Economic Trends

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Contents

Introduction

Economic Trends brings together all the main economic indicators. It contains three regular sections of tables and charts illustrating trends in the UK economy.

'Economic Update' is a feature giving an overview of the latest economic statistics. The content and presentation will vary from month to month depending on topicality and coverage of the published statistics. The accompanying table on main economic indicators is wider in coverage than the table on selected monthly indicators appearing in previous editions of *Economic Trends*. Data included in this section may not be wholly consistent with other sections which will have gone to press earlier.

An article on international economic indicators appears monthly and an article on regional economic indicators appears every March, June, September and December. Occasional articles comment on and analyse economic statistics and introduce new series, new analyses and new methodology.

Quarterly articles on the national accounts and the balance of payments appear in a separate supplement to *Economic Trends* entitled *UK Economic Accounts* which is published every January, April, July and October.

The main section is based on information available to the ONS on the date printed in note 1 below and shows the movements of the key economic indicators. The indicators appear in tabular form on left hand pages with corresponding charts on facing right hand pages. Colour has been used to aid interpretation in some of the charts, for example by creating a background grid on those charts drawn to a logarithmic scale. Index numbers in some tables and charts are given on a common base year for convenience of comparison.

The section on cyclical indicators shows the movements of four composite indices over 20 years against a reference chronology of business cycles. The indices group together indicators which lead, coincide with and lag behind the business cycle, and a short note describes their most recent movements. The March, June, September and December issues carry further graphs showing separately the movements in all of the 27 indicators which make up the composite indices.

Economic Trends is prepared monthly by the Office for National Statistics in collaboration with the statistics divisions of Government Departments and the Bank of England.

Notes on the tables

1. All data in the tables and accompanying charts is current, as far as possible, to 16 August 1996.

2. The four letter identification code at the top of each column of data (eg, DJDD) is ONS's own reference to this series of data on our database. Please quote the relevant code if you contact us requiring any further information about the data.

3. Some data, particularly for the latest time period, is provisional and may be subject to revisions in later issues.

4. The statistics relate mainly to the United Kingdom; where figures are for Great Britain only, this is shown on the table.

5. Almost all quarterly data are seasonally adjusted; those not seasonally adjusted are indicated by NSA.

6. Rounding may lead to inconsistencies between the sum of constituent parts and the total in some tables.

7. A line drawn across a column between two consecutive figures indicates that the figures above and below the line have been compiled on different bases and are not strictly comparable. In each case a footnote explains the difference.

8. 'Billion' denotes one thousand million.

9. There is no single correct definition of *money*. Consequently, several definitions of money stock are widely used:

M0 the narrowest measure consists of notes and coin in circulation outside the Bank of England and bankers' operational deposits at the Bank.

M2 comprises notes and coin in circulation with the public *plus* sterling retail deposits held by the UK private sector with UK banks and building societies.

M4 comprises notes and coin in circulation with the public, together with all sterling deposits (including *certificates of deposit*) held with UK banks and building societies by the rest of the private sector.

The Bank of England also publish data for liquid assets outside M4.

10. Symbols used:
   .. not available
   - nil or less than half the final digit shown
   + alongside a heading indicates a series for which measures of variability are given in the table on page T79
   † indicates that the data has been revised since the last edition; the period marked is the earliest in the table to have been revised
   * average (or total) of five weeks.

If you have any comments or suggestions about *Economic Trends,* please write to Michael Byrne, Technical Editor, ONS, Room 131E/1, Government Buildings, Great George Street, London, SW1P 3AQ.

Marketing and Customer Service Division
Office for National Statistics

16 August 1996

ONS Databank

The data in this publication can be obtained in computer readable form via the ONS Databank service which provides macro- economic time series data on disc. For more details about the availability of this and other datasets, prices or to place your order please telephone, write or fax: ONS Sales Office, Room 131/4, Government Buildings, Great George Street, London, SW1P 3AQ. Telephone: 0171 270 6081 or fax 0171 270 4986. The ONS does not offer direct on-line access for these data but a list of host bureaux offering such a facility is available on request from the ONS.

United Kingdom Macro-Economic Statistics Publications

Annual Publications

- UK National Accounts (Blue Book)
- UK Balance of Payments (Pink Book)
- Input/Output Balances
- Economic Trends Annual Supplement
- Share Ownership
- Public Finance Trends
- Financial Statistics Explanatory Handbook

Quarterly Publications

- UK Economic Accounts
- Consumer Trends
- Overseas trade analysed in terms of industry

Monthly Publications

- Retail Prices Index
- Producer Price Indices
- Economic Trends
- Financial Statistics
- Monthly Review of External Trade Statistics

First Releases

Annual
- Profitability of UK companies

Quarterly
- UK Balance of Payments
- UK National Accounts
- UK Output, Income & Expenditure
- GDP Preliminary estimate
- Capital Expenditure
- Stocks
- Institutional Investment
- Govt Deficit & Debt under the Treaty

Monthly
- UK Trade in goods
- Public Sector Borrowing Requirement
- Cyclical Indicators of the UK economy
- Retail Prices Index
- Producer Prices

Other publications: - Retail Prices 1914-1990 - Input/Output Tables - Labour Market Statistics - Family Spending - Sector Classification Guide

ECONOMIC UPDATE - AUGUST 1996

(includes data up to 20th August 1996)

by Adrian Richards and Philip Blackburn, Economic Assessment - Office for National Statistics

Overview

On the output side, growth in manufacturing still remains flat, despite encouraging signs in the CBI's monthly enquiry, but overall production was boosted by stronger growth in mining and quarrying. New construction orders fell further, but the private sector is showing increased activity. Despite a rise in headline RPI, underlying inflation - as shown by producer prices and average earnings - remains subdued. There are continued indications of increasing demand in the labour market with claimant unemployment falling significantly in July and jobcentre vacancies rising strongly. External demand made a positive contribution to growth in the three months to May as the UK's trade deficit shrank as exports, most prominently in manufactures, out-performed imports. However, the deficit with non-EU worsened in the three months to June.

Activity

1. The ONS's **coincident cyclical indicator** stopped falling in June, but the overall trend for 1996 is flat. Partial information suggests that the **shorter leading index** fell in July due to lower share prices, and the **longer leading index** rose in June and July, driven upward by increased business optimism.

Output and expectations

2. The **index of industrial production**, seasonally adjusted, was 0.2% higher in the three months to June than the previous three months. Within this, **manufacturing output** remained flat, **mining and quarrying output, including oil and gas** extraction rose strongly by 1.4 % and output of the **electricity, gas and water supply** industries increased by 0.8%. Production of durable goods decreased by 0.9% as output of cars fell by 2.7%, whilst production of non-durables rose by 0.4% mainly due to increased clothing and footwear production. Chart 1 highlights the recent weakness in output of durables. Within manufacturing, the largest rises in production were in textiles (up 2.2%), and the largest falls in output were those of coke, minerals, oil refining and nuclear fuels (down 9.3%).

3. The **CBI Monthly Trends Enquiry in manufacturing** reported the **output expectations** balance in the next 4 months, seasonally adjusted, rising sharply from 11% in June to 28% in July, indicating wider optimism of higher future growth in the manufacturing sector.

4. The volume of new **construction orders** in Great Britain, seasonally adjusted, fell by 2% in the three months to June compared with the three months to March. The sectoral pattern shows that, public housing and housing association orders were 22% lower, public non-housing orders were 18% lower, and infrastructure orders were 6% lower. However, as shown in Chart 2, new orders in the private sector, which amount to nearly 80% of total new orders, increased over this period, with private industrial orders up 7%, private commercial orders up 5%, and private housing orders up 3%.

Chart 1

Output of consumer goods

seasonally adjusted

3 month on 3 month % change
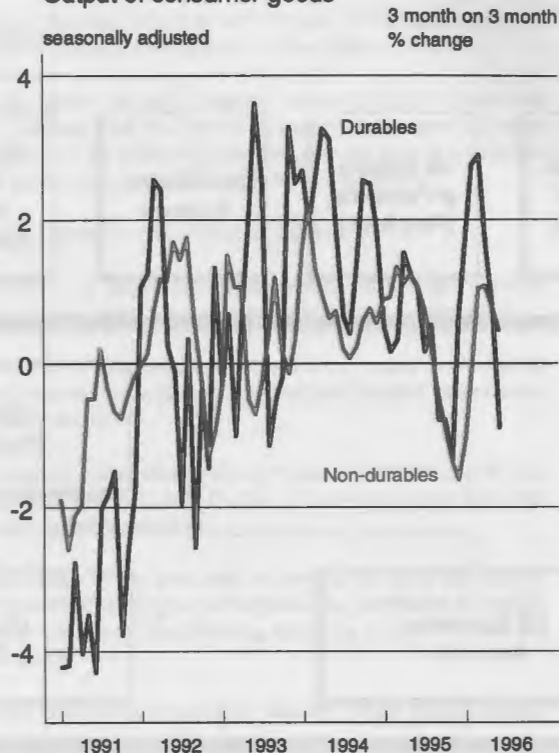
Chart 2

Volume of new orders for new construction work in GB

seasonally adjusted

3 month on 3 month % change
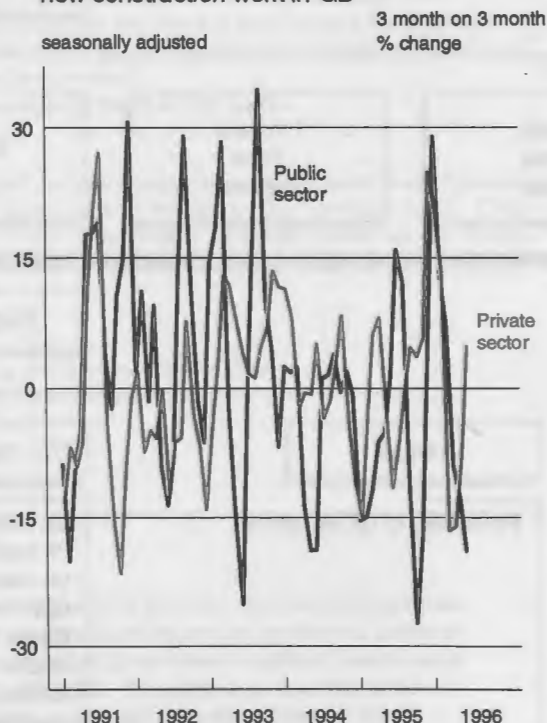
Indicators of domestic demand

5. **Total net personal borrowing**, seasonally adjusted, rose from £6.0 billion in the three months to March to £6.6 billion in the three months to June. Over this period, **net borrowing secured on dwellings**, seasonally adjusted, rose by £0.2 billion to £4.2 billion while **net consumer credit**, seasonally adjusted, rose from £2.0 billion to £2.4 billion, following the surge in demand for credit during April.

Prices and wages

6. The 12-month rate of increase of the **retail prices index (RPI)** edged higher to 2.2% in July, 0.1 percentage points above June's rate, the first rise of 1996. Increasing house prices were the main cause of the upward pressure. **Excluding mortgage interest payments (RPIX)**, the 12-month rate remained unchanged at 2.8% in July. **Excluding mortgage interest payments and indirect taxes (RPIY)**, the 12-month rate rose by 0.1% to 2.4% in July.

7. Producer prices changes continued to fall in July. The three month on three month annualized percentage growth in the **output price index for manufactured products** (home sales), seasonally adjusted and excluding excise duties, fell from 1.4% in June to 0.9% in July. Over the same period the annualized change in **input prices** (all manufacturing), seasonally adjusted, fell further from deflation of 2.3% to deflation of 6.4%. The source of this deflation was the substantial falls in the prices of metals, paper and food materials. Chart 3 illustrates the downward trend in producer price changes since the start of 1995.

Chart 3

Producer prices (all manufacturing)

seasonally adjusted
3 month on 3 month annualized % change
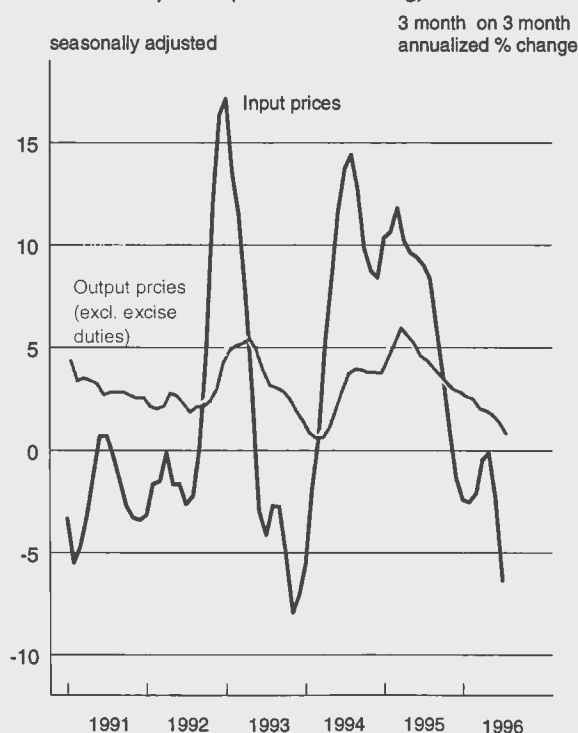
8. **Expectations of price increases** were scarce in July. The CBI Monthly Trends Enquiry for manufacturing showed a balance of only 2%, seasonally adjusted by the ONS, expecting to raise prices in the next four months. The balance was the lowest since April 1994.

9. The annual rise in underlying **whole economy average earnings** for Great Britain remained unchanged in June at 3¾%, following a revision of May's rate, up by ¼ percentage point. Earnings remained unchanged within all sectors during June: in the service sector they were 3½%, in manufacturing they were 4¼%, and in production they were 4%. [For the service and manufacturing sectors, the earnings rate for May was revised upwards by ¼ percentage point.]

Labour market and productivity

10. **UK claimant unemployment**, seasonally adjusted, fell in July by 24,100 to stand at 2.1 million, or 7.6% of the workforce. In the three months to July the average monthly fall was 18,700 compared with an average fall of 8,100 in the three months to April.

11. **Jobcentre vacancies** in the UK rose strongly in July by 11,500 to be at a total of 230,300. As highlighted by Chart 4, vacancies have been rising consistently throughout 1996, with June's increase the largest so far this year at 13,700.

Chart 4

Claimant unemployment and job centre vacancies

seasonally adjusted
3 month on 3 month % change
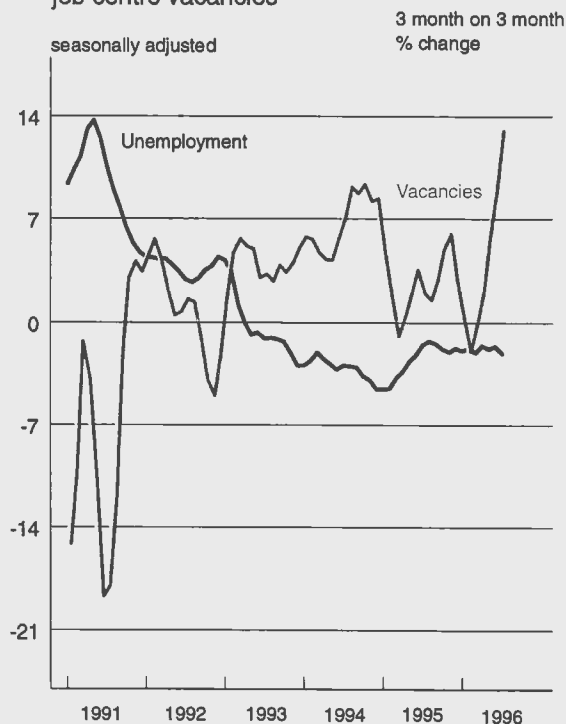
12. There was a rise in **GB employment in manufacturing industries** of 4,000 in the three months to June, and a fall of 26,000 in the twelve months to June. Employment in the rest of the production industries remained the same in the three months to June, and fell by 17,000 in the twelve months to June.

13. In the three months to June, **productivity in manufacturing** was 0.9% up on the three months to June 1995. **Unit wage costs in manufacturing** rose by 3.3% over the same period.

14. There were 228,000 working days lost to **labour disputes** in the UK in June, the highest number in a month since March 1990 (236,000). The majority of days lost was in the transport and communications sector. Chart 5 shows the significance of June's total.

Chart 5

Working days lost due to labour disputes
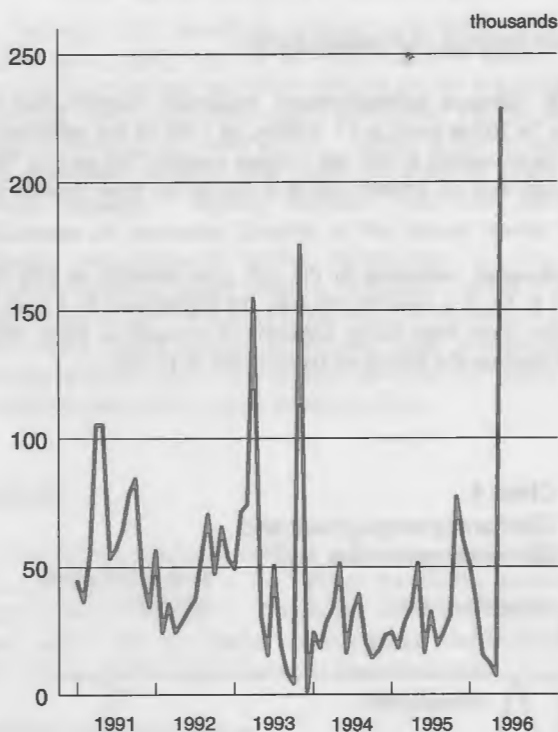
Monetary indicators

15. The annual growth of **narrow money (M0)**, seasonally adjusted, decelerated slightly from 7.4% in June (the largest annual gorwth rate since December 1988) to 7.1% in July, but still remains high. **Annual growth of broad money (M4)**, seasonally adjusted, fell from 9.9% in June to 8.8% in July, the lowest growth rate since September 1995.

Government finances

16. In July the **public sector borrowing requirement (PSBR)** was minus £1.7 billion. For the first four months of 1996-97, the PSBR was £8.8 billion compared with £12.1 billion in the same period last year. **Excluding privatisation proceeds** the figures were £11.0 billion and £12.1 billion respectively.

Balance of payments

17. The deficit on the **balance of UK trade in goods** fell from £3.9 billion in the three months to February to £3.1 billion in the three months to May. Over this period the **volume of total exports, excluding oil and erratics**, rose by 3.9%. On the same basis **imports** rose by 1.8%. Exports of manufactures continue to out-perform other exports: semi-manufactures grew by 7.9% and finished manufactures rose by 4.3%, whilst import growth was substantial for raw materials: fuels up by 14.4% (as exports fell by 4.6%) and basic materials up by 12.4%. Chart 6 highlights the recent strength of manufacturing exports.

18. More timely data on **trade with non-EU countries** shows that the deficit widened from £2.5 billion in the three months to

March to £2.7 billion in the three months to June. Over this period, **export volumes, excluding oil and erratics** rose by 2.7% compared with the previous three months. On the same basis **imports** rose marginally by 1.7%. Chart 7 shows a deterioration of the UK's balance of trade with the Newly Industrial Asia countries.

Chart 6

Volume of trade in manufactures
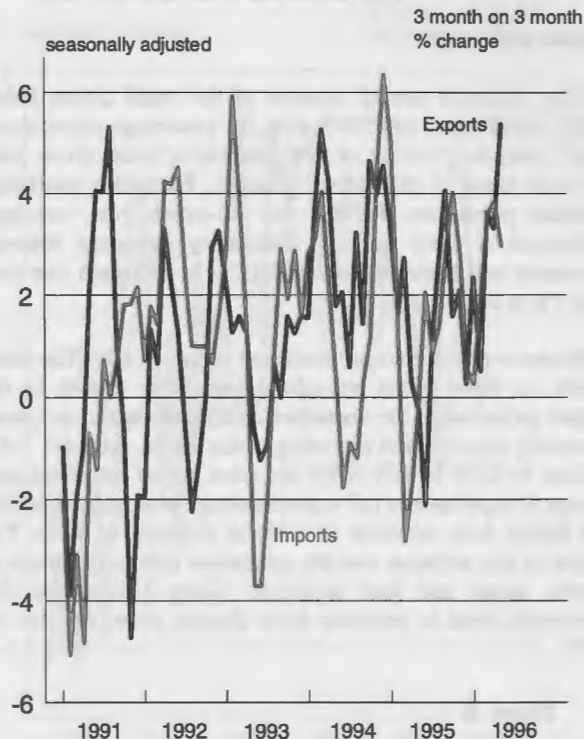
Chart 7

Balance of trade
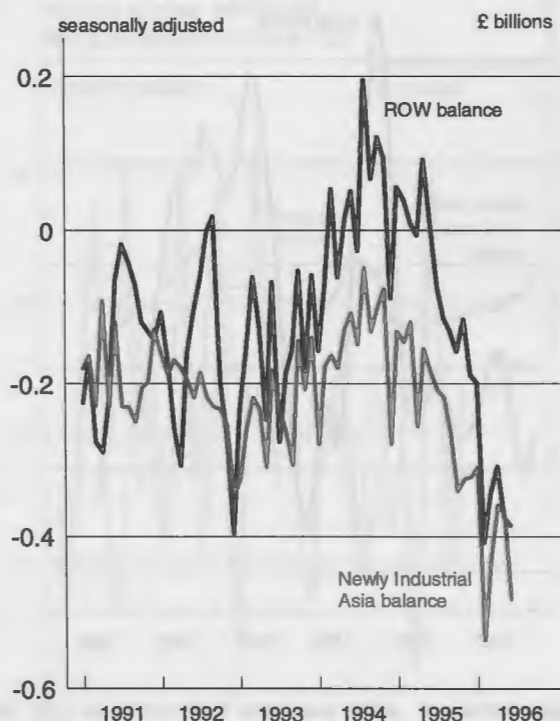
* ROW excludes EU, W.Europe, N.America, other OECD and Oil Exporting Countries

4

Forecast for the UK Economy
A comparison of independent forecasts, August 1996.

