	3949	3897	3863	3829	3777
Cell 10	3886	3889	3891	3892	3895
Cell 11	3982	4005	4021	4036	4059
Cell 12	4539	4572	4593	4615	4648
Cell 13	5078	5242	5352	5461	5626
Flanders	3780	3780	3780	3780	3780

Table 3.C : Grants per capita for proposal 3 (standard tax revenue)

Cell	100/0	70/30	50/50	30/70	0/100
Cell 1	2489	11048	16753	22459	31017
Cell 2	3384	7162	9681	12200	15979
Cell 3	2903	4613	5753	6893	8603
Cell 4	3179	4602	5551	6500	7923
Cell 5	3220	4263	4958	5653	6695
Cell 6	3274	3598	3815	4031	4355
Cell 7	3437	3767	3987	4207	4538
Cell 8	3502	3688	3812	3937	4123
Cell 9	3949	3895	3859	3824	3770
Cell 10	3886	3335	2968	2601	2050
Cell 11	3982	3336	2905	2474	1827
Cell 12	4539	3701	3141	2582	1744
Cell 13	5078	3748	2861	1974	644
Flanders	3780	3780	3780	3780	3780

4.2. Results for the cluster classification

As the reader will have noticed the cell classification does not allow us to clearly describe the municipalities that gain or loose under the proposed grant allocation systems in terms of their social and economic characteristics. In what follows, we therefore turn to a discussion of the results using the cluster classification previously referred to.

Let us again start by considering some descriptive statistics. The information summarized in Table 4 clearly illustrates the special treatment of the urban centres and the coastal municipalities under the current grant allocation scheme. The urban centres (cluster 4) receive a very large grant per capita which would allow them to finance 28% of their standard expenditures, as indicated by the self financing ratio. The coastal municipalities belonging to cluster 5 are in a quite different situation. Although they receive the second highest per capita grants under the existing system, these grants would allow them to finance only

15% of their standard expenditures. For the other clusters there is only a moderate variation in the self financing ratio.

Table 4 : Some descriptive statistics for the cluster classification and the policy proposal

Cluster	Number of cases	Observed grant	Standard expenditures per capita	Self financing ratio	Policy proposal
Cluster 1	25	3823	18717	0.80	3202
Cluster 2	30	2846	16341	0.83	2635
Cluster 4	35	5438	19157	0.72	5468
Cluster 5	6	3949	26279	0.85	3573
Cluster 6	66	2984	14730	0.80	3062
Cluster 7	82	2962	12870	0.77	3051
Cluster 8	55	3197	13997	0.77	3473
Flanders	299	3780	16265	0.77	3780

The results of the sensitivity analysis with respect to our three proposed grant allocation mechanisms can be found in Tables 5.A, 5.B and 5.C.

Comparing the three proposals with each other yields the following results. First, the second proposal has again the smallest range of values. But note that the range of the other proposals is somewhat reduced compared to the cell classification. Second, as the importance of redistribution increases the first and third proposal redistribute from clusters 1 to 5 to the clusters 6 to 9. The poor rural municipalities in cluster 7 are the big winners, while cluster 4 looses relatively most under the first proposal and cluster 5 under the third proposal. With the exception of cluster 4 and 6 the second proposal would redistribute in the same direction. Now cluster 4 is the big winner and cluster 2 the big looser.

Hence the three proposals are similar in favouring the lower income and rural municipalities. Further, we again

observe that despite their different definitions the first and third proposals yield almost identical results. The main difference with the second proposal is clearly that the redistribution implied by the latter is less favorable for the low income municipalities of clusters 7 an 8. To the extent that this redistribution is an explicit policy concern, proposals 1 and 3 may be preferable.

A comparison of the proposals with the existing system reveals that the suggested schemes would imply on average a reduction in the per capita grant for the urban centres (cluster 4), especially under extreme redistributional concerns for proposal 1 and 3. A number of densely populated urban municipalities (cluster 1) gain only under the second proposal. The beneficiaries of the new proposals would be a number of relatively residential suburban municipalities (cluster 2), the coastal municipalities (cluster 5) - but not so for high shares of the redistributional component under the first and third proposal - , and the low income and rural municipalities (clusters 6, 7 and 8).

