

# FULLY RECONCILED UK NATIONAL AND SECTOR ACCOUNTS FOR 1989-1992

M A Baxter, Central Statistical Office

## Introduction

The Central Statistical Office's Agency Framework Document says that 'the Treasury expects the CSO to produce, each year, fully reconciled accounts that remove all inconsistencies in the accounts'. Such accounts were produced for 1988-91 (Baxter 1992); that paper gives details of the methodology. This paper updates the work.

If all items in the National Accounts were known exactly, the sector balancing items, the items in the last row of Table A (summary analysis by sector) of the *Blue Book*, would be zero. For many purposes, it is useful to adjust the National Accounts to make these items zero while of course keeping the constraints that appropriate rows of this Table should sum to zero. When adjusting, the items altered most should be those deemed most uncertain or subject to deficiencies in coverage.

The larger the balancing items, the larger will be the alterations to the accounts needed to make them balance. As the balancing items are now smaller than they were a few years ago, the effects of balancing are smaller than in the original study (CSO 1989).

This exercise is still regarded by the CSO as experimental. Its main aims are to find the likely areas of weakness in the National Accounts, to help in interpreting them and to produce the reconciled accounts required by the Framework Document. It is not yet felt that the results of balancing should supersede the *Blue Book* data; the results have therefore been constrained to retain the published value of GDP.

## Balancing Model

The mathematical details of the model, the method of solution and the diagnostic tests are described in the Annex to Baxter (1992). This section outlines the inputs to the model, with particular attention to those aspects which have changed since that article.

## Error ranges

To balance the accounts in the way chosen, we need the standard deviations of the errors of all items in Table A for 1989 to 1992. As a proxy for these, confidence intervals were used; the compilers of the series were asked to supply intervals such that they are 90% confident that the "true" values are within these intervals. These are based, inevitably, on compilers' judgments, but they allow for both the sampling error of any surveys used to obtain the figures, and all known sources of non-sampling error. Half the width of a confidence interval is called the error range; if the errors are normally distributed, the range is 1.645 times the standard deviation of the error. It is assumed that the confidence intervals are symmetric about the published values. Last year, a bias was assumed in the published figures for ICC and financial company profits and in CSO (1989) many such bias corrections were made.

As a starting point, the ranges used last year were brought forward, so those used for 1988 are now being used for 1989 and so on.

However, many of these ranges have been widened since last year, often on the basis of revisions analyses. In such an analysis, revisions to previously published figures are considered. Thus, if an item is regularly revised by amounts of the order of £100 million three years after first publication, its uncertainty must be at least of this order. The number of items given a range of only £0.5 million (implying that the figure is thought to be correct to the nearest £1 million) has in consequence been greatly reduced. Also, all substantial items (those generally exceeding £100 million) have been given ranges of at least £10 million. This does not mean that CSO estimates are thought to have deteriorated, but that compilers have made more realistic assessments of errors, especially in the light of revisions analyses.

## Rents

For rows not summing to zero, it was assumed in CSO (1989) and Baxter (1992) that the figure for each sector is estimated independently. The row total is thus not an independent estimate conveying any extra information, so it gets an arbitrarily large margin (in practice, £1 million million). This is not appropriate for rents, where a total for persons, ICC and financial is first estimated, then split between these three sectors. Thus the errors in rents for these sectors include the error in the total and further errors due to uncertainties in the split. Rents for public corporations, Central Government and Local Authorities come from other, usually more accurate, sources. A further complication is that personal rent is the sum of actual rent received (a share of total rents) and imputed rent nominally paid by owner occupiers to themselves; this does not apply to other sectors. To model this, a realistic error margin was assigned to total rents, and the margins for the rents by sector for persons, ICC and financial were widened to allow for the allocation errors; the margins for total rent and personal rent were further widened to include the uncertainty in imputed rent.

## The GDP constraint

To remove all inconsistencies, the sum of the components of GDP (on either the income or expenditure breakdown) must, after balancing, equal published GDP, which is not derived from the balancing process. As noted above, balancing makes the income and expenditure components of GDP sum to the same total. In all the results given below, GDP is constrained to the value published in the 1993 *Blue Book*. To achieve this, published GDP was added as an extra variable, with an error margin of £0.5 million; an extra constraint that the sum of the income components (income from employment and self-employment, profits, rent and imputed charge for capital consumption, less stock appreciation) must equal published GDP was added.