The tables below are extracted from HM Treasury's "FORECASTS FOR THE UK ECONOMY" and summarise the average and range of independent forecasts for 1996 and 1997, updated monthly.

	Independent Forecasts for 1996		
	Average	Lowest	Highest
GDP growth (per cent)	2.2	1.8	2.9
Inflation rate (Q4) - RPI - RPI excl MIPS	2.2 2.7	1.5 2.1	3.2 3.5
Unemployment (Q4, mn)	2.10	2.00	2.20
Current Account (£bn)	-5.3	-9.0	-2.4
PSBR (1996-97, £bn)	27.8	25.0	32.0

	Independent Forecasts for 1997		
	Average	Lowest	Highest
GDP growth (per cent)	3.3	2.2	4.2
Inflation rate (Q4) - RPI - RPI excl MIPS	3.4 2.9	1.7 1.6	5.3 4.1
Unemployment (Q4, mn)	1.9	1.6	2.3
Current Account (£bn)	-7.2	-17.0	2.9
PSBR (1997-98, £bn)	23.9	15.0	31.6

NOTE: "FORECASTS FOR THE UK ECONOMY" gives more detailed forecasts, covering 24 variables and is published monthly by HM Treasury, available on annual subscription, price £75,. Subscription enquiries should be addressed to Miss Jehal, Publishing Unit, Room 53a, HM Treasury, Parliament Street, London SW1P 3AG (0171 270 5607).

INTERNATIONAL ECONOMIC INDICATORS

(includes data up to 19 August 1996)

by Kevin Madden, Economic Assessment - Office for National Statistics

INTRODUCTION

The series presented here are taken from the Organisation of Economic Co-operation and Development's (OECD) Main Economic Indicators, except for the United Kingdom where several of the series are those most recently published. The series shown are for each of the G7 economies (United Kingdom, Germany, France, Italy, United States, Japan and Canada) and for the European Communities (EC) and OECD countries in aggregate. **As data on unified Germany becomes available it is included, where applicable, in this article for the first time. Footnotes to the tables explain the commencement or otherwise of the data.**

2. The length and periodicity of the series have been chosen to show their movement over a number of years as well as the recent past. There is no attempt here to make cross country comparisons across cycles. Further, because the length and timing of these cycles varies across countries, comparisons of indicators over the same period should be treated with caution.

COMMENTARY

3. Against a background of both very low inflation and short-term interest rates, and accompanied also by increased government expenditure, **gross domestic product (GDP) at constant market prices** in Japan grew, on a quarterly basis, by 3.1% in 1996 Q1. The Japanese economy has now grown for five consecutive quarters. Growth also picked up in France, where following a contraction of 0.5% recorded in the previous quarter, the rate rebounded by 1.2%. Over the same period, growth in the Canadian economy edged up from 0.2% in 1995 Q4 to 0.3% in 1996 Q1.

4. Despite a general tendency for inflation to fall across the G7 economies, **consumer price inflation** rose in the United Kingdom from 2.1% in June to 2.2% in July although this itself had been preceded by three successive monthly falls. German price inflation was unchanged at 1.8% from April to May, to continue within a band of 1.7%-1.9% which has prevailed since June 1995.

5. **Standardised unemployment rates** (ILO based) fell in the United Kingdom from 8.4% in April to 8.3% in May, reversing the rise of the previous month. In Canada the unemployment rate also fell to 9.3% and likewise reversed a previously recorded monthly increase. However, French unemployment has continued to move steadily upwards, reaching 12.4% in May, a rise of 0.8 percentage points since August 1995.

1 Gross domestic product at constant market prices: index numbers

1990 = 100

	United Kingdom	Germany[1]	France	Italy	EC	United States	Japan[2]	Canada	Major 7	OECD
	FNAO	GABI	GABH	GABJ	GAEK	GAEH	GAEI	GAEG	GAEO	GAEJ
1980	76.8	79.9	79.2	80.3	79.0	75.1	67.5	75.1	75.1	75.5
1985	84.9	84.7	85.4	86.1	85.1	86.8	79.7	86.6	85.1	85.2
1986	88.6	86.7	87.6	88.6	87.5	89.4	82.1	89.5	87.6	87.6
1987	92.8	87.9	89.5	91.4	90.1	92.0	85.4	93.2	90.3	90.4
1988	97.5	91.1	93.5	95.3	93.8	95.5	90.7	97.8	94.3	94.1
1989	99.6	94.4	97.5	97.9	97.1	98.7	95.1	100.3	97.7	97.5
1990	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1991	98.0	112.4	100.8	101.1	103.0	99.0	104.0	98.2	101.3	101.3
1992	97.5	114.4	102.0	101.7	103.9	101.7	105.0	99.0	103.1	103.1
1993	99.6	113.1	100.6	100.6	103.3	104.0	105.1	101.1	104.1	104.1
1994	103.5	116.4	103.5	102.7	106.3	107.6	105.7	105.3	107.0	106.9
1995	106.0	118.9	105.7	105.7	108.9	109.8	106.6	107.7	109.1	108.9
1993 Q2	99.0	112.9	100.4	100.8	103.1	103.5	105.2	100.9	103.8	103.8
Q3	100.0	113.7	100.7	99.9	103.5	104.1	105.4	101.3	104.2	104.3
Q4	100.7	113.5	100.9	101.0	103.9	105.3	104.9	102.3	104.9	104.8
1994 Q1	101.8	114.8	101.5	101.2	104.7	106.0	105.3	103.4	105.6	105.5
Q2	103.1	116.2	103.2	102.2	106.0	107.2	105.8	104.5	106.7	106.6
Q3	104.1	117.0	104.0	103.6	106.9	108.2	106.5	106.0	107.6	107.5
Q4	104.9	117.7	105.1	103.6	107.6	109.0	105.3	107.3	108.1	107.9
1995 Q1	105.3	118.0	105.7	105.0	108.3	109.2	105.5	107.7	108.4	108.3
Q2	105.7	119.3	105.8	105.0	108.8	109.3	106.1	107.4	108.7	108.4
Q3	106.3	119.4	105.9	106.9	109.4	110.3	106.7	107.8	109.5	109.2
Q4	106.7	118.9	105.4	105.9	109.2	110.4	108.0	108.0	109.7	109.5
1996 Q1	107.1	..	106.7	..	..	111.0	111.3	108.3	..	..
Percentage change, latest quarter on corresponding quarter of previous year										
1995 Q4	1.8	1.0	0.3	2.2	1.5	1.3	2.6	0.7	1.5	1.5
1996 Q1	1.7	..	0.9	..	..	1.6	5.5	0.6	..	..
Percentage change, latest quarter on previous quarter										
1995 Q4	0.4	−0.4	−0.5	−0.9	−0.2	0.1	1.2	0.2	0.2	0.3
1996 Q1	0.4	..	1.2	..	..	0.5	3.1	0.3	..	..

1 Data available for unified Germany since 1991
2 GNP

2 Consumer prices[1]
Percentage change on year earlier

	United Kingdom	Germany[2]	France	Italy	EC	United States	Japan	Canada	Major 7	OECD[3]
1980	18.0	5.5	13.4	21.1	13.3	13.7	8.0	10.2	12.6	14.8
1985	6.1	2.2	5.9	8.6	6.0	3.5	2.1	4.0	3.8	7.1
1986	3.4	-0.1	2.7	6.2	3.8	1.9	0.4	4.1	2.1	5.8
1987	4.2	0.2	3.1	4.6	3.2	3.7	-0.2	4.4	2.9	7.8
1988	4.9	1.3	2.8	5.0	3.7	4.0	0.5	4.0	3.3	8.6
1989	7.8	2.8	3.5	6.6	5.2	4.9	2.2	5.0	4.5	6.2
1990	9.5	2.7	3.4	6.0	5.7	5.4	3.1	4.8	5.0	6.8
1991	5.9	3.5	3.2	6.5	5.2	4.2	3.3	5.6	4.3	6.1
1992	3.7	4.0	2.4	5.3	4.5	3.1	1.6	1.5	3.2	5.0
1993	1.6	-1.2	2.1	4.2	3.5	3.0	1.1	1.9	2.7	4.2
1994	2.4	2.7	1.7	3.9	3.0	2.5	0.5	0.2	2.3	4.4
1995	3.5	1.9	1.7	5.4	3.2	2.8	-0.3	2.2	2.4	5.5
1995 Q3	3.7	1.7	1.8	5.8	3.1	2.6	-0.2	2.4	2.4	5.7
Q4	3.2	1.8	1.9	5.7	3.0	2.7	-0.7	2.0	2.3	5.4
1996 Q1	2.8	1.8	2.1	5.0	2.8	2.8	-0.4	1.4	2.2	5.6
Q2	2.2	..	2.4	4.2	..	..	..	..	..	..
1995 Aug	3.6	1.7	1.9	5.8	3.1	2.6	-0.5	2.3	2.3	5.6
Sep	3.9	1.8	2.0	5.8	3.2	2.6	-0.1	2.3	2.4	5.7
Oct	3.2	1.8	1.8	5.9	3.0	2.8	-0.7	2.4	2.4	5.6
Nov	3.1	1.7	1.9	5.7	3.0	2.6	-0.8	2.0	2.2	5.4
Dec	3.2	1.8	2.1	5.5	3.1	2.5	-0.4	1.7	2.2	5.4
1996 Jan	2.9	1.7	2.0	5.6	2.9	2.8	-0.6	1.5	2.2	5.6
Feb	2.7	1.7	2.0	5.0	2.8	2.7	-0.4	1.3	2.2	5.5
Mar	2.7	1.9	2.3	4.4	2.8	2.8	-0.2	1.4	2.3	5.6
Apr	2.4	1.8	2.4	4.6	2.7	2.8	0.2	1.4	2.3	5.7
May	2.2	1.8	2.4	4.3	2.6	2.9	0.1	1.5	2.3	5.6
Jun	2.1	..	2.2	3.9	..	..	..	..	..	..
Jul	2.2	..	..	..	..	..	..	..	..	..

1 Components and coverage not uniform across countries
2 Data available for Unified Germany from 1991
3 OECD data includes 'higher inflation' countries (Mexico and Turkey)

3 Standardised unemployment rates: percentage of total labour force[1]

	United Kingdom	Germany[2]	France	Italy	EC[3]	United States	Japan	Canada	Major 7	OECD
	GABF	GABD	GABC	GABE	GADR	GADO	GADP	GADN	GAEQ	GADQ
1980	6.4	3.1	6.3	7.5	6.4	7.1	2.0	7.5	5.6	5.8
1985	11.2	7.1	10.3	9.6	10.5	7.1	2.6	10.5	7.2	7.9
1986	11.2	6.4	10.4	10.5	10.5	6.9	2.8	9.5	7.1	7.7
1987	10.3	6.2	10.5	10.9	10.2	6.1	2.9	8.8	6.7	7.3
1988	8.6	6.2	10.0	11.0	9.6	5.4	2.5	7.7	6.1	6.7
1989	7.2	5.6	9.4	10.9	8.7	5.2	2.3	7.5	5.7	6.2
1990	6.9	4.8	8.9	10.3	8.1	5.5	2.1	8.1	5.6	6.1
1991	8.8	4.2	9.5	9.9	8.5	6.8	2.1	10.3	6.4	6.8
1992	10.1	4.6	10.4	10.5	9.3	7.4	2.2	11.3	6.9	7.4
1993	10.4	7.9	11.7	10.2	10.9	6.8	2.5	11.2	7.2	8.0
1994	9.6	8.4	12.3	11.1	11.4	6.0	2.9	10.3	7.0	7.9
1995	8.7	8.2	11.8	12.2	11.1	5.5	3.1	9.5	6.8	7.6
1995 Q4	8.6	8.5	11.9	..	11.2	5.5	3.3	9.4	6.8	7.6
1996 Q1	8.4	9.0	12.2	..	11.2	5.6	3.3	9.4	6.9	7.6
1995 Jul	8.8	8.2	11.6	12.1	11.0	5.6	3.2	9.7	6.8	7.6
Aug	8.7	8.2	11.6	..	11.0	5.6	3.2	9.5	6.8	7.5
Sep	8.7	8.3	11.7	..	11.0	5.6	3.2	9.2	6.8	7.5
Oct	8.7	8.4	11.8	12.1	11.1	5.4	3.2	9.4	6.7	7.5
Nov	8.6	8.5	11.9	..	11.1	5.5	3.4	9.4	6.8	7.6
Dec	8.5	8.6	12.0	..	11.3	5.5	3.3	9.4	6.9	7.7
1996 Jan	8.5	8.8	12.1	12.1	11.1	5.7	3.4	9.5	7.0	7.7
Feb	8.4	9.1	12.2	..	11.3	5.5	3.3	9.5	6.9	7.6
Mar	8.3	9.1	12.3	..	11.2	5.6	3.1	9.3	6.9	7.6
Apr	8.4	8.9	12.3	12.2	11.2	5.4	3.4	9.4	6.9	7.6
May	8.3	9.0	12.4	..	..	5.5	..	9.3	..	..
Jun	..	..	..	..	..	5.2	..	..	..	..

1 Uses an ILO based measure of those without work, currently available for work, actively seeking work or waiting to start a job already obtained
2 Data available on Unified Germany from January 1993
3 Excludes Denmark, Greece and Luxembourg

4 Balance of payments current account as percentage of GDP

	United Kingdom	Germany[1,2]	France	Italy	United States[1]	Japan[1]	Canada
1980	1.2	−1.7	−0.6	−2.3	0.1	−0.1	−0.6
1985	0.6	2.7	−0.1	−0.9	−3.1	0.4	−1.3
1986	−0.2	4.5	0.3	0.4	−3.5	0.4	−2.8
1987	−1.1	4.1	−0.6	−0.2	−3.7	0.4	−2.9
1988	−3.5	4.2	−0.5	−0.7	−2.6	0.3	−3.5
1989	−4.3	4.9	−0.5	−1.2	−2.0	0.2	−4.1
1990	−3.4	3.1	−0.8	−1.3	−1.7	1.2	−3.8
1991	−1.4	−1.2	−0.5	−2.1	−0.1	2.1	−4.1
1992	−1.7	−1.2	0.3	−2.3	−1.1	3.2	−3.9
1993	−1.7	−1.1	1.1	1.1	−1.6	3.1	−4.3
1994	−0.4	−0.9	0.7	1.5	−2.2	2.8	−3.3
1995	−0.4	−0.7	1.1	2.5	−2.1	2.2	−1.7
1995 Q1	0.2	–	1.9	1.0	−2.3	2.5	−3.7
Q2	−0.5	−0.1	1.3	3.0	−2.5	2.2	−2.6
Q3	−0.6	−1.4	0.3	3.3	2.2	2.1	−0.6
Q4	−0.7	−0.9	0.9	2.6	−1.7	1.9	0.1
1996 Q1	−0.6	−0.1	..	..	..	..	..

1 Balance as percentage of GNP
2 Data available for Unified Germany from July 1990

5 Total industrial production: index numbers

1990 = 100

	United Kingdom	Germany[1]	France	Italy	EC	United States	Japan[2]	Canada[3]	Major 7	OECD[4]
	DVZI	HFGA	HFFZ	HFGB	GACY	HFGD	HFGC	HFFY	GAES	GACX
1980	81.5	83.0	88.0	87.9	83.8	79.3	67.3	81.4	78.7	78.9
1985	88.0	85.6	88.5	84.8	86.5	89.0	79.8	94.5	86.4	86.4
1986	90.1	87.3	89.5	87.9	88.4	89.9	79.6	93.8	87.3	87.2
1987	93.7	87.6	91.3	91.3	90.2	94.3	82.4	98.4	90.5	90.3
1988	98.2	90.7	95.0	96.8	94.3	98.5	90.7	103.6	95.6	95.4
1989	100.3	95.0	98.5	99.8	98.0	100.0	95.9	103.4	98.5	98.4
1990	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1991	96.3	103.6	100.3	99.1	99.8	98.3	101.9	95.8	99.6	99.6
1992	96.2	100.9	100.2	98.9	98.5	101.7	96.1	96.8	99.3	99.4
1993	98.3	93.6	97.6	96.5	95.3	105.2	92.0	101.2	98.8	98.9
1994	103.2	96.9	101.3	101.5	100.0	111.4	93.1	107.8	103.1	103.6
1995	105.9	97.7	103.6	106.9	103.2	115.1	96.2	112.0	106.3	106.6
1995 Q3	106.4	98.3	104.7	107.9	103.5	115.4	95.1	112.1	106.4	106.7
Q4	106.3	96.4	101.6	109.4	103.2	115.6	97.1	111.7	106.6	107.0
1996 Q1	106.6	97.1	98.9	105.5	102.7	116.4	97.5	112.2	107.0	107.3
Q2	106.8	..	..	..	..	..	..	..	..	..
1995 Jun	105.5	98.4	104.9	105.3	103.4	114.5	95.9	111.2	105.9	106.3
Jul	106.0	99.5	105.4	107.8	103.6	114.6	94.0	111.8	106.0	106.2
Aug	106.4	97.5	105.4	108.4	103.9	115.7	96.1	112.1	106.7	107.1
Sep	106.9	97.8	103.3	107.5	103.1	115.8	95.2	112.3	106.4	106.7
Oct	105.9	95.6	101.5	106.7	102.2	115.3	96.4	111.8	106.0	106.3
Nov	106.4	96.7	102.0	106.1	102.8	115.6	97.0	111.8	106.4	106.8
Dec	106.8	96.8	101.3	115.3	104.6	115.8	97.8	111.5	107.5	107.8
1996 Jan	106.0	97.8	98.7	103.4	102.6	115.5	98.2	112.4	106.6	107.1
Feb	106.5	96.1	99.1	104.7	102.1	117.1	100.1	112.1	107.6	107.7
Mar	107.2	97.4	99.0	108.4	103.5	116.6	94.2	112.0	106.7	107.1
Apr	106.5	97.4	98.8	104.2	102.6	117.3	97.2	112.1	107.1	107.5
May	107.5	98.6	98.6	..	..	118.2	98.9	..	..	..
Jun	106.3	..	..	..	..	..	..	..	..	..

Percentage change: average of latest three months on that of corresponding period of previous year

	United Kingdom	Germany[1]	France	Italy	EC	United States	Japan[2]	Canada[3]	Major 7	OECD[4]
1996 May	1.2	−0.7	−5.3	..	..	2.4	0.2	..	..	..
Jun	1.1	..	..	..	..	..	..	..	..	..

Percentage change: average of latest three months on previous three months

	United Kingdom	Germany[1]	France	Italy	EC	United States	Japan[2]	Canada[3]	Major 7	OECD[4]
1996 May	0.6	0.9	−0.9	..	..	1.1	−2.0	..	..	..
Jun	0.2	..	..	..	..	..	..	..	..	..