This substantial reduction in grants allocated to the urban centres of cluster 4 should be interpreted in view of their special status under the current system. If the general setup of our proposals is accepted and the regression model used to estimate standard expenditures is correctly specified, then there seems to be no compelling reason to treat the urban centres in a special way. In that case the current system is simply too generous. Alternatively, it is possible that our regression model has failed to adequately capture spillover effects. In that case the standard expenditures for the urban municipalities in cluster 4 may on average have been underestimated.

A somewhat surprising finding is the larger grants that would on average be allocated to clusters 2 and 5, which both contain residential municipalities that are characterized

by relatively high incomes. Here the above-average values for the standard expenditures, especially for cluster 5, causes the increase in allocated grant per capita. If one believes that standard expenditures should be reflected in grant design then it seems that the municipalities of clusters 2 and especially 5 are particularly poorly treated under the current system. Therefore, the increase in grants for these residential municipalities should not be interpreted as some perverse redistribution towards the rich.

Finally, the proposal formulated by the Ministry of Internal Affairs again stays close to the current system. The municipalities in clusters 6,7 and 8 would on average receive a larger grant per capita, whereas cluster 1, 2 and 5 would get less. Interestingly, our proposals agree about this direction of redistribution except for clusters 2, 4 and 5. Our proposals - for reasons cited above - unanimously increase the grants for the relatively wealthy communities contained in cluster 2 and for the coastal municipalities (cluster 5) but decrease the grants for the urban centres of cluster 4. The policy proposal does exactly the reverse for cluster 2 and 5 and leaves cluster 4 almost unaffected. Note further that our proposals imply on average somewhat larger departures from the current system than the policy proposal.

Table 5.A : Grants per capita for proposal 1 (local taxbase share)

Cluster	100/0	70/30	50/50	30/70	0/100
Cluster 1	4351	3771	3384	2998	2418
Cluster 2	3798	3600	3468	3336	3138
Cluster 4	4453	3560	2966	2371	1479
Cluster 5	6108	5022	4298	3574	2488
Cluster 6	3424	3692	3870	4049	4316
Cluster 7	2991	4340	5239	6138	7486
Cluster 8	3253	3649	3913	4176	4572
Flanders	3780	3780	3780	3780	3780

Table 5.B : Grants per capita for proposal 2 (gap)

Cluster	100/0	70/30	50/50	30/70	0/100
Cluster 1	4351	4218	4129	4041	3908
Cluster 2	3798	3533	3356	3179	2914
Cluster 4	4453	4570	4649	4727	4844
Cluster 5	6108	5934	5819	5703	5530
Cluster 6	3424	3418	3414	3410	3404
Cluster 7	2991	3012	3026	3040	3061
Cluster 8	3253	3276	3290	3305	3327
Flanders	3780	3780	3780	3780	3780

Table 5.C : Grants per capita for proposal 3 (standard tax revenue)

Cluster	100/0	70/30	50/50	30/70	0/100
Cluster 1	4351	3766	3377	2988	2404
Cluster 2	3798	3597	3462	3328	3126
Cluster 4	4453	3561	2967	2373	1481
Cluster 5	6108	4862	4032	3201	1955
Cluster 6	3424	3680	3851	4022	4279
Cluster 7	2991	4374	5296	6217	7600
Cluster 8	3253	3650	3914	4178	4574
Flanders	3780	3780	3780	3780	3780

5. CONCLUSION AND POLICY IMPLICATIONS

The purpose of this research memorandum was to present grant allocation mechanisms which take account of both the efficiency and the equity reasons involved in grant distribution. Efficiency considerations were incorporated by allocating part of the grant on the basis of 'standard' municipal expenditures, reflecting the demand for local public services and the impact of spillover effects on municipal outlays. Equity considerations were captured by reserving part of the grant budget for redistributive purposes. Three alternative specifications for the equity component of our grant proposal were suggested. The basic idea behind each of them is to correct for differences in local taxbases.

