THE SCOTTISH OFFICE

Local Government Finance Group

New St. Andrew's House
Edinburgh EH1 3TB

Telephone 031-244
Fax 031-244 4785

Finance Circular No 11/1992

The Chief Executive
Regional, Islands and District Councils

7 February 1992

Dear Sir or Madam

THE CLIENT GROUP APPROACH TO ESTIMATING GRANT AIDED EXPENDITURE

1.   This Circular updates the original description of the client group approach provided to local authorities in Appendix 1 of Scottish Office Finance Circular No 13/1983. The Distribution Committee of the Working Party on Local Government Finance in Scotland requested an update to take account of developments in the use of the approach. Its concept and fundamental features have not altered.

Background

2.   The approach was introduced in the early 1980's for the purpose of grant distribution as a replacement for the previous system which had become widely criticised as too subjective and complicated. Within the grant distribution process the approach was originally used to allocate expenditure provision thereby establishing assessments of relative expenditure need. These assessments were subsequently used by the Secretary of State as part of the mechanism for controlling local authority expenditure through the issue of expenditure guidelines and the operation of grant penalties.

3.   With the introduction of new arrangements for local government finance in 1989-90 the controls were discontinued and grant-aided expenditure (GAE) subsequently replaced expenditure provision. GAE is the aggregate amount of expenditure which the Secretary of State considers appropriate to be taken into account in deciding the level of grant support made available to local authorities in Scotland. It does not imply that authorities need to spend the amount of GAE.

4.   Since its introduction in the early 1980's the application of the client group approach to GAE assessments has been refined and kept under review by the Distribution Committee. In accordance with the legislative requirement to consult with COSLA on matters related to local government finance, the Secretary of State has regular meetings with elected local authority members. In support of these meetings, there is the Working Party on Local Government Finance in Scotland and its 4 Committees, including the Distribution Committee. The Working Party and Committees comprise Scottish Office officials and local authority/COSLA officers. The

Distribution Committee is concerned with the method of distribution of Aggregate External Finance (AEF), part of which covers the use of the client group approach for GAE assessments.

5.   The work for the Distribution Committee on the client group approach is mainly carried out by The Scottish Office Central Research Unit (CRU), who consult with service specialists within local authorities and The Scottish Office.   The Committee and CRU are assisted in reviews and other work by advice from 3 COSLA Technical Advisers.

Objective of the Approach

6.   The client group approach is a systematic means of allocating a pre-determined level of grant aided expenditure for each service equitably among local authorities.   It covers nearly all services provided by local authorities with the main exception of housing and water services, for which there are separate arrangements.   It also excludes loan and leasing charges which are treated separately within the grant distribution system. The client group approach does not determine the level of GAE in absolute terms nor its allocation between services.   The total relative GAE for a local authority is the sum of the separate assessments for individual services.   The total estimate of GAE for each authority is used by the Scottish Office for the distribution of AEF.

7.   The client group approach is an objective method used to estimate, within a controlled total, the relative GAE of local authorities and is designed to take into account variations in the demand for services and the costs of providing them to a similar standard and with a similar degree of efficiency.   Central to the approach is the identification of factors associated with inter-authority expenditure variation.   Those demand and cost factors which

are outside the control of local authorities

offer plausible explanations, and

can be shown to be associated with inter-authority expenditure variation

are utilised in the formula for calculating relative GAE.   Analysis is conducted for individual services (and, in some cases, for different elements of a service) as factors influencing expenditure on a service are more likely to be detected in a disaggregated approach and more sensitive GAE assessments achieved.   The approach produces relative GAE assessments which, to a large measure, allow for demand and costs factors but are independent of the effect on expenditure of discretionary policy choice of individual authorities.

8.   There follows a more detailed description of (i) the identification and selection of factors, (ii) their use in the calculation of GAE assessments and (iii) the process of reviewing assessments.

Determining Demand and Cost Factors

9.   The calculation of relative GAEs for individual services involves distributing between authorities an apportionment related to a primary indicator and, where found to be justified, further apportionment(s) for one or more secondary indicators.

10. Expenditure relevant to the analysis of primary and secondary indicators is net revenue expenditure excluding loan and leasing charges and costs of remote teacher, islands and Shetland allowances. Loan and leasing charges are excluded because they are estimated separately within the determination of Revenue Support Grant. The allowances are special payments made to cover particular circumstances in the islands and very remote areas of regions. They are excluded because these circumstances are found in some but not all authorities and because they are separately recognised by these special payments. If they were included in the expenditure used they would introduce a potential bias in the analysis of factors. (There is a separate adjustment in the calculation of the total GAE for each authority to take account of expenditure on remoteness and islands allowances. This is described in Annex 1.)

Selection of Primary Indicator

11. The primary indicator is the most significant single determinant of expenditure on a service. When examining a GAE assessment, more than one potential primary indicator may be identified a priori as likely to be a significant determinant of need to spend uninfluenced by local policy factors or efficiency of provision. There are 3 main types of primary indicator:-

11.1 As far as possible direct measures of the "client" for the service are used (hence the use of the term "client group approach"), ie the number of recipients of the service, such as pupils in Education Authority schools for school teaching staff, numbers of cremations for crematoria service.