1 Data available for Unified Germany from 1991
2 Not adjusted for unequal number of working days in a month
3 GDP in industry at factor cost and 1986 prices
4 Some countries excluded from area total

6 Producer prices (manufacturing)
Percentage change on a year earlier

	United Kingdom	Germany[1]	France[2]	Italy	EC	United States	Japan	Canada	Major 7	OECD[3]
1980	12.8	7.0	9.4	..	11.3	13.5	14.8	13.4	13.2	13.2
1985	5.3	2.1	4.4	7.7	5.0	0.8	−0.8	2.7	1.9	5.0
1986	4.2	−2.4	−2.0	0.1	−0.8	−1.4	−4.7	0.9	−1.4	1.7
1987	3.7	−0.3	0.2	3.1	1.2	2.1	−2.9	2.7	1.0	5.8
1988	4.3	1.5	4.8	3.5	3.3	2.5	−0.3	4.5	2.5	7.4
1989	4.7	3.4	5.2	5.8	4.9	5.2	2.1	1.8	4.3	5.8
1990	5.8	1.5	−1.0	4.2	2.5	4.9	1.6	0.3	3.3	4.7
1991	5.4	2.2	−1.2	3.3	2.2	2.1	1.1	−1.0	1.9	3.3
1992	3.5	1.6	−1.4	1.9	1.3	1.3	−1.0	0.5	0.9	2.2
1993	3.7	0.0	−2.6	3.7	1.3	1.3	−1.6	3.3	0.7	2.1
1994	2.9	−2.9	1.1	3.8	2.1	0.6	−1.7	5.6	0.9	3.3
1995	3.4	2.2	6.4	7.9	4.7	2.0	−0.7	8.1	2.6	7.1
1996 Q1	3.8	0.8	−1.2	4.8	1.9	2.2	−0.9	1.7	1.5	6.7
Q2	3.5	..	..	..	..	..	..	..	..	..
1995 Aug	3.7	2.3	6.8	9.0	5.0	1.2	−0.7	7.2	2.5	7.0
Sep	3.9	2.5	5.7	8.7	4.9	1.8	−0.6	7.7	2.7	7.4
Oct	3.8	2.2	4.0	7.9	4.2	2.3	−0.6	6.7	2.7	7.3
Nov	3.7	1.7	2.6	7.2	3.5	2.1	−0.6	5.6	2.3	7.1
Dec	4.0	1.4	1.7	6.5	3.2	2.3	−0.8	5.1	2.2	7.2
1996 Jan	3.4	0.9	−0.4	5.9	2.3	2.3	−0.8	2.6	1.8	6.9
Feb	4.0	0.7	−1.3	4.9	1.9	2.0	−0.9	2.0	1.4	6.6
Mar	3.9	0.5	−2.0	3.6	1.4	2.4	−0.9	0.6	1.4	6.7
Apr	3.7	0.3	−2.8	2.6	1.1	2.5	−0.9	0.7	1.3	6.8
May	3.5	0.2	−3.6	..	..	2.2	−0.8	0.9	..	..
Jun	3.3	..	..	..	..	..	..	..	..	..
Jul	2.9	..	..	..	..	..	..	..	..	..

1 Data available for Unified Germany from 1991
2 Producer prices in intermediate goods
3 OECD includes 'higher inflation' countries (Mexico and Turkey)

7 Total employment: index numbers[1]

1990 = 100

	United Kingdom	Germany[2,3]	France[3]	Italy	EC	United States[3]	Japan	Canada[3]	Major 7	OECD
	DMBC	GAAR	GAAU	GAAS	GADW	GADT	GADU	GADS	GAEU	GADV
1980	93.5	94.8	96.6	97.0	100.00	84.2	88.6	84.3	89.0	..
1985	91.2	93.1	95.6	97.3	93.10	90.9	92.9	89.3	92.3	92.1
1986	91.4	94.6	96.1	97.9	93.80	92.9	93.7	91.8	93.6	93.4
1987	93.4	95.3	96.5	97.8	95.00	95.4	94.6	94.3	95.2	95.1
1988	96.7	96.1	97.5	99.0	96.80	97.5	96.2	97.5	97.1	96.9
1989	99.4	97.5	99.0	98.6	98.40	99.5	98.1	99.3	98.8	98.9
1990	100.0	100.0	100.0	100.0	100.00	100.0	100.0	100.0	100.0	100.0
1991	97.1	101.9	100.0	101.3	99.90	99.0	102.0	98.1	99.9	99.8
1992	94.6	102.8	99.4	100.7	98.70	100.0	103.0	97.6	100.1	99.7
1993	93.6	100.9	98.2	95.9	96.30	101.0	103.0	98.8	100.1	99.4
1994	94.2	99.3	98.4	94.0	95.80	104.0	104.0	101.0	101.4	100.6
1995	94.9	99.1	99.5	93.9	96.50	106.0	103.0	102.6	102.2	101.6
1995 Q4	95.1	99.4	99.8	94.3	96.8	106.5	103.1	102.7	102.5	101.9
1996 Q1	95.0	..	99.9	93.1	96.1	105.2	101.4	100.8	101.4	100.6
1996 Apr	..	..	..	94.2	..	106.3	103.9	102.0	..	..
May	..	..	..	..	..	107.2	104.5	104.6	..	..

Percentage change, latest quarter on that of corresponding period of previous year

	United Kingdom	Germany[2,3]	France[3]	Italy	EC	United States[3]	Japan	Canada[3]	Major 7	OECD
1995 Q4	0.4	0.4	1.0	0.4	0.8	0.7	−0.1	0.9	0.4	0.6
1996 Q1	0.2	..	0.8	0.8	0.3	0.6	0.0	1.3	0.5	0.3

Percentage change latest quarter on previous quarter

	United Kingdom	Germany[2,3]	France[3]	Italy	EC	United States[3]	Japan	Canada[3]	Major 7	OECD
1995 Q4	0.2	0.2	0.1	−0.7	−0.1	−0.3	−1.2	−2.4	−0.4	−0.4
1996 Q1	−0.1	..	0.1	−1.3	−0.7	−1.2	−1.6	−1.9	−1.1	−1.3

1 Not seasonally adjusted except for the United Kingdom
2 Western Germany (Federal Republic of Germany before unification)
3 Excludes members of armed forces

8 Average wage earnings in manufacturing[1]
Percentage change on a year earlier

	United Kingdom[2]	Germany[3]	France	Italy	EC	United States	Japan	Canada	Major 7	OECD
1980	17.9	6.5	15.0	18.7	11.4	8.7	7.4	10.0	8.9	9.3
1985	9.0	4.2	5.7	11.2	7.1	3.9	3.2	3.8	3.8	5.1
1986	7.7	4.0	4.0	4.7	5.2	2.0	1.4	2.8	3.7	3.3
1987	8.1	3.8	3.1	6.6	5.4	1.8	1.7	3.3	3.5	3.5
1988	8.5	4.6	3.0	6.0	5.4	2.8	4.5	3.9	3.4	4.4
1989	8.8	3.5	3.8	6.0	5.9	2.9	5.8	5.4	4.4	4.9
1990	9.3	5.1	4.6	7.3	6.8	3.3	5.3	4.7	5.3	5.4
1991	8.2	5.7	4.3	9.8	7.1	3.3	3.4	4.8	5.0	5.0
1992	6.6	6.2	3.6	5.4	5.6	2.4	1.2	3.4	2.9	3.6
1993	4.5	−3.6	2.7	3.7	4.5	2.5	0.1	2.0	2.8	2.8
1994	4.7	2.9	1.7	3.3	3.7	2.8	2.1	1.6	2.7	3.0
1995	4.5	..	2.5	3.1	3.9	2.5	3.3	1.5	3.5	3.3
1995 Q3	4.4	3.3	2.7	3.5	4.0	2.8	3.7	2.3	3.5	3.5
Q4	4.0	4.1	2.6	3.9	4.2	2.7	3.1	2.0	3.3	3.4
1996 Q1	4.4	..	..	3.3	..	2.7	1.9	1.8	3.6	3.2
1995 Jun	4.4	..	..	2.2	3.9	2.4	0.9	0.9	2.4	2.6
Jul	5.0	3.3	2.6	3.5	4.1	2.8	6.5	1.1	4.0	4.3
Aug	4.2	..	..	3.4	3.8	2.9	0.3	3.3	2.7	2.9
Sep	3.9	..	..	3.9	4.0	2.7	2.3	2.6	3.7	3.3
Oct	4.0	3.9	2.6	3.9	4.2	2.7	2.3	2.4	2.8	3.3
Nov	3.7	..	..	3.9	4.2	2.5	1.2	1.7	2.7	3.1
Dec	4.1	..	..	3.9	4.3	2.7	4.3	2.2	4.1	3.9
1996 Jan	4.0	..	2.6	3.2	..	3.4	−0.1	1.4	2.7	3.0
Feb	4.6	..	..	3.3	..	2.6	3.0	1.8	3.7	3.4
Mar	4.6	..	..	3.2	..	2.2	2.7	1.9	3.6	3.2
Apr	4.0	..	..	3.4	..	3.5	2.4	1.6	2.7	..
May	..	..	..	..	..	3.3	1.5	..	..	..

1 Definitions of coverage and treatment vary among countries
2 Figures for Great Britain refer to weekly earnings; others are hourly
3 Western Germany (Federal Republic of Germany before unification)

9 Retail Sales (volume): index numbers

1990 = 100

	United Kingdom	Germany[1]	France	Italy	EC	United States	Japan	Canada	Major 7	OECD
	EAPS	GADD	GADC	GADE	GADH	GADA	GADB	GACZ	GAEW	GADG
1980	..	83.5	91.5	72.6	80.2	72.2	84.7	74.8	76.7	77.5
1985	..	80.8	90.5	87.4	84.3	85.9	82.0	89.3	85.2	85.2
1986	87.0	83.6	92.6	93.3	88.0	90.7	83.3	93.4	89.1	89.0
1987	91.5	86.9	94.8	97.8	91.5	93.1	87.9	98.6	92.3	92.1
1988	97.3	89.8	98.2	95.7	94.0	96.7	91.5	102.4	95.4	95.2
1989	99.3	92.2	99.4	102.3	97.6	99.3	95.0	102.3	98.3	98.2
1990	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1991	98.7	105.7	100.1	97.3	100.6	97.6	101.9	89.6	99.0	99.2
1992	99.4	103.6	100.3	102.2	100.8	100.9	99.1	90.8	100.4	100.3
1993	102.4	99.3	100.3	99.0	99.1	106.3	94.3	93.5	102.1	101.3
1994	106.2	97.5	100.8	94.4	98.3	112.9	92.8	101.1	105.1	104.0
1995	107.5	..	100.2	89.1	98.8	117.5	98.6	101.5	107.9	107.3
1996 Q1	108.7	..	101.5	..	..	120.0	101.1	101.7	109.3	108.6
Q2	110.1	..	..	..	..	..	..	..	..	..
1995 Dec	108.8	..	97.3	81.7	97.0	119.7	98.3	101.3	108.1	107.7
1996 Jan	108.0	..	102.7	..	100.0	118.7	100.1	101.4	109.0	108.4
Feb	108.9	..	103.3	..	97.8	121.0	103.1	102.0	110.0	109.2
Mar	109.1	..	98.7	..	..	120.2	100.2	101.4	108.8	108.2
Apr	109.5	..	99.1	..	..	..	..	100.9	..	..
May	109.5	..	99.2	..	..	..	..	..	..	..
Jun	110.9	..	..	..	..	..	..	..	..	..

Percentage change average of latest three months on that of corresponding period of previous year

1996 May	..	..	−1.1	..	..	..	..	..	..	..
Jun	..	..	..	..	..	..	..	..	..	..

Percentage change average of latest three months on previous three months

1996 May	..	..	−2.1	..	..	..	..	..	..	..
Jun	..	..	..	..	..	..	..	..	..	..

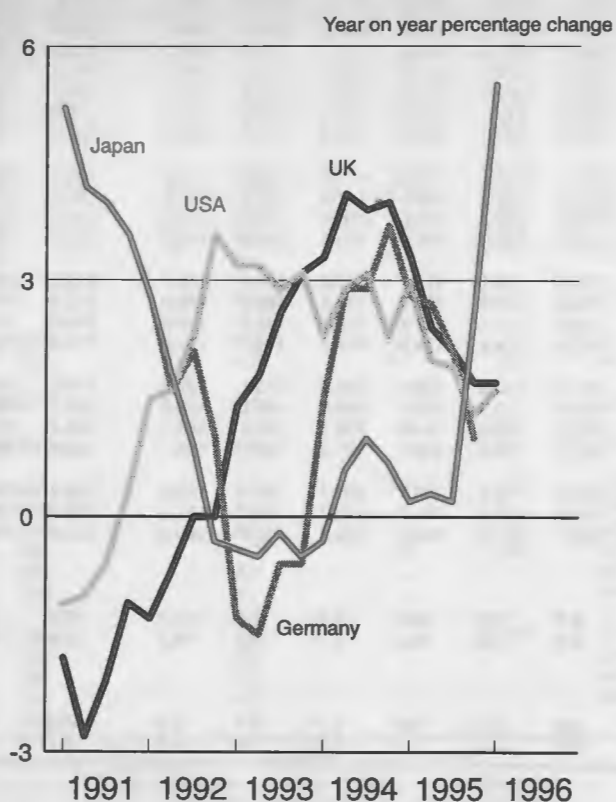1 Western Germany (Federal Republic of Germany before unification) - series suspended
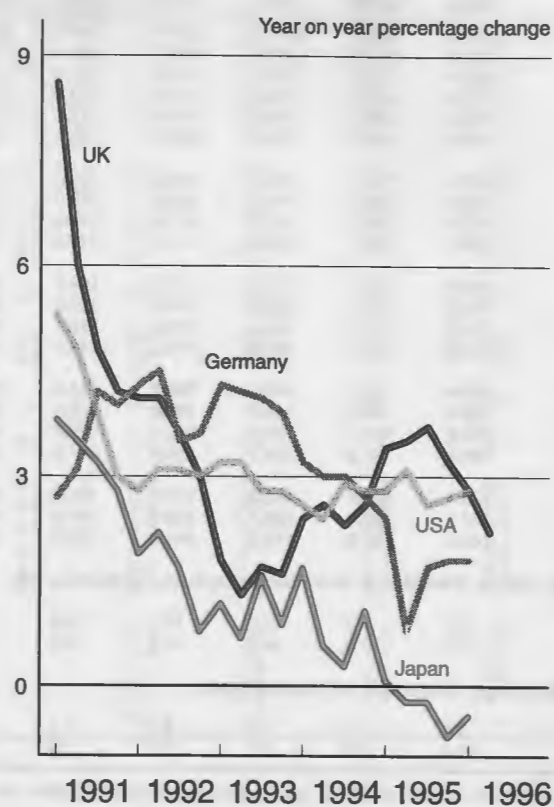
10

10 World trade[1]

1990 = 100

	Export of manufactures			Import of manufactures			Export of goods			Import of goods			World trade	
	World	OECD	Other	World	OECD	Other	World	OECD	Other	World	OECD	Other	manufact- ures	goods
	GAFE	GAFF	GAFG	GAFH	GAFI	GAFJ	GAFK	GAFL	GAFM	GAFN	GAFO	GAFP	GAFR	GAFQ
1990	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1991	103.1	102.3	106.2	104.2	103.4	106.3	103.6	103.2	104.3	103.8	103.1	105.7	103.6	103.7
1992	107.8	107.1	110.7	110.6	109.8	113.0	109.7	108.5	106.8	108.2	109.3	111.3	109.2	108.9
1993	113.9	109.7	130.0	115.2	111.1	126.3	115.3	112.1	123.3	115.0	110.8	126.8	114.5	115.1
1994	127.6	121.5	151.0	128.9	124.3	141.2	127.4	123.0	139.4	126.8	121.9	140.8	128.2	127.1
1992 Q1	107.4	107.1	108.5	109.2	109.0	109.9	108.4	108.4	105.3	107.7	108.4	108.6	108.3	108.0
Q2	106.9	106.0	110.4	109.9	109.0	112.5	109.2	107.5	106.6	107.4	108.7	110.9	108.4	108.3
Q3	108.4	107.5	111.7	111.8	110.8	114.3	110.8	109.2	107.5	108.9	110.4	112.5	110.1	109.8
Q4	108.6	107.7	112.4	111.7	110.4	115.2	110.4	109.0	107.9	108.9	109.6	113.2	110.1	109.6
1993 Q1	109.3	107.1	117.9	111.9	109.2	119.3	110.5	109.1	112.2	111.2	108.7	118.2	110.6	110.6
Q2	113.5	109.2	129.9	114.0	109.8	125.6	115.0	111.7	123.8	114.3	109.9	126.8	113.7	114.6
Q3	114.0	108.8	134.2	115.6	110.7	128.9	115.6	111.2	127.4	115.7	110.7	130.0	115.5	115.6
Q4	116.8	111.4	137.8	118.5	113.7	131.6	117.6	114.2	129.9	117.8	112.7	132.2	114.8	118.1
1994 Q1	120.8	114.4	146.1	122.7	117.4	137.4	121.4	116.6	136.1	121.6	116.1	137.5	117.6	121.6
Q2	125.0	118.9	148.8	126.6	122.1	139.2	124.7	120.5	137.7	124.8	120.0	138.5	121.7	124.9
Q3	128.2	121.4	154.2	130.3	125.4	143.9	127.9	123.0	141.6	128.1	122.7	143.3	125.8	128.1
Q4	131.6	125.6	155.1	134.8	131.2	144.4	131.1	126.9	142.1	131.3	126.8	143.7	129.2	131.1
1995 Q1	136.1	128.7	165.1	138.7	133.0	154.2	134.5	129.8	155.1	134.7	128.1	153.3	133.2	134.9
Q2	137.1	129.9	165.1	139.9	134.6	154.2	135.6	130.4	154.7	135.7	129.5	153.3	138.5	135.7
Q3	140.4	131.0	176.5	143.7	135.9	164.9	139.1	131.6	164.3	139.3	130.7	163.6	142.0	139.2

Percentage change, latest quarter on corresponding quarter of previous year

1995 Q2	9.7	9.3	11.0	10.5	10.2	10.8	8.7	8.2	12.3	8.7	7.9	10.7	13.8	8.6
Q3	9.5	7.9	14.5	10.3	8.4	14.6	8.8	7.0	16.0	8.7	6.5	14.2	12.9	8.7

Percentage change, latest quarter on previous quarter

1995 Q2	0.7	0.9	0.0	0.9	1.2	0.0	0.8	0.5	−0.3	0.7	1.1	0.0	4.0	0.6
Q3	2.4	0.8	6.9	2.7	1.0	6.9	2.6	0.9	6.2	2.7	0.9	6.7	2.5	2.6

1 Data used in the World and OECD aggregates refer to Germany after unifi-
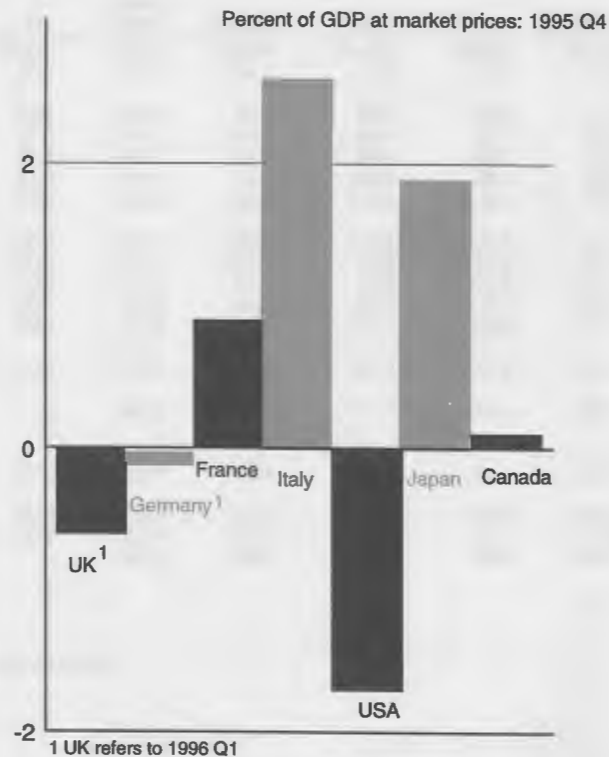cation

11

Chart I: Gross domestic product

Year on year percentage change

Japan
USA
UK
Germany

6
3
0
-3

1991 1992 1993 1994 1995 1996

Chart II: Consumer price index

Year on year percentage change

UK
Germany
USA
Japan

9
6
3
0

1991 1992 1993 1994 1995 1996

Chart III: Standardised unemployment

Percentage of workforce

UK
Germany
USA
Japan

9
6
3

1991 1992 1993 1994 1995 1996
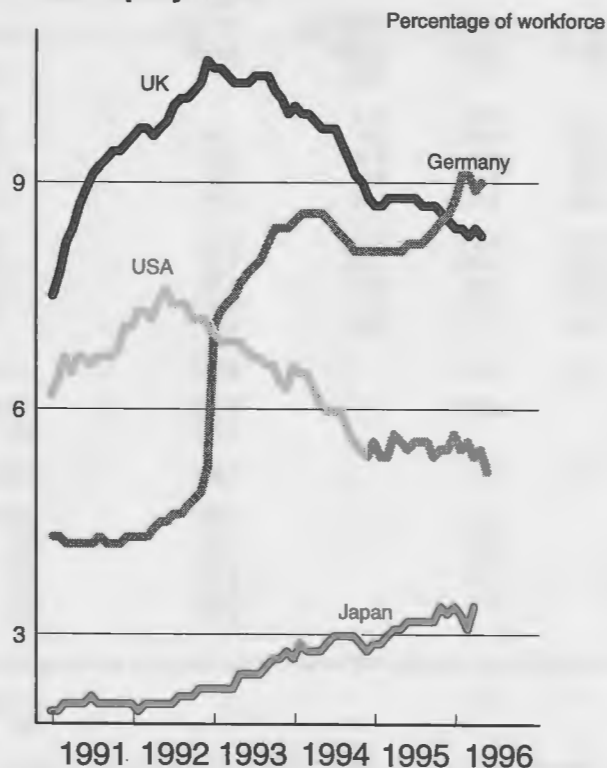
Chart IV: Current account balance