We simulated the outcome of three specific proposals and compared the results both with the existing grant allocation mechanism and with a recent policy proposal formulated by the Ministry of Internal Affairs. The main conclusions are easily summarized as follows. First, compared to the current system our proposals would generally imply a redistribution of grants from municipalities in an urban environment and from regional urban centres towards rural and low-income municipalities. In addition, a number of coastal communities would gain from the introduction of the allocations suggested in this paper. Second, our proposals and the one formulated by the Ministry redistribute in the same direction except for the urban centres and the municipalities situated along the coast. However, the latter proposal implies much less variation in per capita grants than does the former.

The policy implications of the above results can be easily summarised. First, the implications of these three specific proposals for the distribution of block grants from the Flemish government to local authorities in Flanders have

been fully explored at the aggregate level. Second, the proposals consisted of explicit efficiency and equity shares in the grant budget so as to take account of the corrective role of grants stressed in the economic literature. This explicit nature of the efficiency-equity trade-off is in sharp contrast to the implicit choices in the current system as well as in a recent policy proposal. Third, again unlike the current grant allocation system and the recent proposal, these schemes satisfied both some further theoretical criteria - independence of spending and taxing decisions, respect for horizontal equity - and some practical design criteria - continuity , positive monotonicity. In short, it has been shown that the family of grant allocation mechanisms suggested in this paper can be implemented easily and that they share some attractive features.

APPENDIX A : THE ANALYSIS AND DETECTION OF OUTLIERS

Methods to detect outliers (see, e.g., Atkinson (1985), Belsley et al (1980)) can be divided in two categories, viz. those that detect extreme observations and those that detect influential observations. The latter refer to observations which have a decisive influence on the value and significance of some parameter(s) or on the model specification as such. In this paper we used the method of Studentized residuals to eliminate influential observations. The purpose of this appendix is to briefly outline the procedure used and to present the results of its application to our sample.

The i-th observation of a linear regression model can in vector notation be written as $y_i = x_i'\beta + e_i$. It seems reasonable to define outliers on the basis of the magnitude of the estimated residuals $\hat{e}_i$. Confidence intervals can in principle be used to identify outliers. Unfortunately, the properties of the untransformed residuals e_i imply that this procedure is inappropriate. Indeed, it can be shown that

$$\text{var } e_i = \sigma^2(1 - h_i) \qquad [A.1]$$

where e_i is the true residual for observation i
σ^2 is the unknown population variance
$h_i = x_i(X'X)x_i'$ is the leverage value, where X is the matrix of independent variables.

Therefore the variance of the residuals is not constant and depends on the leverage value h_i. The leverage value h_i is an indicator of the weight observation i has in the data data matrix X : it measures the remoteness of observation i in the space spanned by the k independent variables x. It can be shown that $0 \leq h_i \leq 1$ (see Belsley (1980),p.17). Hence h_i reaches a maximum value of 1 for extreme observations. In that case the variance of e_i is 0. Thus, using standard

confidence intervals on the estimated residual $\hat{e}_i$ would leave the outlier undetected. The method of Studentized residuals transforms the original residuals so that they do have a constant variance.

These transformed residuals are defined as

$$e_i^* = \frac{e_i}{s(i)\ (1 - h_i)^{1/2}} \qquad [A.2]$$

where s(i) is the estimated population variance with observation i deleted. The e_i^* follows a t-distribution and can be shown to have constant variance. Outliers can therefore be detected by defining confidence intervals for the appropriate t-values.