11.2 Sometimes an indirect measure such as the number in the main population group containing potential beneficiaries of the service is used eg population aged over 65 years for home helps.

11.3 Occasionally, a primary indicator is defined to reflect the resource to which the service is directed eg road lane length for roads maintenance, area of burial grounds for burial grounds service.

12. A primary indicator is often chosen on grounds of plausibility alone. Where there are several equally plausible indicators, a statistical test is used to determine which indicator is the strongest in explaining inter-authority variation of past expenditure. This test uses the coefficient of variation calculated by dividing the standard deviation by the mean of a distribution. For each possible primary indicator, the mean and standard deviation are calculated of expenditure per unit of indicator of authorities providing the service. The lower the value of the coefficient, the stronger the explanation of expenditure variation for the relevant group of authorities (regional and islands or district and islands). A worked example of the test is at Annex 3.

13. In the assessments for several district services, the primary indicator is a composite measure of the client group - namely adjusted population. This is a measure based mainly on the mid-year estimate of resident population with a small allowance for tourists and for net in-commuters. The annual number of tourist bed nights is the measure of tourists. The number of working days of commuters is weighted, usually to allow for a third of annual working days.

14. Expenditure per unit of primary indicator can vary for one or more of the following reasons:

14.1 the expenditure need of authorities may differ (as a result of differences in demand and/or differences in the costs of provision);

14.2 authorities may choose to provide the same service to different standards as a matter of policy discretion rather than of need; and

14.3 authorities may provide a service with different degrees of efficiency.

The client group approach tries to take account of the first reason only through secondary indicators.

Selection of Secondary Indicator

15. Once the primary indicator has been identified the next stage is to examine whether a secondary determinant of expenditure, representing justified local variation in unit costs of provision and/or need for the service, is warranted. First, local authorities' past expenditure on a service is standardised by expressing it per unit of the primary indicator chosen for the service. It is then necessary to determine whether the remaining variation can be accounted for by characteristics outwith the control of authorities, such as high costs per unit of primary indicator resulting from, for example, small provision points widely dispersed, and/or higher local needs due to, for example, concentrations of deprived households.

16. For a factor to be accepted as a secondary indicator, it has to meet a number of tests. It has to

16.1 be a plausible cause of expenditure variation;

16.2 be statistically related to the variation of expenditure;

16.3 this relationship needs to be a stable one persisting over 2 or 3 years; and

16.4 it should not be a variable that simply reflects authorities' decisions to provide different standards of service.

It can be difficult to obtain relevant data to measure a plausible factor as a secondary indicator. Where suitable data is available it is frequently the case that potential secondary indicators fulfilling criterion 16.1 fail to meet criterion 16.2-16.4 when tested and are therefore rejected. Once established a secondary indicator will continue to be used until there is evidence that its relationship to past expenditure is no longer present (ie it fails to pass criterion 16.3) and is therefore rejected. Normally an assessment will be reviewed by the Committee when a secondary indicator no longer passes the statistical test. Annex 2 provides more detail about the application of criteria to secondary indicators.

17. The relationship between potential secondary indicators and expenditure per unit of primary indicator is examined both visually and statistically. A graph plotting the secondary indicator values for each authority against past expenditure per unit of primary indicator reveals if the relationship hypothesised is apparent and whether any authority

deviates markedly from the relationship shown by the other authorities. The statistical technique of regression analysis is then used to measure the relationship and to test whether it is statistically significant. More than one secondary indicator per service can pass the relevant criteria eg there are 3 secondary indicators for refuse collection. However, the ability to estimate accurately the impact of several factors on regional services is limited by the small number of observations (ie authorities), whereas this is much less of a problem for district services.

18. The relationship between expenditure and the secondary indicator is measured by the regression analysis and tested using standard statistical measures the T statistic and R^2 (coefficient of determination). The T statistic shows if the result is statistically significant. R^2 shows the proportion of expenditure variation which is explained by the secondary indicator. Variation in expenditure which remains unexplained after account is taken of demand/cost factors through application of primary and secondary indicators is largely attributed to differences between authorities in their service standards and efficiency. It is recognised, however, that some of the remaining variation may be due to the absence of suitable measures of additional demand or cost factors.

19. A best fit straight line relating the secondary indicator to expenditure per unit of primary indicator is obtained from the regression analysis. It shows the amount by which expenditure per unit of primary indicator changes for each unit of increase in the value of the secondary indicator. The rate at which the change occurs is measured by the regression coefficient. In general terms the steeper the angle of the line (ie the higher the value of the regression coefficient) the more change in the expenditure per unit of primary indicator for a given change in the value of the secondary indicator. The regression coefficient is used to calculate the secondary indicator effect in a GAE assessment - see paragraph 23 below.

20. The introduction of control variables in the analysis of secondary indicators is an accepted but rarely used feature. When a service standard or factor within the control of individual authorities (i) is identified as affecting the demand or cost of a service and (ii) is consistently measurable for all authorities, it is tested using multiple regression analysis as a potential control variable in conjunction with the secondary indicator. This controls for the effect of the standard of service factor on expenditure variation and identifies more clearly the validity of the secondary indicator. The results for the secondary indicator are used in the assessment but there is no allowance for the control variable. Currently (1992-93 GAE) 2 control variables are used: provision of home helps to people under 65 years and availability of geriatric beds are used in the assessment for Services for the home based elderly. It is difficult to identify suitable measures to use as potential control variables and this has limited their inclusion in analysis.