Published GDP for 1991 and 1992 uses information derived from income, expenditure and output. (For 1989 and 1990, only income and expenditure data were used.) Thus the GDP constraint brings in output data not in Table A. Ways to add this information to the balancing model more directly are being considered.

### Further constraints

In some cases, the sum of a number of items is known more accurately than any of them individually. This can be allowed for in the model by a similar method to the one above: add an extra variable equal to the required sum, with a suitably small error margin, and an extra constraint that the relevant items sum to the new variable. In the balancing, the sum of the items is forced to remain equal to the new item, which changes relatively little because of its smaller margin. This has been done for personal, Central Government and Local Authority consumption (these constraints have not been used before) and for Central Government accruals. The bank profit constraint used in CSO (1989) and Baxter (1992) is no longer thought appropriate.

*Personal consumption:* This item includes two notional values: an imputed charge for capital consumption (ICCC) by private non-profit-making bodies serving the public and imputed rent on owner-occupied and rent-free dwellings. Both also appear in the income part of Table A, so cancel out in the sector balancing item. Allowing for the sign convention in Table A, a new item was added and constrained to be equal to the sum of rent, ICCC and consumption; it has a smaller error margin than consumption, as the uncertainty in imputed rent and ICCC is removed.

*Central Government consumption:* The item with this name has independent components: ICCC and "true" consumption. A new item was added equal to the sum of ICCC and consumption; ICCC cancels out.

*Local Authority consumption:* As for Central Government.

*Central Government accruals:* The sum of a number of items, less the accruals adjustment, equals total cash receipts by Central Government; this is known quite accurately.

### Correlations

Another way to represent the fact that the sum of two items is known more accurately than either of them individually is to add a negative covariance between them to the covariance matrix described in the Annex to Baxter (1992). For the personal, ICC and PC sectors a covariance representing a correlation of -0.235 is assumed between stock appreciation and value of physical increase in stocks (stock appreciation in other sectors is negligible).

In some cases, the sum of two items is known almost exactly. This occurs if the uncertainty in both of them is mainly due to an item which is added to one and subtracted from the other. In these cases, the two items are given equal error margins and a covariance equivalent to a correlation of -1. The pairs so treated were:

- Personal: Other current transfers, receipts and Overseas: Other current transfers, payments
- Personal: Other current transfers, payments and Overseas: Other current transfers, receipts

Four pairs so treated last year have on further consideration been excluded. It is probable that many more correlations exist. Work is continuing to identify them and include them in future balancing exercises.

### Financial flows for the Overseas sector

This constraint relates financial flows and dividend and interest receipts for the overseas sector. As explained in the Annex to Baxter (1992), this constraint involves all four years together.

### Results

Published data and balanced accounts for 1989 to 1992 are given in tables 1 to 4 and 5 to 8 respectively. These are in the same format as Table A in the *Blue Book*, except that figures below the line for Banks and Building Societies and for OFIs are not shown separately. There is no point, for the purposes of this article, in splitting them below the line, since we cannot calculate separate sector balancing items if they are not split above the line.

With only one exceptions for 1989 and three for 1990 (shown below) all balanced data are within the confidence intervals of the unbalanced data. These four items do not necessarily have errors greater than the assumed ranges; the magnitudes of the adjustments needed to achieve balance are merely symptoms of the incoherence of the overall accounts. Nor does the fact that they are all in the public sectors mean that these are the weak link in the accounts; on the contrary, these sectors usually have the smallest balancing items. It may, however, mean that for these sectors some of the error ranges are too small. As the confidence intervals are 90% ones, not 100% ones, it would be surprising if nothing went outside them; indeed, it might be expected that this would happen more often.