Ordinary Least Squares estimation of the model discussed in Section 2.1 on the basis of the complete sample yielded the following results :

$$\begin{aligned} Exp = {} & \underset{(.36)^{**}}{4.82}\ Constant + \underset{(.02)^{**}}{.12}\ Houses + \underset{(.38)}{.58}\ Old + \underset{(.15)}{.23}\ Industry \\ & + \underset{(14.70)^{*}}{28.47}\ Spillover + \underset{(28.23)^{*}}{72.11}\ Density + \underset{(.039)^{**}}{.36}\ Wealth + \underset{(.03)^{**}}{.09}\ Poor \end{aligned}$$

$R^2 = .63$
SER = .18 [A.3]
N = 308

where standard errors are between brackets and the * and ** indicate significance at respectively the 90% level and the 99% level.

The application of a 99% confidence interval on the data matrix of the regression [A.3] resulted in the detection of the following list of outliers :

ANTWERPEN	Cell 14	Cluster 3
ZWIJNDRECHT	Cell 9	Cluster 1
MECHELEN	Cell 13	Cluster 4
WESTERLO	Cell 8	Cluster 8
SPIERE-HELKIJN	Cell 1	Cluster 7

NIEUWPOORT	Cell 5	Cluster 5
GENT	Cell 14	Cluster 4
DILSEN	Cell 7	Cluster 8
HERSTAPPE	Cell 2	Cluster 7

These municipalities were eliminated from the sample. Note that this implies that our analysis will have nothing to say about the effect of alternative grant allocations schemes for three large Flemish cities, viz. Antwerp, Ghent and Mechelen.

APPENDIX B : NORMAL PROBABILITY PLOTS AND TESTING FOR HOMOSKEDASTICITY

1. Standardized residuals are defined as :

$$e_i' = \frac{e_i}{s\ (1 - h_i)^{1/2}} \qquad [B.1]$$

where s is the estimator of the population variance. Note the minor difference with [A.1]. These standardized residuals can now be shown to be normally distributed. Hence a plot of the calculated standardized residuals from the sample against the normal distribution is useful to reveal deviations from normality. The normal probability plots for both the original regression [A.3] and for the regression on the restricted sample (see equation (2)) are presented in Figure 1 and 2 below. These plots clearly do not suggest important deviations from normality.

Fig 1 : Normal Probability Plot Standardized Residuals (N=308)