Calculation of GAE Assessment

21. The GAE assessment for a service is calculated using the primary indicator, adjusted for any secondary indicator.

22. The primary indicator effect is calculated by apportioning the predetermined GAE for a service among individual authorities who undertake that service according to their shares of the primary indicator for that service. The formula is:-

$$\text{Primary effect in authority A} = \frac{\text{Units of primary indicator in authority A}}{\text{Units of primary indicator in Scotland}} \times \text{GAE}$$

23. A secondary indicator effect is calculated by the following formula:-

$$\text{Secondary effect in authority A} = \text{Units of primary indicator in authority A} \times \text{Regression coefficient} \times \text{Difference between the value of the secondary indicator variable in authority A and the average value of the variable}$$

24. The value of the regression coefficient (see para 19) is updated from the year of analysis of past expenditure to the year for which GAE is being estimated by applying to the value of the coefficient the percentage change of average expenditure per unit of primary indicator from the year of analysis to the year of estimation. This is called repricing the regression coefficient. Also the repriced coefficient is averaged with the coefficient value used in the calculation of the previous year's assessment. This is known as damping and has the effect of reducing the impact of any marked changes in the coefficient value, thereby increasing the stability of the annual estimate of GAE. Damping can only occur after the first year in which it is used in an assessment.

25. Providing that the regression coefficient is positive, then authorities with values of the secondary indicator exceeding the national average will have positive secondary indicator allowances, and those with values of the variable below the national average will have negative allowances. The positive and negative allowances of different authorities exactly balance, thus secondary indicator allowances are a redistribution of GAE as determined at the first stage by the primary indicator. For each authority the primary and secondary indicator allowances sum to the total GAE for services.

26. A worked example of the testing of a secondary indicator and the calculation of an assessment are at Annex 3.

Exceptions to Client Group Treatment

27. The client group approach has not been used for services where high rates of specific grant are paid (eg civil defence), or where local authorities have no discretion as to the level of expenditure (eg river board requisitions), or where it has been impossible to identify a plausible and statistically valid determinant of need (eg planning). The alternative method adopted in these cases has been to adjust each authority's budgeted or latest actual expenditure so that, in total, they equal the GAE for the service. The urban programme is excluded from the assessment of GAE and taken into account in the determination of RSG by a separate adjustment.

Notification of GAE Assessments

28. The GAE total for each authority is notified by Scottish Office Finance Circular in the Autumn (usually late September/early October). The GAE assessments for individual services are published each year

shortly after the Finance Circular in a booklet (the "Green Book"), the most recent being "Grant Aided Expenditure 1992-93". The main tables show details of the GAE distribution to authorities for each service including the primary and secondary indicator values used and their effect in the calculation. The booklet also contains summarised information on the relative importance of each primary and secondary indicator in the overall calculation and the definitions of primary and secondary indicators.

Reviews of GAE Assessments

29. The Distribution Committee of the Working Party on Local Government Finance is concerned with the basis of the distribution of Aggregate External Finance, of which the client group approach is an important part. When the client group approach was introduced there were 63 assessments of services. This has increased to 92 assessments in the 1992-93 GAE. Some of these additions are because local authorities have assumed responsibility for a new service which has required a separate assessment. Most of the increase reflects the work of the Distribution Committee to improve and refine the application of the approach.

30. In relation to the client group approach the Committee draws up an annual work programme. The programme is formally agreed between the Secretary of State and COSLA representatives at member level. It normally includes GAE assessments to review, either partially (ie examine secondary indicator) or completely (ie examine primary and secondary indicators), and matters concerning the application of the approach more generally. The work programme is finalised in the Autumn and is concluded in June of the following year. The size of the work programme is constrained by the staff resources available. These are mainly drawn from CRU with some input from the COSLA Technical Advisers.

31. Assessments to be reviewed are identified by the Committee using members' knowledge and expertise and on the basis of suggestions and criticisms submitted to the Committee by individual local authorities. Reviews of assessments can be required for several reasons. New or improved information sources (eg more disaggregated expenditure information or better data for measuring a potential secondary indicator) provide the opportunity to change primary or secondary indicators in existing assessments or to disaggregate an assessment into 2 or more new assessments. Legislative changes can alter the need to incur expenditure on a service and necessitate a review. The Committee reviews an assessment whenever an existing secondary indicator no longer passes the criteria to consider possible alternatives/replacements.

32. It is recognised that the opportunity for further disaggregation of assessments is limited and the main focus is on the improvement of existing assessments and the integrity of the data being used. When considering the possibility of disaggregating existing assessments the Committee takes account of the likely improvement in the resultant distribution, the availability of expenditure and other information to examine possible indicators and the extra demands that could be made on local authorities to supply annual updated information for an assessment. Some further disaggregation of assessments may be possible.