Percent of GDP at market prices: 1995 Q4

France   Italy
Germany¹   Japan   Canada
UK¹
USA

2
0
-2

1 UK refers to 1996 Q1

Chart V: Industrial Production

Year on year percentage change

Germany
USA
Japan
UK

6
0
-6

1991 1992 1993 1994 1995 1996
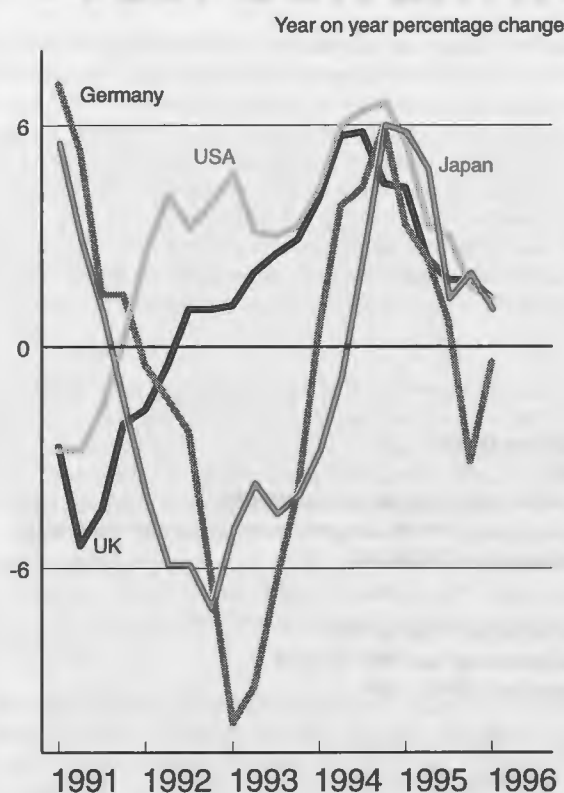
Chart VI: Producer price inflation

Year on year percentage change

UK
USA
Germany
Japan

6
3
0
-3

1991 1992 1993 1994 1995 1996

Chart VII: Employment

Year on year percentage change

USA
Japan
UK

3
0
-3

1990 1991 1992 1993 1994 1995
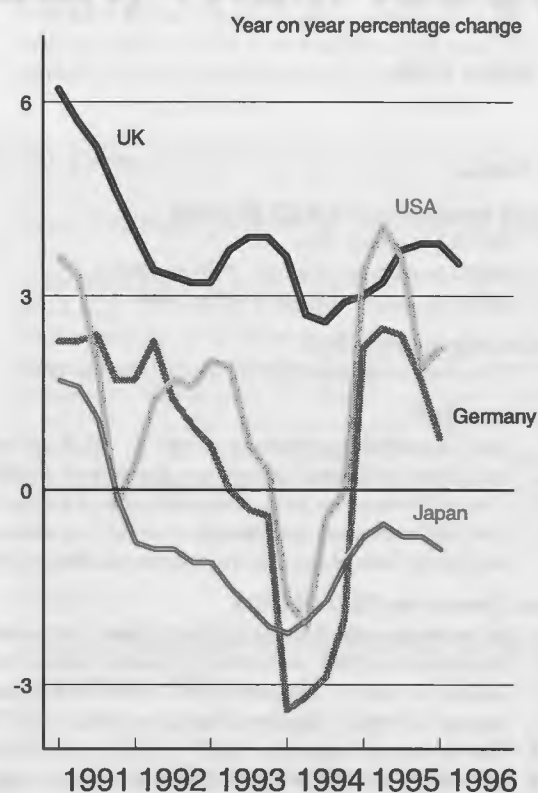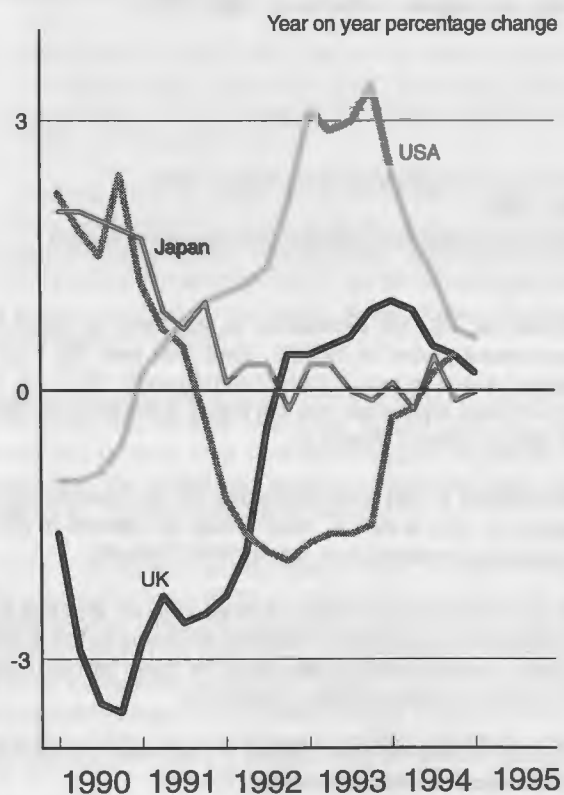
Chart VIII: Wage earnings (manufacturing)

Year on year percentage change

UK
Western Germany
USA
Japan

8
4
0
-4

1991 1992 1993 1994 1995 1996
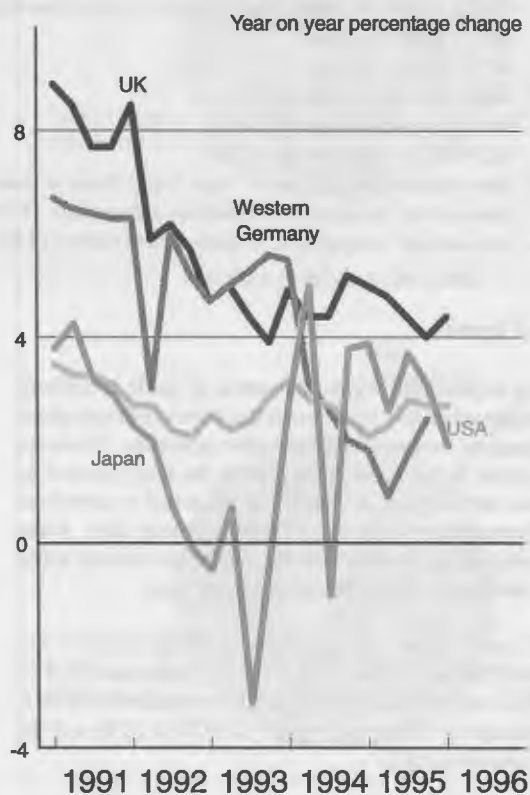
RESEARCH AND EXPERIMENTAL DEVELOPMENT (R&D) STATISTICS 1994

by Peter Jones ONS

Summary of trends

● Measuring expenditure and employment of R&D is difficult because of the subjective judgements that have to be made about the dividing line between R&D and other activities. There are discontinuities in the series arising from the interpretation of definitions, and because of changes in the actual or perceived status of organisations (Ref 1, chapter 1 details this). Some general conclusions can be drawn, but significance should not be given to small percentage changes between years.

● In 1994 Gross Domestic Expenditure on R&D (GERD) was 2.19% of GDP, very similar to 1993 (Table 2). In terms of international comparisons in 1994, R&D expenditure in the UK as a percentage of GDP was above the OECD (2.15%) and EU (1.91%) averages (ref 5).

● Within the UK, net expenditure in real terms on R&D by government peaked in 1980/81, since then there has been a gradual downward trend (Table 5) and (figure 2). However, net Government expenditure was still higher in real terms in 1994/95 than in 1966/67 (Figure 2).

● Expenditure in real terms performed by the business sector peaked in 1990 in the UK. After falling by 8 percent in 1991, expenditure increased each year to 1994 (Table 9).

● In the Government and Higher Education sector spending as a percentage of regional gross domestic product is highest in East Anglia, whereas in the business sector the South East and North West are the largest spenders (Table 16).

● Since 1986 there has been a decline in R&D employment in the Government and Business sectors (Table 4).

● Between 1981 and 1994 the chemicals broad product group had seen the biggest growth in R&D expenditure (Table 10).

Background

This article updates statistics published in the August 1995 edition of Economic Trends. Most of the figures have already been published by the Office for National Statistics, the Department of Trade and Industry (Office of Science and Technology) or the OECD (refs 1,2,4,5). Following the publication of last year's article major users of the data were contacted to see what additional analysis they would like to see. This generated a lot of interest and where possible requests have been met eg we have included time series data back to 1966/67 for the Government and Business sectors and breakdowns of broad product groups into more detailed groups in the business sector.

The statistics are consistent with OECD's Frascati Manual (ref 3) which defines Research and Experimental Development (R&D) and gives guidelines on how to measure expenditure and employment on R&D. The manual is applied throughout the OECD so it is possible to make comparisons between countries (refs 5,6,7).

R&D is defined as creative work undertaken systematically to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this knowledge to devise new applications.

Care should be exercised when using R&D statistics for economic analysis. R&D can lead to the technological inventions that are necessary for a successful innovative economy. However, such inventions are not a sufficient condition for success - many other economic and social factors are important. Undue weight should not be given to the economic significance of R&D's role as a generator of inventions. On the other hand, the economic benefit of R&D is not limited to that role: R&D develops skills and techniques that are important for any economy.

Sources of information

Performers and funders of R&D are divided into four economic sectors: Government, Businesses, Higher Education Institutions (HEIs), and the Private Non-Profit (PNP) sector. Definitions are provided at the end of this article.

The ONS conducts an annual survey of Central Government R&D which is addressed to all Government departments. The survey collects data on expenditure and employment for outturn and planning years. Detailed recent results are in the statistical supplement to OST's *Forward Look of Government-funded Science, Engineering and Technology 1996 (ref 1)*.

The ONS also conducts an annual survey of R&D in businesses. The 1994 survey was the first "new style" annual small scale sample survey and is based on a continually updated register of R&D performers. The results and detailed methodology notes can be found in the Business Monitor of 1994 (ref 2).

Statistics on expenditure and employment on R&D in Higher Education Institutions (HEIs) are based on information collected by Higher Education Funding Councils and HESA (Higher Education Statistics Agency). In 1994 a new methodology was introduced to estimate expenditure on R&D in HEIs. This was based on the allocation of various Funding Council Grants. Full details of the new methodology are contained in Chapter 1 of the Statistical Supplement (ref 1).

Much less R&D is performed in the PNP sector than in any of the other sectors. PNP R&D expenditure estimates use statistics on Government funding of PNP R&D reported in the Government R&D survey, and assume that annual changes in other funding of PNP R&D follow the same pattern as funding of HEI R&D. PNP R&D statistics are the least reliable of the four sectors. ONS is currently reviewing their methodology.

The Tables

Gross Domestic Expenditure on R&D (GERD) (tables 1-3)

These tables show the performers and funders of R&D in the UK. Measuring expenditure on R&D performed within each sector avoids problems of omission and double counting that can arise when measuring funds provided for R&D. GERD is the sum of R&D performed in the four sectors. Tables 1 and 2 show that UK GERD in 1994 was £14.6 billion in cash terms. GERD is often quoted as a percentage of GDP when making international comparisons. In 1994 UK GERD was 2.19% of GDP, very similar to the previous year's figure.

Figure 1

Gross Expenditure on R&D (GERD) in the UK, by sectors, 1994

£ million

Sectors carrying out the work

Higher education £ 2559m (17.5%)
Private non-profit £ 504m (3.5%)
Government £ 2021m (13.8%)
Business enterprise £ 9529m (65.2%)

Sectors providing the funds

Abroad £ 1857m (12.7%)
Higher education £ 110m (0.8%)
Private non-profit £ 521m (3.6%)
Business enterprise £ 7407m (50.7%)
Government £ 4718m (32.3%)

Source ONS
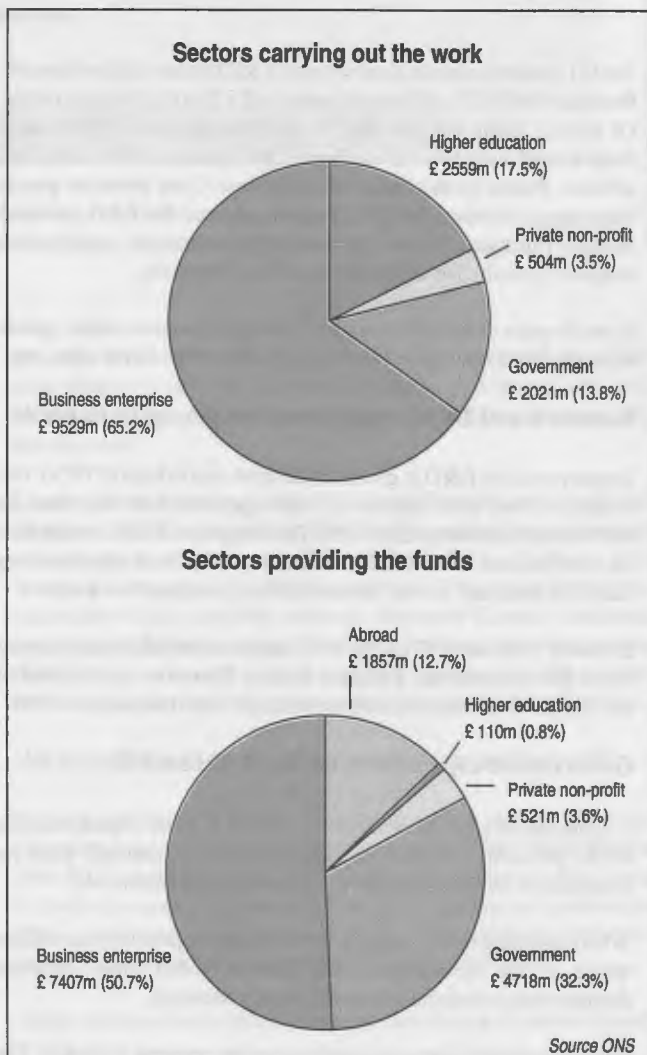
Figure 2
Net government expenditure on R&D by departments in cash and real terms, 1966-67 to 1994-95

£ billion

Total R&D in real terms (1990-91=100)

Total R&D in cash terms

1966-67   1971-72   1976-77   1981-82   1986-87   1991-92   1994-95

Source: ONS

Figure 3
Central Government current expenditure on intramural R&D type of activity, 1994-95

£ million

OPSS & Research Councils

Experimental Development £ 10m (2.0%)

Applied £ 273m (53.6%)

Basic £ 226m (44.4%)

Civil Departments

Experimental Development £ 64m (16.5%)

Basic £ 39m (10.1%)

Applied £ 284m (73.4%)

MOD

Experimental Development £ 214m (34.1%)

Applied £ 413m (65.9%)

Source ONS

Table 1 shows the interaction between R&D funders and performers. For example £9529 million was spent on R&D in the business sector. Of this, £1130m was provided by the government, £1559m came from abroad and £6841m was funded by businesses from their own sources. Funds from abroad include those from overseas parent companies, contracts for R&D projects, support for R&D provided through European Union schemes and international collaborative projects typically for aerospace or defence projects.

It can be seen clearly from figure 1 that the business sector spends more on R&D than any of the other three sectors of the economy.

Research and Development total employment (table 4)

Employment on R&D is given in full time equivalents (FTE's). For example, a full time member of staff spending half their time on R&D would be counted as 0.5 FTE. The categories of staff (researchers etc.) are defined in the Frascati Manual (ref 3). Staff administering R&D are included as well as those directly engaged on projects.

Between 1986 and 1994 there were decreases in R&D employment in the Government and Business sectors. However employment in the Higher Education sector rose to stand at 66 thousand in 1993.

Government expenditure on R&D (tables 5-8)

A department's gross expenditure on R&D is its expenditure on R&D performed within the department (intramural) plus its expenditure on R&D outside the department (extramural).

When summing individual department gross expenditure across the whole of the Government, the flow of R&D funds between departments is deducted to avoid double counting.

Net expenditure is gross expenditure minus receipts for R&D. The sum of departments' net expenditures is the R&D element of the
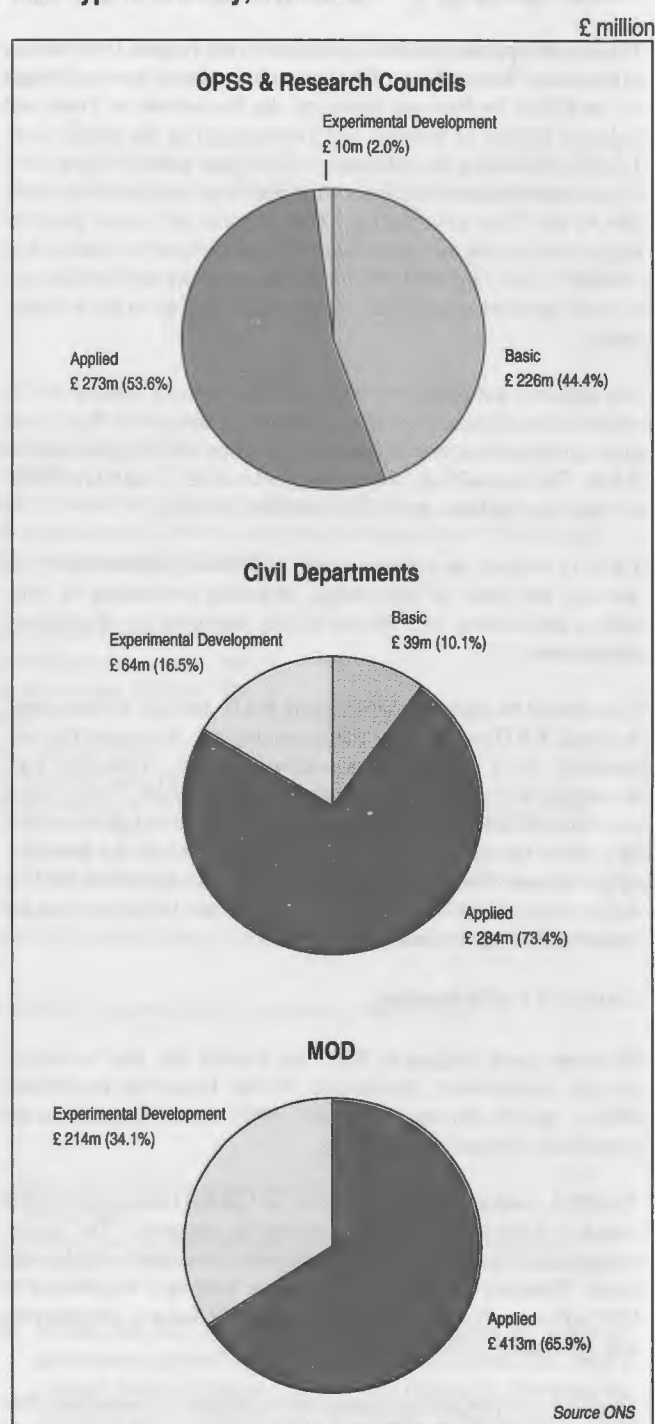
government's budget expenditure. This is used for international comparisons of Government appropriations for R&D (eg table 19). The UK has a high proportion of Central Government expenditure devoted to R&D for defence purposes.