### Items changed by more than their error ranges

Item	Blue Book	Balanced	Change	Range	Change/range
<b>1989</b>					
LA Accruals adjustments	-94	-497	-403	336	-1.20
<b>1990</b>					
CG Taxes on capital	4342	4551	209	150	1.39
CG Other capital transfers: payments	-11094	-10870	224	200	1.12
LA Other capital transfers: receipts	2039	1872	-167	150	-1.11

### Diagnostic tests

A useful test of the error ranges and the coherence of the accounts is to see if the sector balancing items are larger than would be expected from the size of the ranges. This can be tested by using the Mahalanobis distance; see Baxter (1992).

Applying this test to the data gives the following diagnostic statistics. As an aid to interpretation, note that with the assumptions given in Baxter (1992) each diagnostic has a chi square distribution with seven degrees of freedom. Thus the expected value of each diagnostic is 7, and values greater than 18.5 occur by chance with only 1% probability. Thus, values greater than 18.5 imply that there is probably some incoherence in the accounts, and the greater the diagnostic the more the incoherence. The values of the diagnostic depend crucially on having accurate error ranges.

1989	20.10
1990	30.06
1991	6.42
1992	9.89

The figure for 1989 is clearly, and that for 1990 is very, significant, though both are far lower than the 52.47 found last year for 1988. However, those for 1991 and 1992 are far from significant. Indeed, the figure for 1991 is less than its expected value. Last year, 1989 and 1990 were not quite significant at 1% and 1991 was not significant. This may mean that the accounts for the two most recent years are more coherent than the preceding ones, but it could also mean that compilers are realistic about the errors in recent data but overly optimistic about how the data improve over time.

Table 14 gives a rough breakdown of these diagnostic statistics by sector. The only sectors for which the sector balancing item differs significantly from zero with even 5% confidence are PC for 1989 (1.8%) and 1992 (4.3%) and personal for 1990 (2.4%). This is a great improvement on the 1992 results, when there were six such sectors, two with significance 0.01%. Again, this does not prove that these sectors are the weak link in the accounts, but that for them some of the error ranges are too small.

### Conclusions

This paper presents the fully reconciled accounts required by our Framework Document. It also tests whether the incoherence of the published accounts is too great to be explained by the assumed errors. There are some problems with 1989 and 1990, probably in the public corporation and personal sectors respectively, where the balancing items are larger than would be expected from the error ranges and correlations in the balancing model. There may possibly be problems with public corporations in 1992, but not enough to make the accounts significantly incoherent overall. However, the diagnostic tools available do not allow us to be more specific. There seem to be no problems with 1991.

### Further work

The diagnostic tests would be more sensitive if they had more degrees of freedom, which means more sectors. The only feasible way to do this is to split the financial sector above the line into two or more sectors; data to do this should be available by next year.

The correlations within rows that sum to zero would be better represented if the way that the rows are made to sum to zero were correctly modelled. For some rows, this is done by double entry book-keeping; the row is the sum of a limited number of items, each of which is added to one sector and subtracted from another. The entries in this row should be replaced by these underlying items. The constraint that the row must sum to zero can then be removed, as it will sum automatically. It may be easier to model some rows if they are split up. Table A has 20 rows below the line but *Blue Book* table 11.1 has 45. This will substantially increase the size of the model, and it will be necessary to get error ranges for all the resultant items.

### References

- BAXTER M A (1992) The production of fully reconciled UK national and sector accounts for 1988-1991. *Economic Trends*, 469, November 1992, p. 80-98.
- CSO (1989) An investigation into balancing the UK national and financial accounts, 1985-7. *Economic Trends*, 424, February 1989, p. 74-103.
- STONE J R N, CHAMPERNOWNE D G and MEADE J E (1942) The precision of National Income accounting estimates. *Rev. Econ. Studies*, 9, p. 111-125.