33. Reviews of assessments are normally carried out for the Committee by CRU and involve a number of stages. Any existing research on factors influencing expenditure on the service is examined, and discussions are held with relevant policy makers and professionals in the Scottish Office. This is followed by consultations with service specialists in local authorities to obtain views, advice and information on factors and their possible measurement. A selection of authorities with relevant characteristics are normally consulted to identify the range of factors influencing expenditure on a service. When an assessment is being reviewed the Committee welcome written contributions from individual authorities suggesting factors and possible secondary indicators. The outcome of these interviews are reported to the Committee for its decision on a primary indicator and on any additional demand/cost factors which warrant testing with past expenditure as possible secondary indicators. At the next stage relevant information is assembled, secondary indicators are tested and the results reported to the Committee for decision on the appropriate basis of the assessment. The Committee often requires further analysis of options before taking a decision. Immediately prior to a final decision the Committee considers an exemplification of the outcome for individual authorities of the potential assessment. This is based on the most up-to-date information on primary and secondary indicators applied to the most recent GAE total for the service.

34. In June, the Committee reports to the Working Party the outcomes of reviews and any recommended changes to GAE assessments. Following consideration, the Working Party refers them to a meeting between the Secretary of State and COSLA representatives for final approval of the assessments to be used for the coming financial year. A diagram of the stages of the review of an assessment is on the next page.

General

35. A copy of this Circular is enclosed for your Director of Finance.

36. Any enquiries relating to this Circular should be made to Mr Hamish Clark (031-244-4381) or Mr Andrew Fleming (031-244-4377) of the Central Research Unit, Scottish Office, New St Andrew's House, St James Centre, Edinburgh, EH1 3SZ.
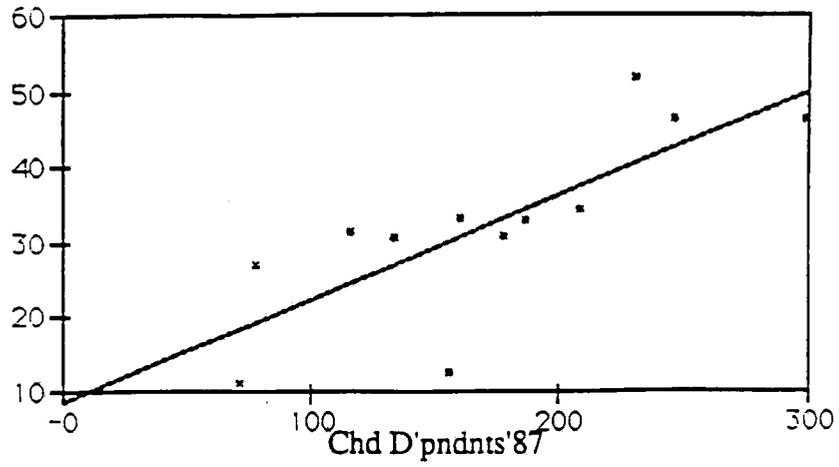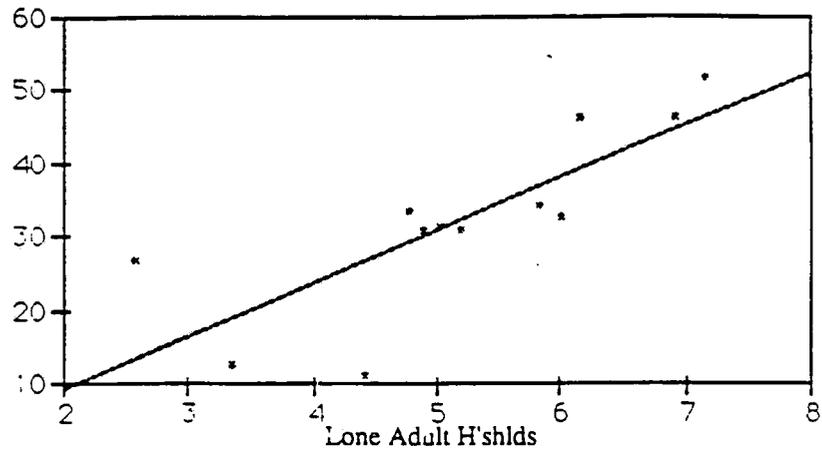
Yours faithfully