Figures in tables 6 and 8 for Governments' net expenditure on R&D differ from Government funding figures in tables 1 and 3. This is because tables 1 to 3 are based on information supplied by R&D **performers** whilst tables 5 to 8 contain expenditure figures reported by Government departments (**funders**). The gap is mainly accounted for by differences in the reporting of Government contracts with

Figure 4
Central Government net expenditure on R&D by socio-economic objectives, 1994-95

£ million

Source: ONS
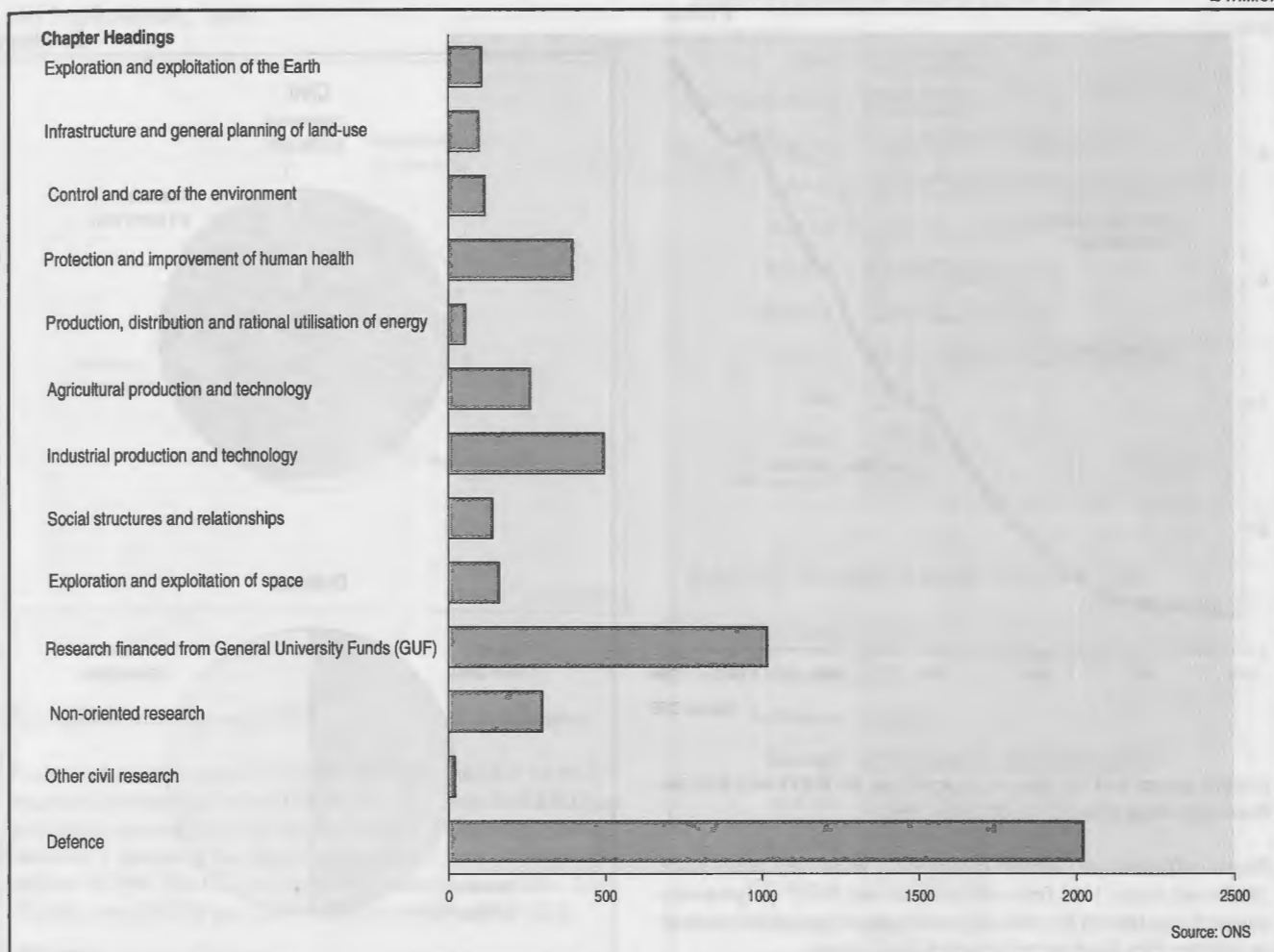
businesses for certain types of defence R&D and R&D performed abroad but funded by the UK Government. In addition, the difference is also attributed to other factors such as time lag problems due to differences in accounting periods and not all monies given being used in that financial period, treatment of VAT and sub contracting of R&D work.

The figures for Central Government intramural R&D are slightly lower than those performed by the government sector in tables 1 and 2. This is because the latter includes estimates for a small amount of R&D not available from the Government survey: R&D performed by local authorities and the support cost of R&D in NHS hospitals.

Table 5 and figure 2 show a time series dating back to 1966/67. They show that in 1994/95 the net Government expenditure on R&D (by civil and defence departments) was £5.2 billion. In real terms, spending on R&D was flat in the late sixties but rose in the seventies to a peak in 1980/81. Since then it has declined although spending in 1994/95 was still more than in 1966/67. Table 5 shows the breakdown between civil and defence departments.

Gross expenditure by the Office of Public Service and Science (OPSS), the Research Councils and the Higher Education Funding Councils (HEFCs) was £2396m in 1994/95 (Table 6). This sum represents public funding for the advancement of knowledge and is

sometimes referred to as the science budget. Most of the R&D expenditure by other departments serves the delivery of services, policy making, regulation and the promotion of economic development.

Current intramural expenditure by Central Government is analysed by type of R&D (refer to definitions' below; capital expenditure is not measured on this basis). Table 7 (and figure 3) shows that Research Councils, civil departments and MOD establishments undertake mainly applied research. Research Council institutes conduct a higher proportion of basic research than elsewhere within Central Government. Figure 4 and table 8 show that the largest element of the Government's net expenditure on R&D is on Defence.

R&D performed by the Business Sector (tables 9-15)

Table 9 and figure 5 show a time series dating back to 1966 for expenditure performed by the Business sector. They show that in 1994 R&D expenditure was £9.5 billion. Expenditure in real terms in the business sector peaked in 1990. After falling by 8 percent in 1991, expenditure increased each year to 1994. R&D performed by business has increased in real terms by 69% since 1966.

Table 10 shows that within the business sector, the chemicals broad

17

Figure 5
R&D performed by the Business Sector, 1966 to 1994

£ billion

Total R&D in real terms
(1990-91=100)

Total R&D in cash terms

Source: ONS

Figure 6
Sources of funds for Business Enterprise R&D, 1994

£ million

Civil

Government
£ 372m (5%)

Overseas
£ 1187m (15%)

Businesses
£ 6453m (80%)

Defence

Businesses
£ 387m (26%)

Government
£ 757m (50%)

Overseas
£ 372m (25%)

Source: ONS
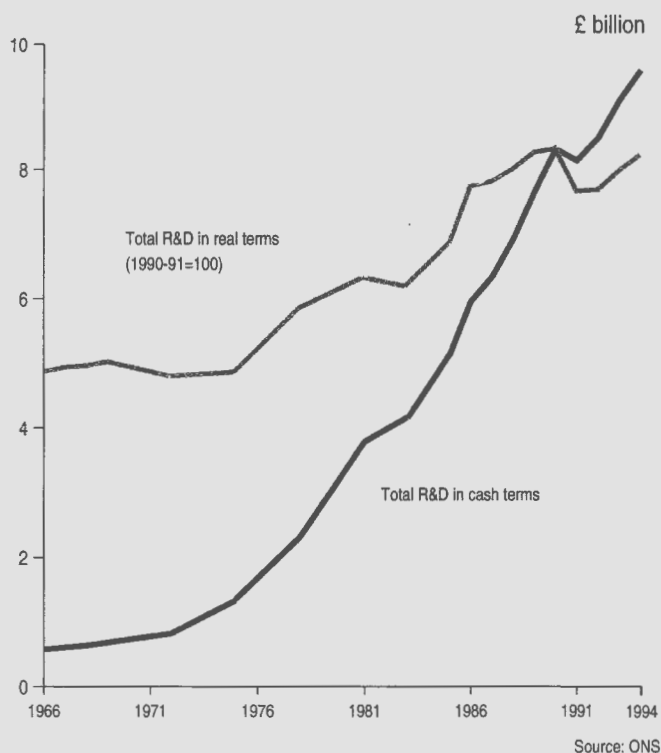
product group had the largest expenditure on R&D and was the fastest growing group from 1981 to 1994.

Statistics for civil and defence have been collected separately since 1989 (see table 11). Defence includes all R&D programmes undertaken primarily for defence reasons, regardless of their content or whether they have secondary civil applications.

In 1994, civil R&D represented 84% of all R&D expenditure, performed by business (Table 11). Table 12 (and figure 6) shows that, in 1994, 81% of civil R&D performed by businesses was funded by businesses themselves. 5% of civil R&D was funded by the Government, whereas the Government funded 50% of defence R&D.

Between 1993 and 1994 there was a small decrease in the total personnel engaged on R&D within the business sector (Table 13).

The breakdown into detailed product groups is shown in tables 14 and 15. The product group with the largest expenditure is pharmaceuticals, medical chemicals and botanical products, which accounts for £1824m in 1994, followed by aerospace at £1059m.

Figure 7 shows the split of current and capital expenditure on R&D performed by UK businesses. Current expenditure is the sum of salaries and wages, basic and applied research and experimental development. Capital is the expenditure on land, buildings, plant and machinery (Table 15).

Regional R&D statistics (tables 16-17)

Regional estimates for the Government and Business sectors are derived from the ONS surveys of Government and Business Enterprises. The HEI regional R&D estimates are less reliable and should be treated with special caution. The expenditure estimates
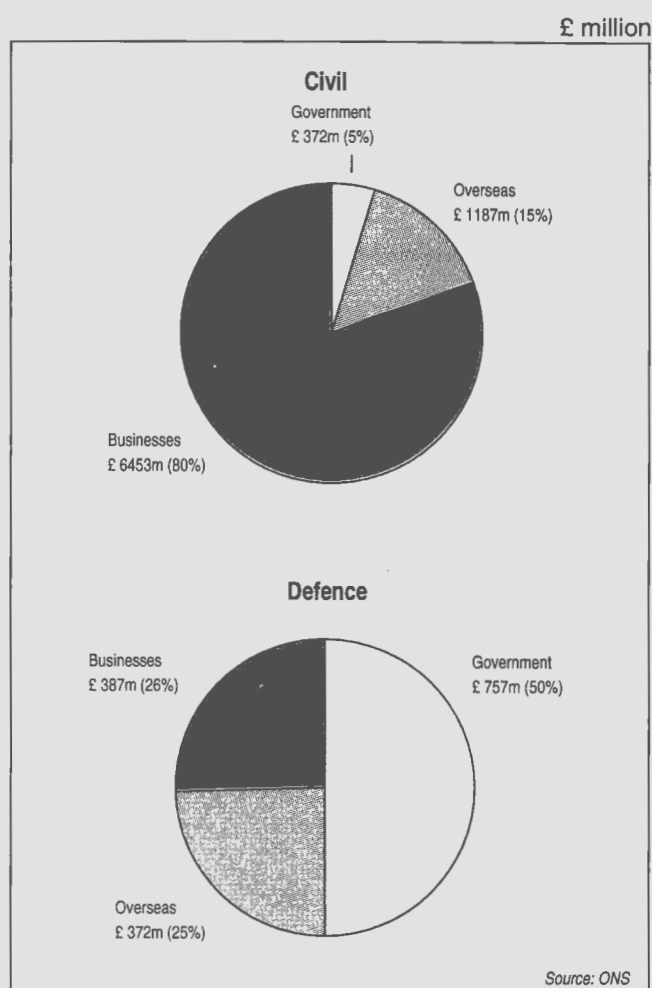
are obtained by allocating total R&D performed by HEIs (HERD) to individual HEIs in proportion to their income from research grants and contracts. An estimate of the labour force in FTEs is not available.

Estimates are given for UK standard economic regions (NUTS1 - see definitions)

Of the eleven NUTS1 regions the South East of England has by far the highest number of R&D personnel and the largest expenditure on R&D. This reflects in part the greater size of the South East. To adjust for this the R&D expenditure estimates are also shown as a percentage of GDP, and the personnel estimates as a percentage of the labour force (see figures 8 & 9). Tables 16 and 17 show that, within the UK, the South East, North West and East Anglia have the highest concentration of R&D expenditure performed by Businesses. For the Government sector, the three dominant regions are East Anglia, South East and the South West, whilst for the Higher Education sector, East Anglia and Scotland are prominent (see figure 8).

International comparisons of R&D (tables 18-21)

Although the guidelines in the Frascati Manual are generally followed, methods of collecting R&D data do vary from country to country (refs 5 and 6 discuss national variations). Therefore small differences should not be treated as significant when making international comparisons.

Figure 7
Current and capital expenditure on R&D performed by UK businesses, 1994

£ million

Capital total
£ 1105m (12%)

Other current
£ 4348m (46%)

Salaries and wages
£ 4076m (43%)

Source: ONS
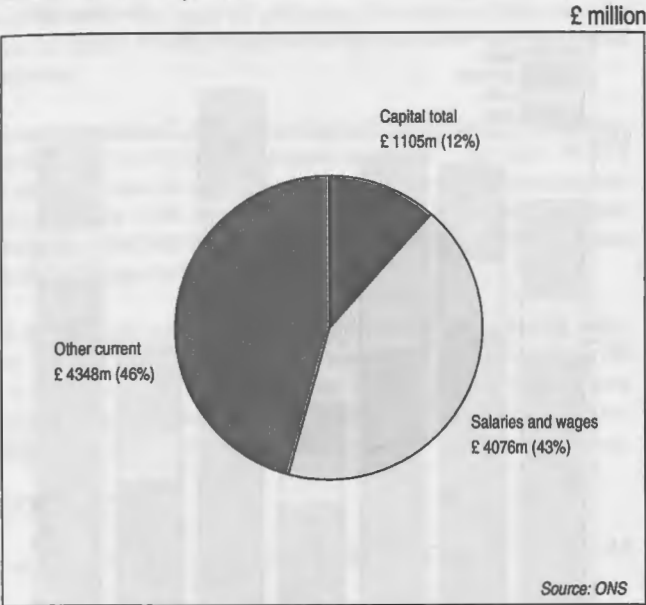
The figures shown for Japan in the tables are OECD estimates.

Table 18 shows the trend of R&D as a percentage of GDP for the G7 countries over the time period 1988 to 1994. The ratio for GERD has been fairly constant over this time for most of the countries although Germany's spending has shown a decline. Figure 10 shows the position in 1994. The UK continues to be ranked in the middle. Table 18 also shows BERD and GOVERD as a percentage of GDP.

Table 19 shows the international comparisons of GERD by sector of performance and source of funding. Table 20 shows R&D performed in the business sector. Table 18 also shows this as a percentage of GDP; the USA and Japan are the top spenders with the UK holding a middle ranking position. International comparison of Government funding of R&D in 1994 by socio-economic objective is shown in table 21. Of the G7 countries, the USA, France and the UK devoted the highest proportion of their total Government funding of R&D to defence. For Germany, Italy and Japan about half of their total Government funding of R&D was classified as the advancement of knowledge.

Figure 8(i) Estimated regional BERD in 1994

Percentage of regional GDP

UK average (1.43)
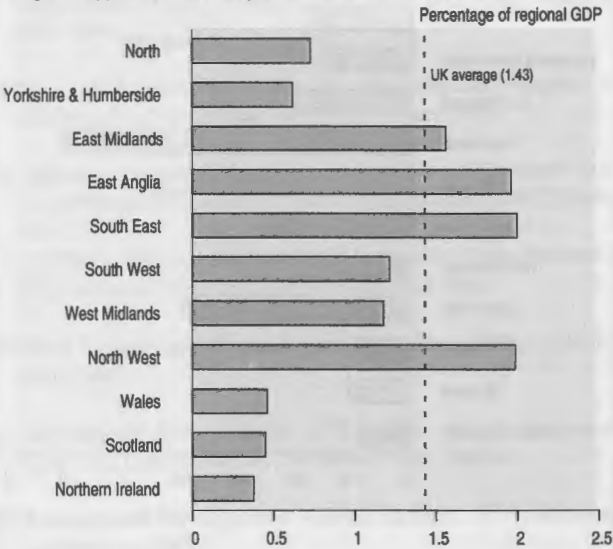
Figure 8(ii) Estimated regional GOVERD in 1994

Percentage of regional GDP

UK average (0.3)
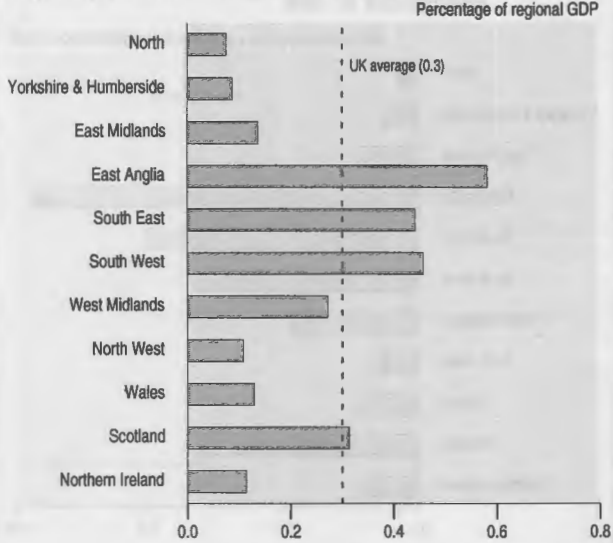
Figure 8(iii) Estimated regional HERD in 1994

Percentage of regional GDP

UK average (0.38)

Source: ONS
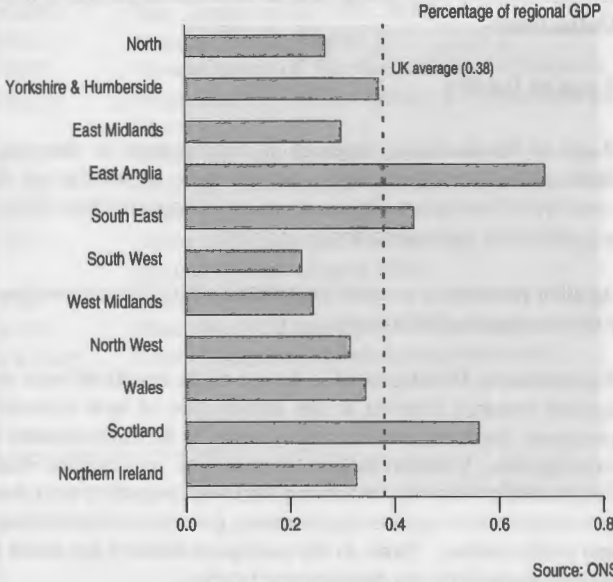
Figure 9(i) Estimated Business regional R&D in 1994

R&D employment as a percentage of regional labour force

Region	
North	
Yorkshire & Humberside	
East Midlands	
East Anglia	
South East	
South West	
West Midlands	
North West	
Wales	
Scotland	
Northern Ireland	

UK average (0.62)

0   0.2   0.4   0.6   0.8   1   1.2   1.4

Figure 9(ii) Estimated Government regional R&D employment in 1994

R&D employment as a percentage of regional labour force

Region	
North	
Yorkshire & Humberside	
East Midlands	
East Anglia	
South East	
South West	
West Midlands	
North West	
Wales	
Scotland	
Northern Ireland	

UK average (0.12)

0.0   0.1   0.2   0.3

Source: ONS

Figure 10
Comparison of BERD, GOVERD, HERD and ORD as a percentage of GDP, 1994

Percentage of GDP

Legend: BERD, GOVERD, HERD, ORD

3.0, 2.5, 2.0, 1.5, 1.0, 0.5, 0.0

UK   Germany   France   Italy   Japan (1993)   Canada   USA

G7 countries

Source: OECD

Definitions

Type of R&D

Basic or fundamental research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

Applied research is research undertaken with either a general or a particular application in view.

Experimental Development is the use of the results of basic and applied research directed to the introduction of new materials, processes, products, devices and systems, or the improvement of existing ones. It should include the prototype or pilot plant stage, design and drawing required during R&D and innovative work done on contracts with outside organisations, government departments, and public bodies. Firms in the aerospace industry are asked to include expenditure on development batches.

Sectors of the Economy

The four sectors of the economy are defined in a CSO publication (ref 4), except that higher education is identified separately as recommended in the Frascati Manual.

Central Government includes the central government departments, research councils, higher education funding councils, NDPBs, and Executive Agencies.

Business Enterprises include private businesses, public corporations, and research associations serving businesses.

Higher Education includes the former polytechnics and central institutions in Scotland as well as the old universities.

Private Non-Profit sector makes up the remainder and includes medical research charities.

Regional data

Data is classified using the Nomenclature of Territorial Units for Statistics (NUTS) developed by EUROSTAT. NUTS provides a single, uniform breakdown of territorial units for the production of Community statistics. NUTS is a three-level hierarchical classification system. In the UK NUTS1 regions correspond to the UK's eleven Standard Economic Regions, NUTS2 regions are individual counties or groups of counties and NUTS3 regions are individual counties and metropolitan counties.

Rounding

Throughout the tables components of totals have been rounded independently of the totals. Therefore the rounded totals will not always be equal to the sums of the rounded components. Symbols follow the conventions used elsewhere in Economic Trends.

Revisions and Discontinuities

The employment table 4 has a value missing for the HE staff because HESA only collected numbers of research staff during this year. This was HESA's first year of collecting the data, so there may be discontinuities in future years when the full set of data required is collected.

In the Government Tables, a new method for estimating Government funded R&D in HE was introduced in 1994/95, therefore 1993/94 figures have been revised. It is not possible to revise the data for prior years because of the structural changes in the HE sector. The other revision is the Ministry of Defence figures for 1993/94 which includes rationalisation costs of DERA.

In the International Comparison Tables, some discontinuity arises for the UK data following the transfer of UKAEA from the Government to the business sector from 1986 and reclassifying Scottish Agricultural Research Institutes as Government sector, rather than PNP, from 1992.