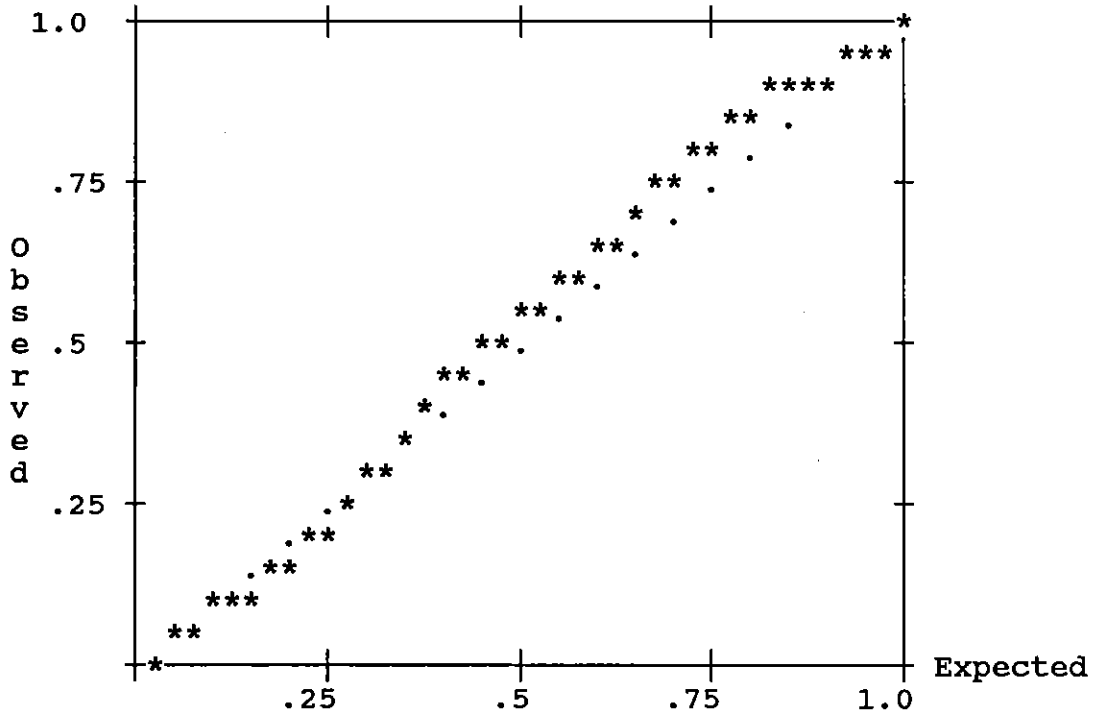
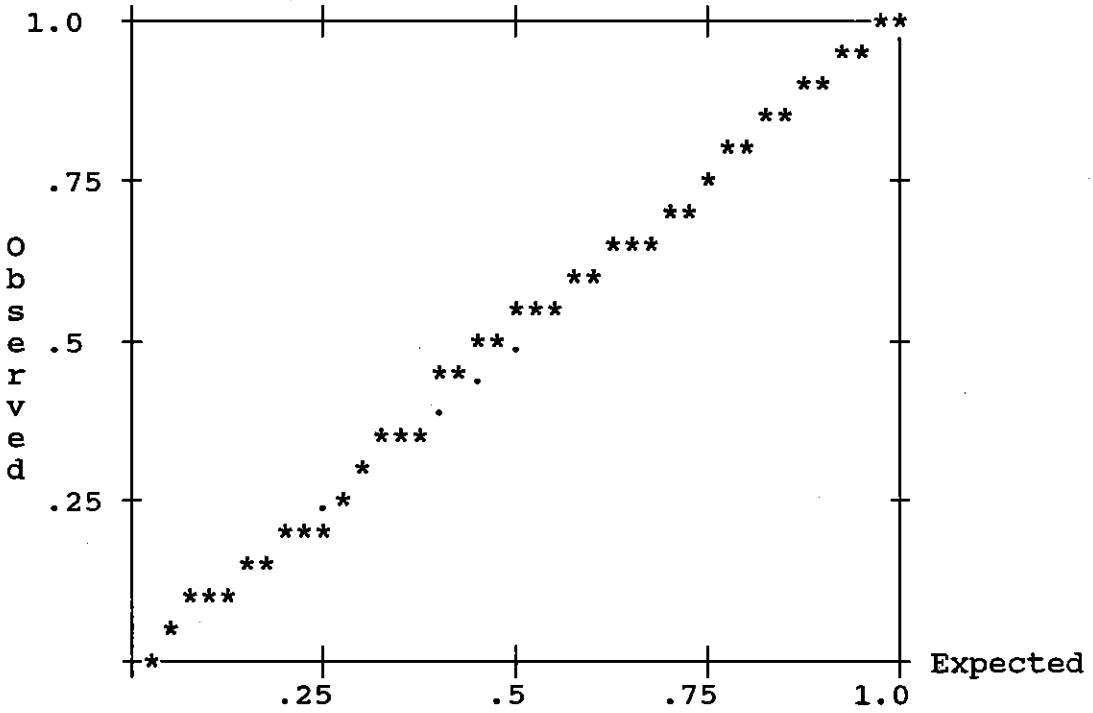


Fig 2 : Normal Probability Plot Standardized Residuals (N=299)



2. Application of White's test for heteroscedasticity (see Amemyia (1985), p. 200) involves estimation of an auxiliary regression. The squared residuals of equation (2) were regressed on a constant , all independent variables, their squares and their cross products. The number of observations times the unadjusted R-squared is distributed chi-squared with degrees of freedom equal to the number of coefficients in the auxiliary regression, excluding the constant. The auxiliary regression yielded an R-squared of 0.075 and the sample size was 299. The resulting test statistic is 22.61. The critical value for the chi-squared distribution at the 5 % level with 35 d.f. is well above 53. Therefore the null hypothesis that all coefficients in the auxiliary regression equal zero and hence that there is no heteroskedasticity cannot be rejected.

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