Table 1  
1989 data as published

£ million

	Personal sector	ICCs	Financial sector	Public corps	Central govt	Local auths	Overseas sector	TOTAL
<b>CURRENT TRANSACTIONS</b>								
<b>Factor incomes:</b>								
Income from employment	283454	0	0	0	0	0	0	283454
Income from self-employment	54440	0	0	0	0	0	0	54440
Gross trading profits, etc	0	80095	-13631	6528	-323	522	0	73191
Rent	24802	4458	556	568	108	3238	0	33730
Imputed charge for capital consumption less stock appreciation	557	0	0	0	1484	1964	0	4005
	-803	-6203	0	-55	0	0	0	-7061
<b>Inter-sector transfers:</b>								
Earnings on direct investment overseas	123	16190	342	1	0	0	-16656	0
Earnings due abroad	-81	-8635	-522	0	0	0	9238	0
Dividends and interest: receipts	61714	10014	119647	659	9974	1368	61352	264728
payments	-44038	-41292	-96154	-2616	-17984	-5322	-57322	-264728
Taxes on income	-48204	-19038	-2706	-102	70050	0	0	0
Social security contributions	-32902	0	0	0	32902	0	0	0
Social security benefits	44965	0	0	0	-45503	0	538	0
Community charge	-586	0	0	0	0	586	0	0
Other current grants by government: receipts	9068	0	0	0	2143	24200	5883	41294
payments	0	0	0	0	-33793	-5358	-2143	-41294
Other current transfers: receipts	2034	0	0	0	431	0	2050	4515
payments	-2441	-260	-64	0	0	0	-1750	-4515
Royalties and licence fees on oil and gas production	0	-556	0	0	556	0	0	0
<b>Factor cost adjustment:</b>								
Taxes on expenditure	0	0	0	0	60067	19913	0	79980
Subsidies	0	0	0	0	-4774	-1008	0	-5782
<b>Expenditure:</b>								
Consumption	-327363	0	0	0	-63294	-38502	0	-429159
Exports of goods and services	0	0	0	0	0	0	-121486	-121486
Imports of goods and services	0	0	0	0	0	0	142808	142808
Balance = Saving	24739	34773	7468	4983	12044	1601	22512	108120
<b>CAPITAL TRANSACTIONS</b>								
Gross domestic fixed capital formation	-29075	-52538	-7873	-5467	-4951	-4631	0	-104535
Value of physical increase in stocks and work in progress	-449	-3080	0	-219	163	0	0	-3585
Taxes on capital	-3175	-1114	-151	0	4440	0	0	0
Other capital transfers: receipts	2509	561	0	1453	24	2387	0	6934
payments	-90	-319	0	-148	-5503	-874	0	-6934
Balance = Financial surplus or deficit	-5541	-21717	-556	602	6217	-1517	22512	0
<b>FINANCIAL TRANSACTIONS</b>								
Notes and coin	826	67	320	-27	-1245	0	59	0
Sterling treasury bills and government securities	-3306	-140	-11612	-4	15391	13	-342	0
National savings and tax instrument	-1492	136	37	-78	1397	0	0	0
Issue Departments transactions in commercial bills	0	1996	1230	0	-3598	0	372	0
Other government domestic transactions	-47	-7	-608	6	-347	1003	0	0
Government overseas transactions	0	0	-62	0	-6613	0	6675	0
Local authority debt	-427	29	-699	-44	2589	-1385	-63	0
Public corporations' debt	21	0	-207	607	1798	-84	-2135	0
Deposits with banks:								
Sterling sight	10964	2059	-15337	2	179	16	2117	0
Sterling time	10097	5278	-25469	-197	107	-169	10353	0
Foreign currency	359	3095	-35815	-42	-2	21	32384	0
Deposits with BS: sterling	17580	1044	-19239	0	0	0	615	0
: foreign	11	23	-1082	0	0	0	1048	0
Bank lending (excluding public sector)	-13280	-35948	78211	0	0	0	-28983	0
Other lending	-35166	-5944	40126	259	1081	-292	-64	0
Trade and retail credit	-451	-1182	1131	582	-8	0	-72	0
UK and overseas securities and unit trust units	-20898	10376	36528	-9	-4657	149	-21489	0
Other domestic instruments	29728	-13374	-46879	152	-289	-119	30781	0
Other overseas instruments	32	10205	1569	62	-27	0	-11841	0
Accruals adjustments	3904	42	-4099	17	230	-94	0	0
Total financial transactions	-1545	-22245	-1956	1286	5986	-941	19415	0
<b>BALANCING ITEM</b>	-3996	528	1400	-684	231	-576	3097	0