CONTACTS

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General information on Science & Technology (Ref 1)	Steve Knight Tel. 01633 812003
International comparisons (Ref 5,6,7)	Jane Morgan Tel. 01633 813109
Definitions of R&D (Ref 3)	Susie Sturgess Tel. 01633 813061

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(5) Main Science and Technological Indicators 1996/1, OECD, Paris 1996

(6) International Comparisons of Research and Development Spending, Cabinet Office, December 1992, HMSO.

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Abbreviations

BERD	Business Expenditure on R&D
DERA	Defence Establishment Research Agency
EU	European Union
EUROSTAT	The Statistical Office of the European Communities
FTE	Full Time Equivalent
G7	Group of Seven countries, comprising: UK, Germany, France, Italy, Japan, Canada, USA
GDP	Gross Domestic Product
GERD	Gross (Domestic) Expenditure on R&D
GOVERD	Government Intramural Expenditure on R&D
HEFC	Higher Education Funding Council
HEIs	Higher Education Institutions
HERD	Higher Education Expenditure on R&D
HESA	Higher Education Statistics Agency
MSTI	Main Science and Technological Indicators (an OECD publication)
NABS	Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets
NDPB	Non-Departmental Public Body
NHS	National Health Service
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
ONS	Office for National Statistics
OPSS	Office of Public Service and Science (see also OST)
ORD	Other (Private Non-Profit) R&D
OST	Office of Science and Technology (part of DTI since April 1996)
PNP	Private Non-Profit
R&D	Research and (Experimental) Development
UKAEA	United Kingdom Atomic Energy Authority

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Table 1   Gross expenditure on civil and defence R&D performed in the UK in 1994[1][2]

£ million

| Sector providing the funds | Sector carrying out the work | | | | | Abroad |
	Government education	Higher enterprise	Business non-profit	Private	Totals	
Government	1712	1740	1130	136	4718	304
Higher education	2	109	-	-	110	..
Business enterprise	197	157	6841	213	7407	..
Private non-profit	47	354	-	120	521	..
Abroad	64	199	1559	34	1857	..
TOTAL	**2021**	**2559**	**9529**	**504**	**14613**	..
Civil						
Government	1169	1708	372	127	3376	268
Higher education	2	109	-	-	110	..
Business enterprise	113	139	6453	213	6918	..
Private non-profit	45	354	-	120	519	..
Abroad	45	199	1187	34	1466	..
TOTAL	**1374**	**2509**	**8012**	**495**	**12389**	..
Defence						
Government	543	32	757	9	1342	35
Higher education	-	-	-	-	-	..
Business enterprise	84	18	388	-	489	..
Private non-profit	2	-	-	-	2	..
Abroad	19	-	372	-	391	..
TOTAL	**648**	**50**	**1517**	**9**	**2224**	..

Notes:

1. The total for R&D performed by government includes estimates for three components: a small amount of R&D not available from the Government Survey; R&D performed by local authorities; and the support costs of R&D in NHS hospitals.
2. PNP estimates are based largely on trends in the Higher Education sector.

Table 2   Gross expenditure on R&D in the UK by performing sector 1987 to 1994[1]

£ million

	1987	1988	1989	1990	1991	1992	1993[2]	1994
Expenditure in cash terms (£m):								
Performed by:								
Government	1264	1360	1534	1566	1757	1846	1928	2021
Business enterprise	6335	6922	7650	8318	8135	8489	9069	9529
Higher education	1460	1575	1689	1873	2020	2129	2312	2559
Private non-profit	324	370	415	480	494	516	520	504
TOTAL	**9383**	**10227**	**11288**	**12238**	**12406**	**12981**	**13829**	**14613**
Expenditure in real terms (1990=100)[3] (£m):								
Performed by:								
Government	1559	1572	1657	1566	1654	1670	1695	1744
Business enterprise	7811	7999	8263	8318	7657	7678	7970	8220
Higher education	1800	1820	1824	1873	1901	1926	2032	2207
Private non-profit	400	428	449	480	465	467	457	435
TOTAL £ million	**11569**	**11818**	**12193**	**12238**	**11677**	**11741**	**12153**	**12606**
Total as percentage of GDP[4]	**2.22**	**2.18**	**2.20**	**2.23**	**2.16**	**2.18**	**2.20**	**2.19**

Notes:
1. See notes at table 1
2. 1993 figures have been revised because of two reasons; a new method for estimating Government funded R&D in Higher Education (HE) was introduced for 1994-95 and revisions to 1993-94 have been made but not for prior years as it is not possible because structural changes in HE sector ; Ministry of Defence figures for 1993-94 include rationalisation costs of DERA.
3. Using the GDP deflator adjusted for the abolition of domestic rates.

The deflators are:

	1987	1988	1989	1990	1991	1992	1993	1994
	81.1	86.5	92.6	100.0	106.2	110.6	113.8	115.9

4. Gross Domestic Product at market prices (average based) based on the UN definition.

Gross Domestic Product values are: £ million

	1987	1988	1989	1990	1991	1992	1993	1994
	421891	469760	514241	549386	573556	595338	628384	666181

Table 3   Gross expenditure on R&D in the UK by source of funds 1987 to 1994[1]

£ million

	1987	1988	1989	1990	1991	1992	1993[1]	1994
Sector providing funds								
Expenditure in cash terms (£m):								
Funded by:								
Government	3640	3665	4031	4262	4248	4355	4522	4718
Higher education	65	77	81	84	90	98	101	110
Business enterprise	4643	5331	5788	6156	6248	6666	7172	7407
Private non-profit	195	217	253	309	362	404	418	521
Abroad	840	937	1134	1428	1457	1458	1617	1857
TOTAL	**9383**	**10227**	**11288**	**12238**	**12406**	**12981**	**13829**	**14613**
Expenditure in real terms (1990=100)[2] (£m):								
Funded by:								
Government	4488	4235	4354	4262	3998	3939	3974	4070
Higher education	80	89	87	84	85	89	89	95
Business enterprise	5725	6161	6252	6156	5881	6029	6303	6390
Private non-profit	241	251	274	309	341	365	367	450
Abroad	1036	1083	1225	1428	1371	1319	1421	1601
TOTAL £million	**11569**	**11818**	**12193**	**12238**	**11677**	**11741**	**12153**	**12606**
Total as percentage of GDP[3]	**2.22**	**2.18**	**2.20**	**2.23**	**2.16**	**2.18**	**2.20**	**2.19**

Notes:
1. See notes at table 1 and 2.
2. Using the GDP deflator adjusted for the abolition of domestic rates (see table 2).
3. Gross Domestic Product at market prices (average based) based on the UN definition (see table 3).

Table 4   Total employment on R&D by performing sector, 1986 to 1994

Full time equivalents, 000s

	Government	Higher Education[1]	Business Enterprise	Private Non-profit	Total
1986	38	52	188	13	291
1988	37	55	185	13	290
1990	37	57	171	15	280
1991	36	59	159	14	269
1992	38	62	159	13	272
1993	34	66	164	15	279
1994	32	..	161	15	..

Notes:
1. HESA only collects research staff numbers and therefore a full breakdown of R&D personnel for Higher Education institutions is not available for the for the 1994 period.

Table 5   Net Government expenditure on R&D by departments, in cash terms and real terms (1990-91 = 100), 1966-67 to 1994-95

£ million

Year	In cash terms				In real terms (1990 - 91 = 100)[2] (£m)			
	OPSS & Research Councils R&D	All other civil departments R&D	MOD	TOTAL R&D	OPSS & Research Councils R&D	All other civil departments R&D	MOD	TOTAL R&D
1966-67	57.0	225.0	261.0	**486.0**	479.2	1891.7	2194.4	**4086.0**
1967-68	67.0	261.0	242.0	**503.0**	547.5	2132.8	1977.6	**4110.4**
1968-69	75.0	294.0	237.0	**531.0**	583.3	2286.4	1843.1	**4129.5**
1969-70	86.0	323.0	239.0	**562.0**	635.6	2387.1	1766.3	**4153.4**
1970-71	97.0	347.0	259.0	**606.0**	662.3	2369.4	1768.5	**4137.9**
1971-72	113.0	451.0	304.0	**755.0**	707.0	2821.8	1902.0	**4723.8**
1972-73	124.0	493.0	354.0	**847.0**	717.3	2852.0	2047.9	**4899.9**
1973-74	122.0	558.0	406.0	**964.0**	660.4	3020.6	2197.8	**5218.4**
1974-75	140.0	670.0	499.0	**1169.0**	633.4	3031.3	2257.6	**5288.9**
1975-76	168.0	831.0	664.0	**1495.0**	605.9	2997.2	2394.8	**5392.0**
1976-77	196.0	892.0	755.0	**1647.0**	622.8	2834.3	2399.0	**5233.2**
1977-78	207.0	943.0	871.0	**1814.0**	579.0	2637.6	2436.2	**5073.8**
1978-79	239.0	1070.0	1028.0	**2097.0**	601.3	2692.0	2586.3	**5275.7**
1979-80	279.0	1295.0	1306.0	**2601.0**	601.4	2791.6	2815.3	**5606.9**
1980-81	341.0	1556.0	1628.0	**3184.0**	621.3	2834.8	2966.0	**5800.8**
1981-82	421.4	1819.0	1575.9	**3394.9**	700.0	3021.7	2617.8	**5639.5**
1982-83	451.1	1925.0	1593.7	**3518.7**	699.5	2985.2	2471.4	**5456.6**
1983-84	479.8	2002.9	1727.3	**3730.2**	711.1	2968.3	2559.8	**5528.1**
1984-85	506.9	2086.7	1877.7	**3964.3**	715.3	2944.5	2649.6	**5594.0**
1985-86	564.9	2271.8	1903.7	**4175.5**	755.7	3039.1	2546.7	**5585.7**
1986-87	566.4	2329.7	1925.1	**4254.8**	735.5	3025.3	2499.9	**5525.2**
1987-88	624.0	2412.1	1995.7	**4407.8**	769.3	2973.9	2460.6	**5434.5**
1988-89	665.2	2532.9	1963.6	**4496.5**	768.7	2927.0	2269.1	**5196.1**
1989-90	767.3	2631.9	2139.9	**4771.8**	828.8	2842.9	2311.4	**5154.4**
1990-91	844.8	2793.3	2161.8	**4955.1**	844.8	2793.3	2161.8	**4955.1**
1991-92	869.4	2813.8	2213.6	**5027.4**	818.3	2648.4	2083.5	**4732.0**
1992-93	1008.8	2997.2	2075.5	**5072.7**	912.4	2710.8	1877.2	**4588.0**
1993-94[1]	1134.9	3123.8	2278.5	**5402.3**	997.3	2745.2	2002.3	**4747.6**
1994-95	1173.5	3168.9	2031.5	**5200.4**	1012.3	2733.5	1752.4	**4485.9**

Notes:
1. A new method for estimating Government funded R&D in Higher Education (HE) was introduced for 1994-95. Figures for 1993-94 have been revised to reflect this, but not for earlier years because of structural changes within the HE sector. Ministry of Defence figures for 1993-94 have also been revised to take account of rationalisation costs within DERA.
2. Using the GDP deflator adjusted for the abolition of domestic rates (see table 2).

Table 6 Breakdown of Central Government expenditure on R&D, 1994-95 [1]

£million

	Intramural expenditure[2]			Extramural expenditure					Total Gross Expenditure	Total Receipts[4]	Total Net Expenditure
	Current	Capital	Total Intramural	Higher Education	Business Enterprise	Other Extramural[3][4]	Overseas	Total Extramural			
OPSS	-	-	-	-	-	23.7	-	23.7	23.7	-	23.7
Research Councils											
BBSRC	129.0	11.7	140.6	88.5	-	2.4	0.3	91.2	231.8	95.8	136.0
ESRC	4.0	0.3	4.3	45.1	0.3	6.4	-	51.7	56.0	1.3	54.7
MRC	135.0	23.4	158.4	115.1	2.9	9.1	8.0	135.1	293.5	26.8	266.7
NERC	112.3	21.5	133.8	50.3	0.4	0.1	0.2	51.0	184.8	45.5	139.4
EPSRC	105.3	11.4	116.7	214.1	0.4	59.1	14.0	287.5	404.2	60.4	343.8
PPARC	23.1	2.2	25.3	42.3	-	22.2	94.7	159.2	184.5	4.6	179.9
Total OPSS and Research Councils	**508.7**	**70.3**	**579.0**	**555.4**	**4.0**	**123.0**	**117.2**	**799.5**	**1378.6**	**234.4**	**1144.2**
Higher Education Funding Councils											
HEFC	-	-	-	1017.0	-	-	-	1017.0	1017.0	-	1017.0
Total Higher Education Funding Councils	**-**	**-**	**-**	**1017.0**	**-**	**-**	**-**	**1017.0**	**1017.0**	**-**	**1017.0**
Civil Departments											
MAFF	88.5	7.4	95.8	12.3	6.2	43.9	0.0	62.4	158.2	21.0	137.2
DFE	0.5	-	0.5	4.9	0.3	20.4	0.1	25.7	26.1	0.0	26.1
ED	9.1	0.0	9.2	12.3	33.5	4.3	0.0	50.2	59.4	0.5	58.9
DOE	30.5	0.7	31.2	8.8	41.6	23.4	0.0	73.8	105.0	4.5	100.5
DH	29.8	1.8	31.6	22.8	2.0	10.7	0.1	35.6	67.2	8.2	59.0
DSS	0.7	-	0.7	1.0	2.6	0.5	-	4.1	4.9	-	4.9
HSC	8.7	2.1	10.8	2.6	13.9	1.9	0.2	18.5	29.3	6.8	22.6
HO	9.6	0.6	10.2	2.1	3.3	1.2	0.0	6.7	17.0	0.4	16.6
DNH	10.1	0.5	10.6	1.6	0.8	0.4	-	2.9	13.4	2.1	11.4
ODA	16.0	0.5	16.5	23.2	2.8	12.0	57.4	95.4	111.9	0.5	111.4
DTI	64.7	0.1	64.9	13.3	99.3	55.0	89.3	256.9	321.7	56.6	265.1
DOT	25.3	3.1	28.4	1.1	8.8	5.5	0.3	15.6	44.0	5.7	38.3
NI departments	8.7	1.6	10.3	3.1	11.0	0.4	-	14.6	24.9	-	24.9
SO	61.7	9.5	71.3	9.7	3.7	2.1	-	15.6	86.8	11.9	75.0
WO	0.2	-	0.2	0.7	0.2	1.7	-	2.7	2.9	0.0	2.8
Other departments	22.7	1.2	23.9	0.8	0.3	0.3	0.0	1.4	25.3	1.6	23.7
Total civil departments	**386.8**	**29.2**	**416.0**	**120.4**	**230.2**	**183.9**	**147.5**	**682.0**	**1098.1**	**119.7**	**978.4**
Total civil R&D	**895.5**	**99.5**	**995.1**	**1692.8**	**234.2**	**306.8**	**264.8**	**2498.5**	**3493.6**	**354.1**	**3139.5**
MOD	627.1	80.0	707.1	32.4	1374.4	16.0	35.3	1458.1	2165.2	133.6	2031.5
TOTAL	**1522.6**	**179.5**	**1702.1**	**1725.2**	**1608.6**	**322.8**	**300.1**	**3956.6**	**5658.8**	**487.7**	**5171.1**
of which:											
Natural Sciences & Engineering	..	..	1649.1	1262.0	1560.7	277.3	288.8	3388.9	5038.0	..	..
Social Sciences & Humanities	..	..	53.0	463.2	47.9	45.5	11.3	567.7	620.8	..	..

Notes:
1 Excludes Research Councils' pensions/other expenditure
2 Includes intramural R&D funded by other departments.
3 Other extramural expenditure includes Central Government, Local Authorities, NHS and the Private Non-profit sector.
4 Excludes expenditure between individual departments reporting units.

Table 7 Central Government current expenditure on intramural R&D by department and type of activity, 1994-95 [1][2]

£ million

	Basic	Applied	Experimental development	TOTAL
OPSS	-	-	-	-
Research Councils				
BBSRC	68.3	60.6	-	129.0
ESRC	4.0	-	-	4.0
MRC	61.6	73.4	-	135.0
NERC	29.0	73.1	10.2	112.3
EPSRC	42.1	63.2	-	105.3
PPARC	20.8	2.3	-	23.1
Total OPSS & Research Councils	**225.8**	**272.6**	**10.2**	**508.7**
Civil Departments				
MAFF	15.1	50.7	22.7	88.5
DFE	0.1	0.4	-	0.5
ED	-	5.9	3.3	9.1
DOE	0.3	30.0	0.1	30.5
DH	2.0	21.3	6.5	29.8
DSS	-	0.7	-	0.7
HSC	-	7.8	0.9	8.7
Home Office	0.0	7.5	2.1	9.6
DNH	8.3	1.6	0.2	10.1
ODA	-	13.6	2.4	16.0
DTI	0.1	48.2	16.4	64.7
DOT	-	20.5	4.8	25.3
Northern Ireland	0.8	6.8	1.1	8.7
Scottish Office	8.6	52.2	0.9	61.7
Welsh Office	-	0.2	-	0.2
Other Departments	3.6	16.6	2.5	22.7
Total Civil Departments	**39.0**	**284.1**	**63.8**	**386.8**
Total Civil	**264.8**	**556.7**	**74.0**	**895.5**
MoD	-	413.4	213.6	627.1
TOTAL	**264.8**	**970.2**	**287.6**	**1522.6**

Notes:
1 Higher Education Funding Councils have no intramural expenditure on R&D. Their funds are allocated to Higher Education Institutions whose expenditure falls in the Higher Education sector.
2 Excludes Research Council pensions and other costs.

Table 8   **Central Government net expenditure on R&D by socio-economic objectives, 1994-95, using the Nomenclature for the Analysis and Comparison of Science Programmes and Budgets (NABS) developed by EUROSTAT[1][2]**

	Description	£000	Percentage of chapter totals	Percentage of overall total
Chapter 1	**Exploration and exploitation of the Earth**			
1.0	General research	93120	87.2	
1.1	Mineral, oil and natural gas prospecting	191	0.2	
1.2	Exploration and exploitation of the sea bed	35	0.0	
1.3	Earth's crust and mantle excluding sea-bed	1	0.0	
1.4	Hydrology	899	0.8	
1.5	Sea and oceans	1435	1.3	
1.6	Atmosphere	11167	10.5	
total 1		**106848**	**100.0**	**2.1**
Chapter 2	**Infrastructure and general planning of land-use**			
2.0	General research	17978	18.3	
2.1	General planning of land-use	12466	12.7	
2.2	Construction and planning of buildings	969	1.0	
2.3	Civil engineering	42161	43.0	
2.4	Transport systems	15316	15.6	
2.5	Telecommunication systems	1828	1.9	
2.6	Water supply	7354	7.5	
2.9	Other research on the infrastructure and planning of land use	51	0.1	
total 2		**98123**	**100.0**	**1.9**
Chapter 3	**Control and care of the environment**			
3.0	General research on the environment	31420	26.8	
3.1	Protection of atmosphere and climate	24965	21.3	
3.2	Protection of ambient air	12291	10.5	
3.3	Solid waste	2563	2.2	
3.4	Protection of ambient water (excluding groundwater)	5908	5.0	
3.5	Protection of soil and groundwater	14683	12.5	
3.6	Noise and vibration	939	0.8	
3.7	Protection of species and habitats	7456	6.4	
3.8	Protection against natural hazards	782	0.7	
3.9	Radioactive pollution	10830	9.2	
3.10	Other research on the environment	5341	4.6	
total 3		**117179**	**100.0**	**2.3**
Chapter 4	**Protection and improvement of human health**			
4.0	General research	297086	74.8	
4.1	Medical research, hospital treatment, surgery	11643	2.9	
4.2	Preventive medicine	3060	0.8	
4.3	Biomedical engineering and medicines	8659	2.2	
4.4	Occupational medicine	26723	6.7	
4.5	Nutrition and food hygiene	29913	7.5	
4.6	Drug abuse and addiction	1083	0.3	
4.7	Social medicine	6103	1.5	
4.8	Hospital structure and organisation of medical care	5667	1.4	
4.9	Other medical research	7235	1.8	
total 4		**397171**	**100.0**	**7.6**
Chapter 5	**Production, distribution and rational utilisation of energy**			
5.0	General research	2126	3.8	
5.1	Fossil fuels and their derivatives	12281	22.1	
5.2	Nuclear fission	2916	5.3	
5.3	Radioactive waste management including decommissioning with regard to fuel/energy	4828	8.7	
5.4	Nuclear fusion	15823	28.5	
5.5	Renewable energy sources	13500	24.3	
5.6	Rational utilisation of energy	4034	7.3	
total 5		**55508**	**100.0**	**1.1**
Chapter 6	**Agricultural production and technology**			
6.0	General research	44767	17.0	
6.1	Animal products	30853	11.7	
6.2	Fishing and fish-farming	14675	5.6	

	Description	£000	Percentage of chapter totals	Percentage of overall total
6.3	Veterinary medicine	37999	14.4	
6.4	Crops	93765	35.6	
6.5	Forestry and timber production	23600	9.0	
6.6	Food technology	7627	2.9	
6.9	Other research on agricultural production and technology	10088	3.8	
total 6		**263374**	**100.0**	**5.1**
Chapter 7	**Industrial production and technology**			
7.0	General research	502226	101.0	
7.1	Increasing economic efficiency and competitiveness	6807	1.4	
7.2	Manufacturing and processing techniques	3701	0.7	
7.3	Extraction and processing of non-energy minerals and derived products	2203	0.4	
7.4	Products of the chemical industry	2501	0.5	
7.5	Manufacture of motor vehicles and other means of transport	-21745	-4.4	
7.6	Electronic and related industries	821	0.2	
7.9	Manufacture of instruments	118	0.0	
7.10	Manufacture of food products and beverages	380	0.1	
7.13	Recycling waste	32	0.0	
total 7		**497043**	**100.0**	**9.6**
chapter 8	**Social structures and relationship**			
8.0	Research of a general nature	46458	32.8	
8.1	Education, training, recurrent education and retraining	62357	44.0	
8.2	Cultural activities	1522	1.1	
8.3	Management of businesses and institutions	6263	4.4	
8.4	Improvement of working conditions	341	0.2	
8.5	Social security systems	5833	4.1	
8.6	Political structure of society	1329	0.9	
8.7	Social change, social processes and social conflicts	5933	4.2	
8.9	Other research with regard to society	11817	8.3	
total 8		**141853**	**100.0**	**2.7**
Chapter 9	**Exploration and exploitation of space**			
9.0	Research of a general nature	73881	45.7	
9.1	Scientific exploration of space	4222	2.6	
9.2	Applied research programmes	82362	51.0	
9.3	Launch systems	1011	0.6	
9.4	Space laboratories and space travel	44	0.0	
total 9		**161520**	**100.0**	**3.1**
Chapter 10	**Research Financed from General University Funds (GUF)**			
10.0	Mathematics and computer sciences	1016980	99.9	
10.3	Biological Sciences	276	0.0	
10.8	Social sciences	643	0.1	
total 10		**1017899**	**100.0**	**19.6**
Chapter 11	**Non-oriented research**			
11.0	Mathematics and computer sciences	37659	12.6	
11.1	Physical sciences	153551	51.2	
11.2	Chemical sciences	749	0.2	
11.3	Biological sciences	68972	23.0	
11.4	Earth and related (environmental) sciences	4152	1.4	
11.5	Engineering sciences	2382	0.8	
11.6	Medical sciences	1275	0.4	
11.7	Agricultural sciences	8243	2.7	
11.8	Social sciences	22857	7.6	
total 11		**299837**	**100.0**	**5.8**
Chapter 12	**Other civil research**	22165	100.0	
total 12		**22165**	**100.0**	**0.4**
Chapter 13	**Defence**	2021895	100.0	
total 13		**2021895**	**100.0**	**38.9**
TOTAL		**5200413**	**100.0**	**100.0**

Notes:
1 Subject codes where expenditure is nil are not listed.
2 EUROSTAT is the Statistical Office of the European Communities.