K W McKAY

1987-88 Expenditure on Community and Residential Care for Children per Child under 16 and 4 Possible Secondary Indicators
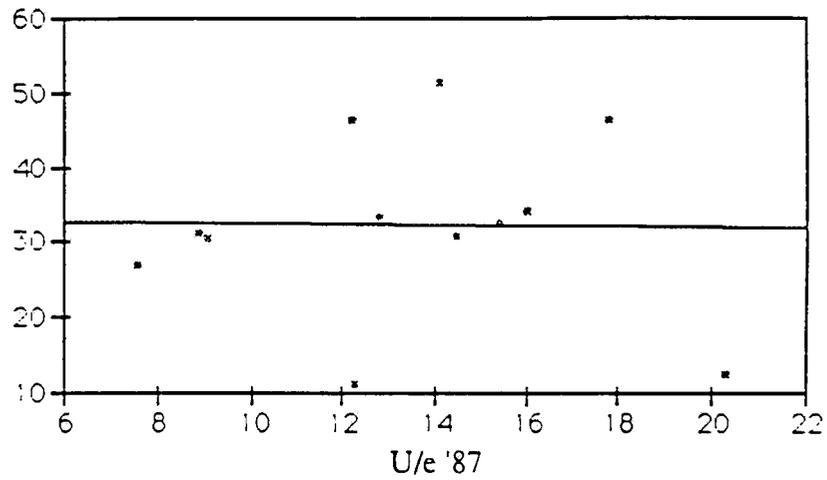
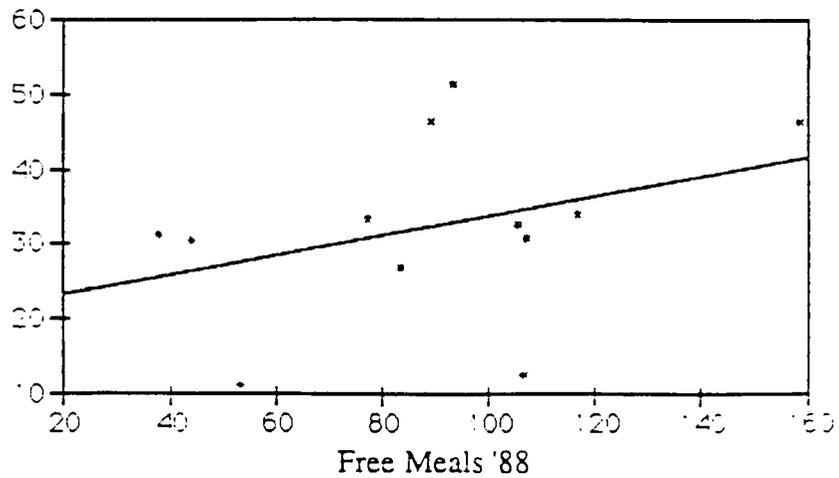**Table 2 Community and Residential Care for Children :**
1987-88 Expenditure and Possible Secondary Indicators

	1987-88 Expend per child <16 (1987)	Child dependants of SB recip'nts (1987) A	Lone Adult Households (1981) B	Unemployment Rate (1987) C	Free School Meals (1988) D
BORDERS	31.35	116.4	5.03	8.9	38.24
CENTRAL	34.12	209.1	5.83	16.0	116.91
DUMFRIES	33.22	161.2	4.79	12.8	77.26
FIFE	32.65	186.5	6.01	15.4	105.95
GRAMPIAN	30.68	134.4	5.20	9.1	44.28
HIGHLAND	30.77	178.4	4.90	14.5	107.44
LOTHIAN	46.20	246.8	6.93	12.2	89.27
SCLYDE	46.29	299.1	6.18	17.8	158.27
TAYSIDE	51.53	231.0	7.17	14.1	93.18
ORKNEY	11.14	71.0	4.43	12.3	53.00
SHETLAND	26.97	77.0	2.58	7.6	83.41
W ISLES	12.65	155.8	3.35	20.3	106.62

Definitions of Indicators

A   Estimates of children dependent on Supp Ben recipients per 1000 of population under 16

B   Children under 16 in lone adult households as %age of all children under 16

C   Average annual rate of unemployment

D   Children entitled to free school meals per 1000 of population under 16

Table 3   Community and Residential Care for Children : Results of Regression Analysis

INDICATOR	1985-6 t stat (Signf level)	1985-6 R^2	1986-7 t stat (Signf level)	1986-7 R^2	1987-8 t stat (Signf level)	1987-8 R^2
Child dependants of Supp Ben recipients	5.400 (99.95%)	0.719	3.740 (99.5%)	0.541	3.898 (99.5%)	0.563
Lone adult households	7.725 (99.95%)	0.842	3.178 (99.5%)	0.453	4.155 (99.5%)	0.597
Unemployment rate	1.682 (NS)		0.137 (NS)		-0.054 (NS)	
Free school meals	NA		NA		1.226 (NS)	

Minimum values of significance levels   (NS) Not Significant

95%	1.812
97.5%	2.228
99.5%	3.169
99.95%	4.590

NA   Not Available

Table 4 Averaged and Repriced Regression Coefficient
(for 1990-91 GAE Assessment for Community and Residential Care for Children)

Step A Smoothed Average

Year of Expenditure	Regression Coefficient (A)	Weight (B)	(A)X(B)
1985-86	0.210	0.25	0.0525
1986-87	0.132	0.5	0.066
1987-88	0.139	1	0.139
	Smoothed Average		0.2575 / 1.75
			= 0.147

Step B Repricing of Regression Coefficient

Repricing factor $= \dfrac{\text{1990-91 GAE per child <16 (1988)}}{\text{1987-88 Expenditure per child <16 (1987)}}$

$= \dfrac{(60368 \times 1027849)}{(43522 / 1042904)}$

$= 1.41$

Repriced Coefficient = 0.147 x 1.41

= **0.207**

Value of repriced coefficient used in 1990-91
GAE assessment for Community and Residential Care for Children   **0.000207**

Table 5 Repricing and Damping Regression Coefficient
(for 1991-92 GAE Assessment for Community and Residential Care for Children)

Regression Coefficient from analysis
of secondary indicator with 1988-89 expenditure   = **0.142**

Repricing factor $= \dfrac{\text{1991-92 GAE per child <16 (1989)}}{\text{1988-89 Expenditure per child <16 (1988)}}$