Table 9   Business Enterprise R&D, in cash and real terms (1990 = 100), 1966 to 1994

£ million

Year	In Cash Terms Total R&D	In real terms (1990 = 100) Total R&D
1966	580	4876
1967	605	4944
1968	639	4969
1969	680	5025
1970	N/S	N/S
1971	N/S	N/S
1972	831	4807
1973	N/S	N/S
1974	N/S	N/S
1975	1340	4833
1976	N/S	N/S
1977	N/S	N/S
1978	2324	5847
1979	N/S	N/S
1980	N/S	N/S
1981	3793	6301
1982	N/S	N/S
1983	4163	6170
1984	N/S	N/S
1985	5122	6852
1986	5951	7728
1987	6335	7811
1988	6922	7999
1989	7650	8263
1990	8318	8318
1991	8135	7657
1992	8489	7678
1993	9069	7970
1994	9529	8220

Notes:
1. Using the GDP deflator adjusted for the abolition of domestic rates (see table 2)

N/S No survey

Table 10 Expenditure on R&D performed by Business Enterprises, by broad product group, 1981 to 1994

(i) in cash terms (£m):

	1981	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	percentage change 1981 to 1994[2]
All product groups	3793	4163	5122	5951	6335	6922	7650	8318	8135	8489	9069	9529	151
All manufactured products	3130	3446	4202	4604	4873	5389	5901	6490	6273	6583	6986	7454	138
Chemicals	618	735	942	1039	1303	1574	1692	2027	2003	2262	2489	2651	329
Mechanical engineering	273	290	299	261	292	284	345	374	400	433	560	589	116
Electrical machinery	823	1001	1228	1498	1341	1548	1525	1662	1454	1511	1642	1542	87
Transport equipment	220	274	390	419	483	511	548	590	609	640	677	685	211
Aerospace	763	720	818	830	871	850	1090	1124	1125	1027	863	1059	39
Other manufacturing	435	426	526	557	583	622	701	713	682	711	755	927	113
Services	662	718	919	1347	1462	1533	1749	1828	1861	1907	2083	2075	213.

(ii) in real terms (£m 1990 prices) (1):

	1981	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	percentage change 1981 to 1994[2]
All product groups	6301	6169	6852	7728	7811	8002	8261	8318	7660	7675	7969	8222	30
All manufactured products	5199	5107	5621	5978	6008	6227	6374	6490	5907	5952	6139	6431	24
Chemicals	1027	1089	1260	1349	1604	1819	1828	2027	1886	2045	2187	2287	123
Mechanical engineering	453	430	400	339	360	328	373	374	377	392	492	508	12
Electrical machinery	1367	1483	1643	1945	1653	1789	1647	1662	1369	1366	1443	1330	-3
Transport equipment	365	406	522	544	595	590	592	590	573	579	595	591	62
Aerospace	1267	1067	1094	1078	1074	982	1177	1124	1059	929	758	914	-28
Other manufacturing	723	631	704	723	719	719	757	713	642	643	663	800	11
Services	1100	1064	1229	1749	1802	1771	1889	1828	1752	1724	1830	1790	63

Notes:
1 Using the GDP deflator (see table 2)
2 Percentage change calculated using rounded values shown in table.

Table 11　Expenditure on civil and defence R&D performed by Business Enterprises, 1989 to 1994

(i) in cash terms (£m)

	Civil							Defence					
	1989	1990	1991	1992	1993	1994		1989	1990	1991	1992	1993	1994
All product groups	**5923**	**6557**	**6669**	**7092**	**7710**	**8012**		**1727**	**1761**	**1466**	**1397**	**1359**	**1517**
All manufactured products	4339	4892	4969	5326	5799	6053		1562	1598	1304	1256	1187	1401
Chemicals and pharmaceuticals	1673	2013	1986	2242	2463	2641		19	14	17	20	26	10
Mechanical engineering	257	237	263	326	396	389		88	137	137	107	164	201
Electrical machinery	986	1147	1099	1153	1268	1141		539	516	355	358	375	400
Transport equipment	491	525	550	575	619	671		57	65	59	64	59	14
Aerospace	335	357	478	404	372	382		755	767	647	623	491	677
Other manufacturing	597	613	592	626	681	829		104	100	90	84	73	99
Services	1584	1666	1700	1766	1911	1959		165	163	162	141	172	116

(ii) in real terms (£m 1990 prices)(1):

	Civil							Defence					
	1989	1990	1991	1992	1993	1994		1989	1990	1991	1992	1993	1994
All product groups	**6398**	**6557**	**6277**	**6414**	**6776**	**6911**		**1865**	**1761**	**1380**	**1264**	**1194**	**1309**
All manufactured products	4687	4892	4677	4817	5096	5221		1687	1598	1227	1136	1043	1209
Chemicals and pharmaceuticals	1807	2013	1869	2028	2164	2278		21	14	16	18	23	9
Mechanical engineering	278	237	248	295	348	336		95	137	129	97	144	173
Electrical machinery	1065	1147	1034	1043	1114	984		582	516	334	324	330	345
Transport equipment	530	525	518	520	544	579		62	65	56	58	52	12
Aerospace	362	357	450	365	327	330		816	767	609	563	431	584
Other manufacturing	645	613	557	566	598	715		112	100	85	76	64	85
Services	1711	1666	1600	1597	1679	1690		178	163	152	128	151	100

Notes:
1　See table 2 for deflators

Table 12 Sources of funds for Business Enterprise R&D, 1981 to 1994

£ m, cash terms

		Government	Overseas	Mainly own resources [1]	Total
1981		1137	331	2324	3793
1983		1258	283	2663	4163
1985		1176	569	3377	5122
1986		1392	727	3832	5951
1987		1267	760	4308	6335
1988		1177	831	4914	6922
1989		1312	1023	5315	7650
of which:	civil	306	739	4879	5923
	defence	1007	284	436	1727
1990		1392	1289	5638	8318
of which:	civil	428	904	5227	6557
	defence	964	385	411	1761
1991		1189	1299	5647	8135
of which:	civil	479	950	5240	6669
	defence	710	349	407	1466
1992		1171	1270	6048	8489
of which:	civil	478	981	5633	7092
	defence	693	289	415	1397
1993		1129	1398	6542	9069
of which:	civil	390	1103	6217	7710
	defence	739	295	324	1359
1994		1130	1559	6840	9529
of which:	civil	372	1187	6453	8012
	defence	757	372	387	1517

Per Cent

		Government	Overseas	Mainly own resources [1]	Total
1981		30	9	61	100
1983		30	7	63	100
1985		23	11	66	100
1986		23	12	65	100
1987		20	12	68	100
1988		17	12	71	100
1989		17	13	69	100
of which:	civil	5	12	82	100
	defence	58	16	25	100
1990		17	15	68	100
of which:	civil	7	14	80	100
	defence	55	22	23	100
1991		15	16	69	100
of which:	civil	7	14	79	100
	defence	48	24	28	100
1992		14	15	71	100
of which:	civil	7	14	79	100
	defence	50	21	30	100
1993		12	15	72	100
of which:	civil	5	14	81	100
	defence	54	22	24	100
1994		12	16	72	100
of which:	civil	5	15	81	100
	defence	50	25	26	100

Note:
1 Includes own funds and funds from other UK businesses.

Table 13   Total personnel engaged on R&D within Business Enterprises, 1981 to 1994

Full time equivalents, 000s

		1981	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Scientists and engineers		77	77	81	87	87	89	85	83	80	82	86	85
of which:	civil	..	..	..	..	..	..	66	67	68	69	73	71
	defence	..	..	..	..	..	..	19	16	12	13	13	14
Technicians, laboratory assistants and draughtsmen		66	60	50	49	49	46	46	43	38	38	40	41
of which:	civil	..	..	..	..	..	..	37	35	31	32	36	35
	defence	..	..	..	..	..	..	9	8	7	6	4	6
Administrative, clerical, industrial and other staff		52	49	42	52	49	50	45	45	41	39	37	35
of which:	civil	..	..	..	..	..	..	36	36	34	33	33	30
	defence	..	..	..	..	..	..	9	9	7	6	4	6
TOTAL		**195**	**186**	**173**	**188**	**185**	**185**	**176**	**171**	**159**	**159**	**164**	**161**

Table 14 Expenditure on R&D performed in UK businesses: Detailed product groups, 1981 to 1994

£ million

	Intramural Expenditure											
	1981	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total	**3793**	**4163**	**5122**	**5951**	**6335**	**6922**	**7650**	**8318**	**8135**	**8489**	**9069**	**9529**
Agriculture, hunting and forestry; Fishing	9	9	14	37	41	46	59	67	76	80	89	85
Extractive Industries	63	76	105	104	113	113	110	115	129	126	62	72
Electrical machinery and apparatus	228	234	429	463	451	442	426	502	518	523	576	585
Radio, television and communication equipment	470	563	502	728	574	686	602	688	542	609	658	628
Chemicals, man made fibres. Processing of nuclear fuel	321	357	473	518	636	749	767	842	825	840	839	828
Pharmaceuticals, medical chemicals and botanical products	296	378	469	521	667	825	925	1185	1178	1422	1649	1824
Refined petroleum products and coke oven products	37	31	55	63	56	68	72	105	102	108	53	54
Aerospace	763	720	818	830	871	850	1090	1124	1125	1027	863	1059
Motor Vehicles and parts	195	249	369	398	460	486	517	541	576	605	643	642
Shipbuilding and repairs	18	17	12	11	12	13	17	33	16	16	18	17
Other transport equipment	7	7	9	10	11	12	14	16	17	18	17	26
Casting of iron and steel	32	27	36	38	47	60	45	50	40	43	50	74
Non-ferrous metals	22	24	18	20	21	23	25	31	24	22	16	15
Fabricated metal products	38	41	41	49	47	57	55	52	48	63	72	77
Precision instruments	183	184	207	236	247	276	289	268	276	283	312	254
Office machinery and computers	126	204	298	307	316	420	497	471	394	379	409	329
Other machinery	235	250	258	212	245	227	290	322	352	369	488	512
Food products and beverages; Tobacco products	92	80	123	125	121	113	168	185	185	214	177	354
Textiles, clothing and leather products	14	16	22	23	17	19	17	19	23	25	44	45
Rubber and plastic products	30	25	38	32	36	35	41	46	35	25	67	81
Other non-metallic mineral products	33	36	42	38	40	43	55	48	39	37	27	39
Pulp, paper and paper products; printing and publishing [1]	18	21	21	26	33	30	41	43	38	38	33	43
Furniture; wood and straw products [1]	4	4	3	3	3	4	..	..	..	..	8	8
Other manufactured goods; Recycling	8	10	14	16	18	19	20	21	21	23	21	14
Electricity, gas and water supply	78	86	103	147	161	167	187	188	192	187	214	195
Construction	15	16	21	26	25	30	29	19	19	15	11	10
Transport and storage	1	1	2	4	5	5	6	7	8	10	13	8
Post and telecommunications	103	113	136	193	209	210	235	234	247	243	273	290
Research and development consultancy; Technical testing and analysis	205	222	281	467	512	537	616	628	631	675	859	788
Computer related activities	142	155	189	282	315	331	404	435	427	432	478	552
Miscellaneous business activities	5	5	6	9	9	9	11	11	12	12	14	11
Public administration	4	4	6	12	13	13	16	15	15	14	11	4
Wholesale and retail trade	..	..	1	3	3	4	4	4	4	4	5	5

Note:
1 From 1989 to 1992 furniture, wood and straw products was included with pulp, paper and paper products, printing and publishing.

Table 15 Current and capital expenditure, and as a percentage, on R&D performed in the UK Businesses; detailed product groups, 1994

	£ million					Per Cent				
	Total	Capital Total	Current Total	Salaries and Wages	Other current	Total	Capital Total	Current Total	Salaries and Wages	Other current
Total	**9529**	**1105**	**8424**	**4076**	**4348**	**100**	**12**	**88**	**43**	**46**
Agriculture, hunting and forestry; Fishing	85	5	80	35	46	100	6	94	41	54
Extractive Industries	72	6	66	32	34	100	8	92	44	47
Electrical machinery and apparatus	585	38	547	258	289	100	6	94	44	49
Radio, television and communication equipment	628	53	575	283	292	100	8	92	45	46
Chemicals, man made fibres. Processing of nuclear fuel	828	93	735	359	376	100	11	89	43	45
Pharmaceuticals, medical chemicals and botanical products	1824	507	1317	628	689	100	28	72	34	38
Refined petroleum products and coke oven products	54	10	44	22	22	100	19	81	41	41
Aerospace	1059	33	1026	395	631	100	3	97	37	60
Motor Vehicles and parts	642	47	595	300	295	100	7	93	47	46
Shipbuilding and repairs	17	1	17	10	6	100	6	94	59	35
Other transport equipment	26	2	24	13	11	100	8	92	50	42
Casting of iron and steel	74	2	71	42	29	100	3	96	57	39
Non-ferrous metals	15	1	14	7	7	100	7	93	47	47
Fabricated metal products	77	6	71	38	33	100	8	92	49	43
Precision instruments	254	14	240	133	106	100	6	94	52	42
Office machinery and computers	329	40	289	141	148	100	12	88	43	45
Other machinery	512	21	492	217	275	100	4	96	42	54
Food products and beverages; Tobacco products	354	52	302	153	149	100	15	85	43	42
Textiles, clothing and leather products	45	31	14	9	5	100	69	31	20	11
Rubber and plastic products	81	23	58	31	28	100	28	72	38	35
Other non-metallic mineral products	39	2	37	22	15	100	5	95	56	38
Pulp, paper and paper products; printing and publishing	43	8	35	17	18	100	19	81	40	42
Furniture; wood and straw products	8	-	8	5	3	100	-	100	63	38
Other manufactured goods; Recycling	14	1	12	7	5	100	7	86	50	36
Electricity, gas and water supply	195	16	179	82	96	100	8	92	42	49
Construction	10	-	10	7	4	100	-	100	70	40
Transport and storage	8	1	7	6	1	100	13	88	75	13
Post and telecommunications	290	12	278	129	150	100	4	96	44	52
Research and development consultancy; Technical testing and analysis	788	48	740	396	344	100	6	94	50	44
Computer related activities	552	30	522	286	235	100	5	95	52	43
Miscellaneous business activities	11	1	10	6	4	100	9	91	55	36
Public administration	4	-	3	2	2	100	-	100	50	50
Wholesale and retail trade	5	1	4	3	2	100	20	80	60	40

Table 16   Estimated regional breakdown of expenditure on intramural R&D in the Business, Government and Higher Education sectors, 1994 [1][2]

Regions	R&D performed within Businesses (BERD)		R&D performed within Government Establishments (GOVERD)[3]		R&D performed within Higher Education Institutions (HERD)	
	£m	percentage of regional GDP	£m	percentage of regional GDP	£m	percentage of regional GDP
North	228	0.73	24	0.08	84	0.27
Yorkshire & Humberside	317	0.62	45	0.09	191	0.37
East Midlands	703	1.56	62	0.14	135	0.30
East Anglia	476	1.96	141	0.58	167	0.69
South East	4749	1.99	1051	0.44	1044	0.44
South West	632	1.21	238	0.46	116	0.22
West Midlands	659	1.18	152	0.27	138	0.25
North West	1313	1.99	71	0.11	208	0.32
Total England	**9077**	**1.61**	**1784**	**0.32**	**2083**	**0.37**
Wales	130	0.46	37	0.13	97	0.34
Scotland	263	0.45	183	0.31	328	0.56
Northern Ireland	58	0.38	18	0.11	50	0.33
UK Total	**9529**	**1.43**	**2021**	**0.30**	**2559**	**0.38**

Notes:
1   Regional breakdown is based on the NUTS1 (Nomenclature of Territorial Units for Statistics) classification developed by the Statistical Office of the European Communities.
2   These statistics relate to R&D performed in each sector. For example, the figures for Government R&D expenditure include R&D in government establishments only; they do not include government grants and contracts for R&D performed in businesses or in HEIs.
3   Goverd includes estimates for Central Government R&D not available from the government survey, National Health Service and Local Authority R&D.

Table 17   Estimated regional breakdown of personnel engaged on R&D in the Business, Government and Higher Education sectors, 1994 [1]

Regions	R&D performed within Businesses		R&D performed within Government Establishments[2]		R&D performed within Higher Education Institutions[3]	
	Full time equivalents 000	% of the regional Labour Force[4][5]	Full time equivalents 000	% of the regional Labour Force[4][5]	Full time equivalents 000	% of the regional Labour Force[4][5]
North	4.32	0.34	0.18	0.01	..	..
Yorkshire & Humberside	6.99	0.31	0.54	0.02	..	..
East Midlands	7.87	0.41	0.85	0.05	..	..
East Anglia	12.21	1.22	2.88	0.29	..	..
South East	73.69	0.89	16.66	0.20	..	..
South West	11.70	0.53	3.58	0.16	..	..
West Midlands	13.86	0.59	2.23	0.10	..	..
North West	21.61	0.81	0.77	0.03	..	..
Total England	**152.24**	**0.70**	**27.70**	**0.13**	**..**	**..**
Wales	2.34	0.20	0.53	0.04	..	..
Scotland	5.16	0.23	3.77	0.17	..	..
Northern Ireland	1.23	0.20	0.21	0.03	..	..
UK Total [3]	**160.96**	**0.62**	**32.22**	**0.12**	**..**	**..**

Notes:
1   Regional breakdown is based on the NUTS1 (Nomenclature of Territorial Units for Statistics) classification developed by the Statistical Office of the European Communities.
2   Government sector covers Central Government only. NHS, Local Authorities and those areas of Central Government not available from the Government survey are excluded.
3   There is no regional breakdown for Higher Education for 1994, as only research staff personnel have been collected during this period.
4   Labour Force figure used is a head count. An estimate of the labour force in full-time equivalents (FTE) is not available. Using the head count figure gives a lower percentage than a FTE figure would give.
5   Labour Force figures are Spring 1995, these have been taken from the Labour Force Survey Quarterly Bulletin, No13 September 1995.