$= \dfrac{(64613 / 1021222)}{(46478 / 1027849)}$

= 1.40

Repriced Coefficient   = 0.142 x 1.4   = **0.1988**

Regression Coefficient used in 1991-92 GAE calculation   = 0.207

Damped and Repriced Coefficient   = (0.1988 + 0.207) / 2

= **0.203**

Value of damped and repriced coefficient used in
1991-92 GAE assessment for Community and Residential Care for Children   = **0.000203**

COMMUNITY AND RESIDENTIAL CARE FOR CHILDREN

	A	B	C	D	E	
	PRIMARY INDICATOR	PRIMARY EFFECT	SECONDARY INDICATOR	SECONDARY EFFECT	GRANT AIDED EXPENDITURE	
	POPULATION AGED UNDER 16 1989		CHILDREN OF INCOME SUPPORT RECIPIENTS (1989) PER 1000 UNDER 16	CCL A x 0.000203 x(COL C- 226.72)	(£000)	← Repriced and damped regression coefficient
BORDERS	19011	1242	109.39	-453	789	
CENTRAL	54927	3587	187.85	-433	3154	
DUMFRIES	28621	1869	148.16	-456	1413	
.	70548	4608	182.56	-632	3976	
GRAMPIAN	102122	6670	123.65	-2135	4534	
HIGHLAND	43541	2844	168.21	-517	2327	
LOTHIAN	137771	8998	221.43	-148	8850	
STRCLYDE	473096	30899	281.30	5238	36138	
TAYSIDE	75685	4943	221.74	-77	4867	
ORKNEY	4055	265	67.93	-131	134	
SHETLAND	5293	346	71.89	-166	179	
W ISLES	6552	428	158.43	-91	337	
TOTAL	1021222	66699	226.72	0	66699	

Weighted average

PRIMARY EFFECT

	Lothian	=137771 / 102122 x 66699	=8998
	Strathclyde	=473096 / 102122 x 66699	=30899

SECONDARY EFFECT

	Lothian	=137771 x 0.000203 x (221.43 -226.72)	=-148
	Strathclyde	=473096 x 0.000203 x (281.30 -226.72)	=5238

GRANT AIDED EXPENDITURE

	Lothian	=8998 - 148	=8850
	Strathclyde	=30899 - 5238	=36138

GAE ADJUSTMENT FOR TEACHERS' REMOTENESS AND DISTANT ISLAND ALLOWANCES

1.   Expenditure related to teachers' remoteness and distant island allowances is included within the GAE totals for services and is not separately identified.   Thus in the calculation of service assessments the small part of the GAE covering allowances is distributed to all authorities, not just to those authorities incurring this expenditure.   To remove this anomaly, a separate calculation on teachers' remoteness and distant islands allowances is made.   This redistributes the expenditure on these allowances, included in service assessments, to authorities paying allowances.

2.   The adjustment is included in the calculation of the total GAE for each authority.   The size of the adjustment is given in the Finance Circular notifying authorities' GAEs and in the annual Green Book "Grant Aided Expenditure".   The calculation for 1992-93 is attached.   The adjustment is calculated for all authorities because Island Authorities are all purpose and pay allowances for both Regional and District services. The whole calculation sums to zero because teachers' remoteness and island allowances are included in the GAE for services and are not separately identified.

3.   The calculation is based on the budget estimate of allowances for the year of GAE and is calculated as follows:
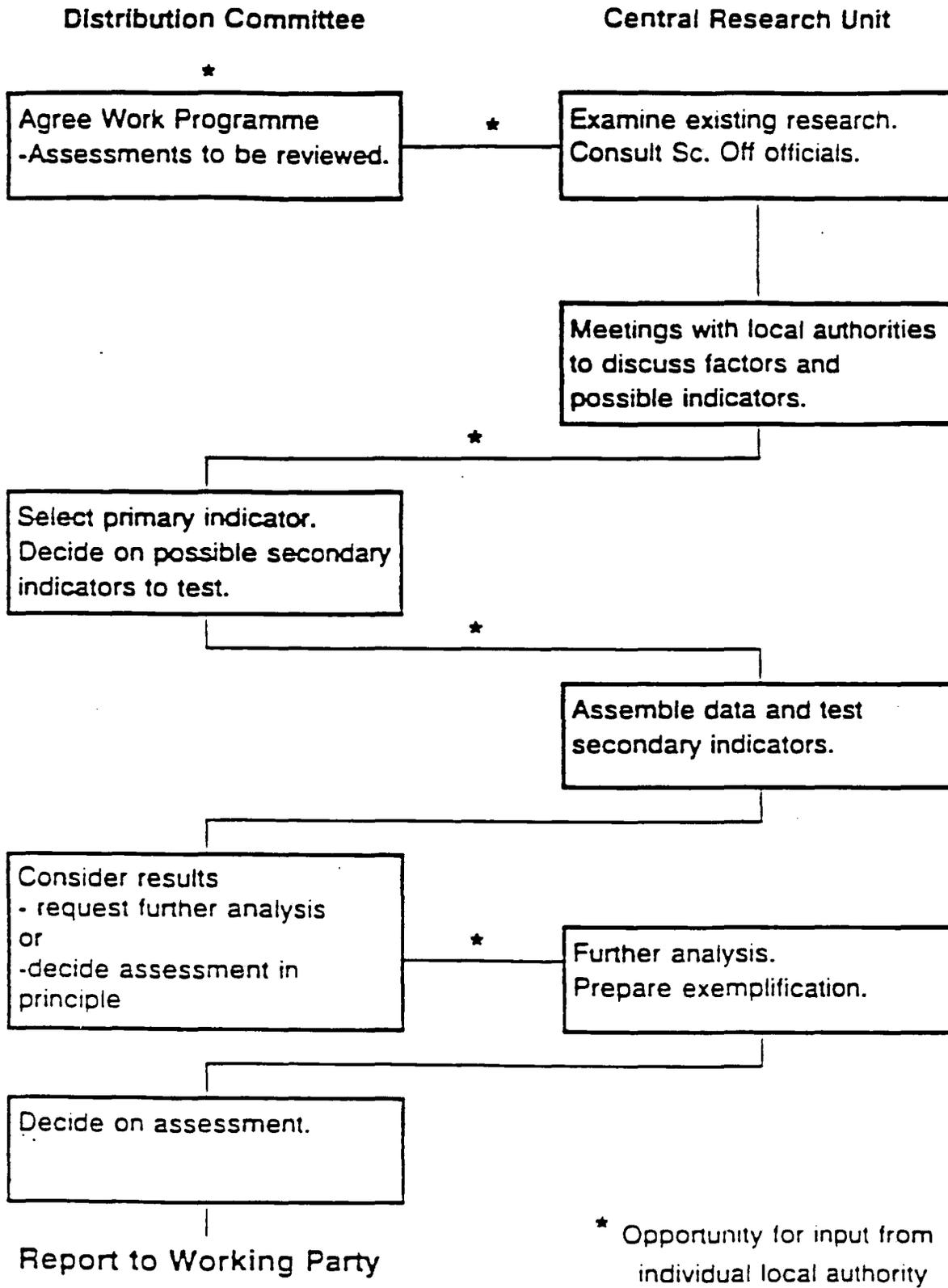
   a share of the budget total is calculated for Districts, Regions and Islands separately, according to the most recent provisional outturn of total expenditure on all services for each of these 3 authority groups (see formula A);

   each authority's share of the amount for its group is calculated on a population basis (see formula B);

   an authority's share (called "Contribution" in the Green Book table) is then subtracted from its budget to give the Adjustment to GAE (see formula C).

The net result is a redistribution to the Islands Authorities from District and Regional Authorities.

Review of Assessment

Distribution Committee   **Central Research Unit**

*

| Agree Work Programme
-Assessments to be reviewed. | * | Examine existing research.
Consult Sc. Off officials. |

Meetings with local authorities
to discuss factors and
possible indicators.

*

Select primary indicator.
Decide on possible secondary
indicators to test.

*

Assemble data and test
secondary indicators.

Consider results
- request further analysis
or
-decide assessment in
principle

*

Further analysis.
Prepare exemplification.

Decide on assessment.

Report to Working Party

* Opportunity for input from
individual local authority

USE OF SECONDARY INDICATORS

1. This section provides more information on the use of secondary indicators. A worked example of the selection of a secondary indicator and its calculation in a GAE assessment is included in Annex 3.

Introducing a Secondary Indicator

2. An allowance is made for a secondary indicator in the assessment of a service's GAE when it is considered both plausible and shows a significant and consistent statistical correlation with past expenditure. A secondary indicator is tested by being regressed against expenditure per unit of primary indicator for each of 3 years. The regression co-efficient from a statistically significant regression test is used in the calculation of the apportionment for the secondary indicator.

3. When a secondary indicator is first introduced the regression co-efficient used is a "smoothed" average of the results based on the 3 most recent years' expenditure data. The "smoothed" average is derived by giving weights of 0.25, 0.5 and 1 to the co-efficient for the earliest, middle and most recent years, respectively, and dividing their sum by 1.75.

Secondary Indicator Re-testing

4. Once a secondary indicator has been introduced it is re-tested annually to check that its correlation with inter authority variation in expenditure has continued and also to obtain a more recent regression co-efficient using updated expenditure information. Should the new correlation no longer be statistically significant, a 3-year average of the secondary indicator is tested and used if a significant correlation is established. In the event that the 3-year average also fails, the regression results from the 3 most recent years are averaged and used. The secondary indicator is tested again in the following year and if it fails it is either removed from the estimate of GAE or a new treatment is introduced based on the results of a review of the service.

EXAMPLES

1.   This annex contains examples of the use of statistical tests for the selection of primary and secondary indicators. A description of repricing and damping and the calculation of an assessment are also included.

Primary Indicator Test

2.   When 2 or more plausible potential primary indicators are identified the coefficient of variation is used to assist with the choice. This statistical measure shows which of the indicators accounts for more of the variation in expenditure between authorities. It is calculated for each indicator by dividing the standard deviation by the mean of the distribution of expenditure per unit of primary indicator for all relevant authorities. This test is used infrequently as the primary indicator is often chosen on grounds of plausibility alone.

3.   The selection of the primary indicator for the GAE assessment for school crossing patrols provides an example. Two potential primary indicators - school pupils and primary schools - were identified. Both were thought plausible because a greater number of pupils or of primary schools is likely to result in greater need for, and therefore expenditure on, school crossing patrols. They seemed equally plausible and hence the statistical test was carried out.

4.   Table 1 shows 1980-81 expenditure for region and islands authorities expressed by unit of each of the potential primary indicators. The standard deviation, mean and co-efficient of variation for each set of figures are given at the foot of the table. The co-efficient is lower when expenditure is expressed per pupil (0.61) than when it is expressed per primary school (0.88), indicating that school pupils provide a better explanation than primary schools of the inter-authority expenditure variation. School pupils was therefore chosen as the primary indicator.

Table 1 - Test of Potential Primary Indicators (based on school crossing patrol expenditure)

	1980-81 Expenditure	Expenditure per pupil	Expenditure per primary school
	£000	£	£
Borders	40	2.30	454
Central	217	4.16	1,764
Dumfries	46	1.76	374
Fife	306	4.75	1,987
Grampian	251	2.95	881
Highland	102	2.68	466
Lothian	522	4.15	2,131
Strathclyde	2,302	4.97	2,413
Tayside	253	3.65	1,188
Orkney	6	1.72	250
Shetland	0	0	0
Western Isles	0	0	0
Standard deviation		1.68	874
Mean		2.75	992
Coefficient of variation		0.61	0.88

Secondary Indicator Tests

5. In 1989 the existing secondary indicator (children under residential supervision requirements) for the GAE assessment for Community and Residential Care for Children was replaced. The existing secondary indicator could not continue to be used because it was no longer sufficiently outwith the influence of local authority policy. It remained the case that there was greater need for this service in some authorities than others due to social and economic circumstances and, therefore, possible alternative secondary indicators were examined.

6. The reasons for children being in community or residential care are many and varied. Whilst certain characteristics such as low income or unstable family relationships may indicate a greater predisposition to requiring these services only a small proportion of children in these circumstances come into care. The possible secondary indicators identified were, therefore, proxy measures for factors causing children to come into care. Four possible secondary indicators were identified and tested - children dependent on Income Support recipients, unemployment rate, lone adult households and children receiving free school meals. (Full definitions of these indicators are given in Table 2).

7. Regression analysis was used to examine the relationship between expenditure per unit of primary indicator and each of the possible secondary indicators. The values for each authority for 1987-88 are given in Table 2. The results of the regression analysis for 1987-88 and the 2 preceding years are given in Table 3 (with accompanying plots for 1987-88). Two of the indicators (unemployment rate and children receiving free school meals) had T-Statistics below the threshold value of being 95% significant and were therefore rejected. Of the 2 indicators which passed the statistical test of significance, lone adult households had

a good plot and superior results (eg T-Statistic of 4.155 in 1987-88 compared to 3.898 for children of IS recipients). Also it explained 60% (R^2(0.597) X100%) of expenditure variation per unit of primary indicator compared to 56% by children of IS recipients. However, the choice of secondary indicator was not based on the results of the statistical tests alone. Children of IS recipients was selected because:

it was a more general indicator of low income/poverty, the most common characteristic of families with children in care;

. it included many single parent families; and

it can be updated annually (lone adult households is Census based).

Secondary Indicator and GAE Assessment Calculation

8. The replacement secondary indicator was first used for the 1990-91 GAE assessment for Community and Residential Care for Children. The regression coefficient used to calculate the secondary indicator's redistributive effect was derived as follows. The standard practice for the first year when a secondary indicator is used is to calculate a smoothed average of the 3 regression coefficients from the analysis based on the 3 most recent year's data. This takes account of the relationship between the secondary indicator and expenditure in recent years and avoids concentrating on a single year. The values of the regression coefficients are given a weighting of 0.25 for the earliest year and 0.5 and 1 in the subsequent years, and their sum is divided by 1.75 - see Table 4, Step A. The average of the coefficient (0.147) was then repriced from the year of analysis (1987-88) to the year of the GAE (1990-91). The repricing factor (1.41) was the ratio of the GAE per unit of primary indicator to 1987-88 expenditure per unit of primary indicator - see Table 4, Step B. Finally the repriced coefficient was divided by 1,000 to scale it with the figures used in the GAE calculation (ie £000s).

9. Secondary indicators are retested annually to check that their relationship with expenditure is maintained and to update the regression coefficient using more recent expenditure and indicator data. For example, following its first year of use, children of IS recipients was retested with 1989-90 expenditure when this became available. It passed the statistical test and the regression coefficient was 0.142. This updated coefficient was prepared for use in the 1991-92 GAE by the following steps:

9.1 It was repriced.

9.2 It was damped (ie averaged with the coefficient value used in the GAE calculation in the preceding year).

9.3 It was scaled by dividing by 1,000.

The figures used for the repricing and damping are given in Table 5. Damping has the effect of reducing the impact of any marked change in the coefficient value, thereby increasing the stability of the annual estimate of GAE.

10. The 1991-92 GAE assessment for Community and Residential Care for Children is given in Table 6. The calculation of the primary and

secondary indicator effects for Strathclyde and Lothian are shown in detail. The weighted average value of the secondary indicator (226.72) is the average of each authority's value of the variable weighted for the number of units of primary indicator in each authority. The positive effect of the secondary indicator for Strathclyde and the negative effect for Lothian are controlled by their values of the secondary indicator compared with the weighted average.