Table 18 OECD Science and Technology indicators
Gross Expenditure on R&D: International Comparisons, 1988 to 1994

	Year	UK[1]	Germany[2]	France[3]	Italy	Japan[4]	Canada	USA[5]
Gross Domestic Product (GDP)[6]	1988	469.8	560.4	489.4	464.0	1046.3	263.3	2788.6
(£ billion at ppp)[7]	1989	514.2	622.1	544.0	511.7	1173.8	288.7	3069.0
	1990	549.4	699.8	592.8	556.1	1309.3	306.4	3306.4
	1991	573.6	865.6	659.8	620.6	1495.0	329.3	3604.7
	1992	595.3	916.8	671.6	634.9	1514.7	326.3	3619.5
	1993	628.4	956.2	687.4	644.1	1611.4	355.7	3989.7
	1994	666.2	980.6	718.7(e)	674.2	1622.8(e)	378.8(e)	4252.7(e)
Gross Expenditure on R&D (GERD)	1988	10.2	16.0	11.1	5.6	28.0	3.6	77.8
(£ billion at ppp)[7]	1989	11.3	17.9	12.7	6.3	32.8	4.0	84.8
	1990	12.2	19.3	14.3	7.2	37.9	4.5	93.1
	1991	12.4	22.6	15.9	8.2	42.8	5.0	102.4
	1992	13.0	22.8	16.3	8.3	42.5	4.9	100.5
	1993	13.8	23.7	16.8	8.4(p)	44.0	5.3(p)	106.0
	1994	14.6	23.2	17.1	8.2(p)	..	5.6(p)	108.0
GERD as a percentage of GDP	1988	2.18	2.86	2.28	1.22	2.67	1.38	2.79
	1989	2.20	2.87	2.33	1.24	2.80	1.37	2.76
	1990	2.23	2.76	2.41	1.30	2.89	1.46	2.82
	1991	2.16	2.61	2.41	1.32	2.86	1.51	2.84
	1992	2.18	2.49	2.42	1.31	2.81	1.51	2.78
	1993	2.20	2.48	2.45	1.31(p)	2.73	1.50(p)	2.66
	1994	2.19	2.37	2.38(e)	1.21(p)	..	1.47(p)	2.54
BERD as a percentage of GDP	1988	1.47	2.07	1.35	0.70	1.94	0.77	2.00
	1989	1.49	2.07	1.41	0.73	2.08	0.75	1.96
	1990	1.51	1.98	1.46	0.76	2.18	0.79	2.00
	1991	1.42	1.81	1.48	0.77	2.16	0.81	2.07
	1992	1.43	1.70	1.51	0.77	2.06	0.82	2.01
	1993	1.44	1.66	1.51	0.76(p)	1.94	0.82(p)	1.89
	1994	1.43	1.56	1.46(e)	0.70(p)	..	0.81(p)	1.80
GOVERD as a percentage of GDP	1988	0.29	0.36	0.57	0.27	0.25	0.26	0.30
	1989	0.30	0.37	0.56	0.27	0.24	0.26	0.30
	1990	0.29	0.36	0.58	0.27	0.23	0.28	0.30
	1991	0.31	0.36	0.55	0.28	0.23	0.28	0.28
	1992	0.31	0.36	0.51	0.27	0.25	0.27	0.27
	1993	0.31	0.37	0.52	0.28(p)	0.27	0.27(p)	0.27
	1994	0.30	0.35	..	0.28(p)	..	0.26(p)	0.27

Source: OECD databank (March 1996).

Notes:
1 Some discontinuity arises for United Kingdom data, following the transfer of the United Kingdom Atomic Energy Authority from the government sector to BERD in 1986.
2 There are breaks in series between 1986 and 1987, 1990 and 1991, and 1991 and 1992.
3 For government and business enterprise data there is a break in series between 1991 and 1992.
4 Data for Japan are adjusted by OECD.
5 Excludes most or all capital expenditure. There is a break in series between 1990 and 1991.
6 The measure of GDP used is at market prices, based on the UN definition.
7 Amounts are converted to £ sterling using the purchasing power parities (ppp) developed by the OECD.

(P)=PROVISIONAL
(E)=ESTIMATE

Table 19   International comparison of gross expenditure on R&D by sector of performance and source of funding 1994

						Percentage of total GERD	
	UK	Germany	France	Italy(p)	Japan[1]	Canada(p)	USA[2](p)
By sector of performance [3]							
Government	13.8	14.9	21.2	21.4	10.0	17.4	10.5
Business enterprise	65.2	66.1	61.6	57.7	71.1	55.2	70.8
Higher education	17.5	18.8	15.7	20.9	14.0	26.0	15.2
Other	3.4	0.3	1.4	..	4.9	1.4	3.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
By source of funds [4]							
Government	32.3	37.8	44.3	45.9	19.6	42.4	38.8
Business enterprise	50.7	59.3	46.2	49.6	73.4	42.3	59.0
Abroad	12.7	2.4	8.1	4.5	0.1	10.0	..
Other	4.3	0.5	1.3	..	7.0	4.5	2.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes:
1. Data for Japan are OECD estimates.
2. Excludes most or all capital expenditure.
3. Data for France, Japan and Canada are for 1993.
4. Data for Canada are for 1993.

(P)=PROVISIONAL

Table 20   R & D performed in the Business Enterprise Sector (BERD), 1986 to 1994

£ billion at ppp[1]

Year	UK[2]	Germany[3]	France[4]	Italy	Japan[5]	Canada	USA[6]
1986	6.0	9.5	5.4	2.6	15.5	1.7	48.5
1987	6.3	10.6	5.9	2.9	17.3	1.9	51.8
1988	6.9	11.6	6.6	3.3	20.3	2.0	55.7
1989	7.7	12.9	7.7	3.7	24.4	2.2	60.2
1990	8.3	13.8	8.6	4.2	28.6	2.4	66.1
1991	8.1	15.7	9.8	4.8	32.3	2.7	74.5
1992	8.5	15.6	10.2	4.9	31.3	2.7	72.6
1993	9.1	15.8	10.4	4.9(p)	31.3	2.9(p)	75.4
1994	9.5	15.3	10.5	4.7(p)	..	3.1(p)	76.5

Notes:
1. Amounts are converted to £ sterling using the purchasing power parities (ppp) developed by the OECD.
2. Some discontinuity arises for United Kingdom data, following the transfer of the United Kingdom Atomic Energy Authority from the government sector to BERD in 1986.
3. There are breaks in series between 1986 and 1987, 1990 and 1991, and 1991 and 1992.
4. There is a break in series between 1991 and 1992.
5. Data for Japan are adjusted by OECD.
6. Excludes most or all capital expenditure. There is a break in series between 1990 and 1991.

(P)=PROVISIONAL

Table 21 International comparison of Government funding of R & D in 1994 by socio-economic objective (percentage distribution)

Per Cent

	UK	Germany(p)	France[1]	Italy(p)	Japan[2](p)	Canada[3](p)	USA[4](p)
Agriculture, forestry and fishing	5.1	2.6	3.9	2.4	3.5	12.2	2.5
Industrial development	9.5	12.7	7.0	10.3	3.7	9.5	0.6
Energy	1.1	3.8	3.9	3.4	20.5	5.5	4.2
Infrastructure	1.9	1.5	0.6	0.5	1.8	4.8	2.9
Environmental protection	2.3	4.2	1.3	2.4	0.5	2.1	0.8
Health	7.6	3.3	4.5	6.1	3.0	7.8	16.5
Social development and services	2.7	2.4	0.8	3.6	1.1	2.1	1.1
Earth and atmosphere	2.1	2.6	1.1	0.9	1.2	3.5	1.4
Advancement of knowledge	25.4	52.6	31.7	49.0	51.2	35.0	4.0
Civil space	3.1	5.6	10.1	9.1	7.5	9.6	10.9
Defence	38.9	8.4	33.6	8.9	6.0	6.2	55.3
Not elsewhere classified	0.4	0.2	1.4	3.5	-	1.8	-
Per Cent	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Total £million(5)	**5197**	**9380**	**8711**	**4233**	**8157**	**2066**	**43675**

Source: OECD databank (March 1996).

Notes:
1. Data are for 1993. Data for 1994 were unavailable at the time of compilation.
2. Data for Japan are OECD estimates.
3. Data are for 1992. Data for 1993 and 1994 were unavailable at the time of compilation.
4. Excludes most or all capital expenditure.
5. Amounts are converted to £ sterling using the purchasing power parities (ppp) developed by the OECD.

(P)=PROVISIONAL

The Pilot United Kingdom Environmental Accounts

by Prashant Vaze and Stephen Balchin, Office for National Statistics

Summary

This article summarises the work of ONS in developing the satellite UK environmental accounts (UKENA). The purpose of the article is to set out the methodology, to highlight some of the issues which need to be addressed and to present results from the analyses of atmospheric emissions. The article is the first in a series which will further develop the UKENA; as work has yet to be done to extend the coverage of the UKENA, any interpretation of economy environment interactions must be tentative.

Environmental accounts, together with environmental indicators are central to assessing the relationship between the economy the environment and whether growth is consistent with sustainable development. The accounts aim to provide information on the way in which economic development impacts on the environment by industry and for the economy taken as a whole, in an objective, comprehensive and systematic way.

The pilot UKENA presents atmospheric emissions disaggregated by household and industries, data on the depletion and stock of oil and gas reserves and disaggregated data on environmental expenditure by industry. With a small number of exceptions data relate to 1993. The accounts are accompanied by an input-output combined use matrix, consistent with the 1995 edition of the UK National Accounts (Blue Book). This can help analyse the interactions between the environment and the economy and identify indirect environmental impacts. The matrix has been used in this article to reallocate emissions from the electricity industry to its customers.

Manufacturing is the largest industry group within the UKENA, it produces 20% of greenhouse gas and 16% of acid rain emissions. 'Energy production and water' (mainly electricity generation) produces 26% of greenhouse gas and 44% of acid rain emissions. Electricity is a major input into the rest of the economy. Households burn a lot of fuel and so are also major emitters. Private cars produce almost a tenth of greenhouse gas, a quarter of volatile organic compounds, 70% of carbon monoxide and over half of benzene emissions. Domestic gas use accounts for more than a tenth of greenhouse gas and over a quarter of blacksmoke emissions. At current rates of extraction known and suspected reserves of both oil and gas will last for about 40 years. The life expectancy of reserves will change as prices change, and as reserve estimates are revised. Total expenditure on environmental protection by the Extraction, Manufacturing and 'Energy production and water' industries was about £2.3bn in 1994. This represents 1.5% of their value added and 0.6% of their total sales.

The full accounts and accompanying input-output tables will be published on the Internet in the winter. Work is currently underway to extend the atmospheric emissions account backwards in time, and to bring production of radioactive waste and water emissions into next year's account. ONS would welcome comments on what has been done so far, on the usage of data, on the methodology, and on proposals and priorities for future work.

Introduction and Background

The long term aim of the UK Environmental Accounts (UKENA) is to provide a systematic and comprehensive account of the pressures placed by the economy on the environment. The accounts use standard national accounts classifications to reveal environmental impacts by different industries. This disaggregation enables environmental data to be seen and analysed along side economic data from the national accounts. The ONS plans to develop the accounts to assist in the modelling of interactions between the environment and the economy.

The first section of this article places the work being carried out by the ONS in a historical and international context. The relationship between environmental accounts and sustainability is briefly described. The second section describes how the environmental accounts relate to conventional national accounts, and explores some of the issues raised in associating the two. The third section presents and discusses results from the first year's work. The fourth section of the accounts describes how the input-output balances can be used in modelling. The fifth section describes possible future enhancements. Data sources and methodology are listed in Annex 1. Annex 2 gives the raw emissions data and explains the aggregation into environmental themes like greenhouse gas or acid rain.

Background to the pilot UK Environmental Accounts

In 1992, DoE funded research on Natural Resource Accounting (Environmental Resources Limited, 1992). The report examined environmental accounts work developed in France and Norway and calculated pilot accounts for forestry, water use and the flow of fossil fuels. The report concluded in favour of a satellite accounting system focusing initially on energy resources because of the high quality of data and the importance of environmental issues related to fuel combustion such as greenhouse gases. Later in 1992 the ONS (then the CSO) published an article *Environmental Issues and the National Accounts* (Bryant and Cook, 1992). The article began by exploring concepts and reviewing data sources. Problems in valuing emissions into the environment were discussed. The article put forward three different approaches to value oil and gas resources. The experimental account consisted of the usage of fossil fuels and timber, and aggregate production of certain atmospheric emissions. Data related to 1990. In April 1996, the ONS published an article setting out different methodologies for valuing oil and gas (Vaze, 1996). Findings from that article are used later in this paper.

In the White Paper *Sustainable Development: The UK Strategy* (Cm. 2426 January 1994) the Government agreed to "Build on the experimental work published in 1992, to take forward work on UK environmental accounts". More recently the Government has been called on by the British Government Panel on Sustainable Development (January 1996) to "give higher priority, both in this country and in the international community, to the promotion and development of new comprehensive systems of national accounts which bring together the three aspects of sustainable development, namely economic, environmental and social change".

The ONS set up a small unit to take forward work on the UKENA in July 1995. This unit has been assisted by an interdepartmental group of economists and statisticians. The ONS also established an advisory group, drawn from academia, other non-government organisations, and government departments to provide feedback and help assess outside priorities.

Environmental accounts and Indicators of Sustainable Development

In March 1996, the DoE published a set of indicators of sustainable development (DoE, 1996). The indicators are intended to highlight some of the key trends in the state of the environment and in stocks of natural resources (state indicators); environment economy interactions (pressure indicators); and the measures which are being taken to mitigate adverse impacts, including expenditure on pollution abatement (response indicators). The terms pressure-state-response were coined by the OECD and are used to classify environmental indicators.

The UKENA are intended to give a systematic and industrially disaggregated assessment of pressures from economic activity. In addition the UKENA give partial information on the state of the environment (stocks of natural resources) and responses (expenditure on environmental protection).

The indicators and the UKENA complement one another. Whereas the indicators present a time series for selected environmental and economic variables, the accounts aim to show in a systematic way how environmental variables relate to economic variables at particular points in time; with annual publication the accounts will develop into a time series. The relationship between the indicators and the UKENA is similar to that between the key economic indicators and the national accounts. The key indicators reflect the focus of policy concern. The aim of the accounts is to provide a consistent and comprehensive framework to relate the indicators to each other and to economic developments. Just as key economic indicators are drawn from both the national accounts and other sources (for example the unemployment rate, or interest rates), so the indicators derived from the UKENA will be supplemented by other indicators, such as the concentrations of key pollutants; and societal responses, for example, recycling of materials or changes in the price of resources.

Environmental accounts in other countries

In order to ensure international comparability, international agencies periodically agree a standard methodology for calculating the national accounts. The most recent is the European System of Accounts 1995 (ESA95) which is the EU's implementation of the UN System of National Accounts 1993 (SNA93). At present, there is no corresponding framework for environmental accounts. In 1994, the European Commission called for work to be done on ensuring that there were coherent environmental accounts throughout Europe (European Commission 1994). Eurostat (the EU's Statistical Office) has issued guidance on the collection of environmental expenditure (Eurostat, 1994). The United Nations (UN, 1993) has developed an ambitious framework (the System for Integrated Environmental and Economic Accounting - 'SEEA') which sets out a series of satellite environmental accounts, and suggests means of valuing environmental costs.

A number of countries have now prepared environmental accounts including Norway, Canada, The Netherlands and Denmark. These accounts vary in the natural resources they consider. All present atmospheric emissions by industry. The Norwegian system includes emissions from waste water treatment, and the Dutch system includes emissions of solid waste. The UK's pilot environmental account is consistent with these systems; it follows, quite closely, the Dutch National Accounting Matrix including Environmental Accounts (de Haan and Keuning, 1995). Several less developed countries have created environmental accounts in collaboration with staff from the UN and World Bank. Unlike the examples mentioned above these often value both environmental emissions and resource depletion. These tend to have only limited industrial disaggregation.

National accounts and the environment

This section looks at the relationships between the economy and the environment, the existing national accounts, and how a satellite account can extend the current framework to include concerns such as the environment.

Interactions between the environment and the economy

Economic activity can be viewed as a chain of interactions with the environment. Materials are extracted from the environment; manipulated within the economy to produce useful goods and services; and may ultimately be returned to the environment as waste. In addition, changes in the use to which the earth is put can affect biodiversity and visual amenity. Many of these interactions are harmless, some are benign, but many damage the environment. Figure 1 illustrates the interactions between the economy and the environment, some of which are to be described by the UKENA:

A. The environment is the source of material and energy inputs into the economy. Resources such as fossil fuels are available in finite quantities, others such as fisheries are self renewing and, if prudently managed, can be used indefinitely.

B. Economic activity occupies physical space, affecting amenity and displacing natural ecosystems or other economic activities offering different or better environmental benefits.

C. Economic activity emits potentially harmful waste products into the environment.

D. Deterioration of the environment can increase costs borne by industry and households.

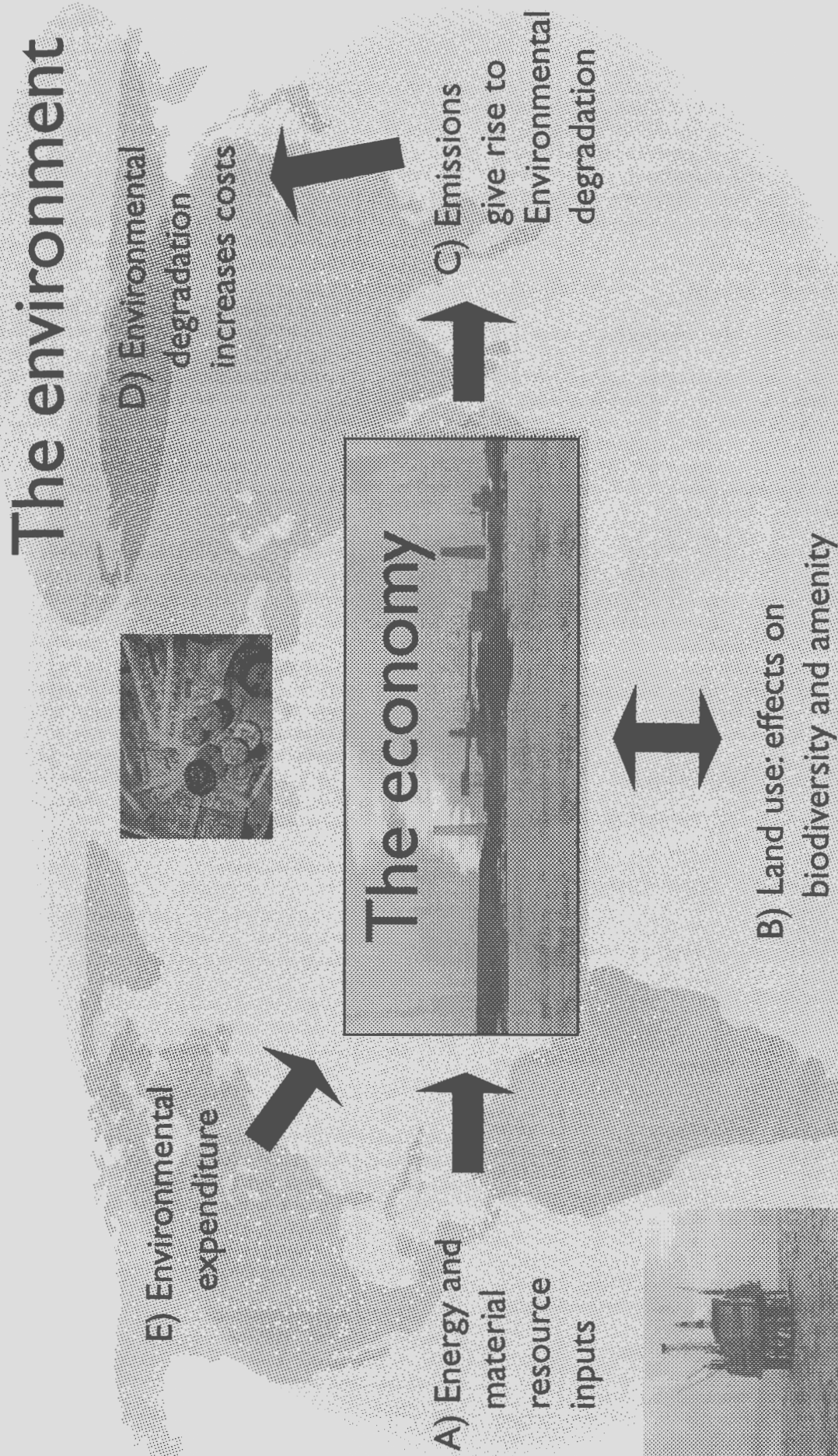E. Society spends money on reducing environmental emissions.

For instance, the economy extracts fossil fuels from the environment (A). The land on which the plant using the oil is located (B) could be put to a more visually attractive and biodiverse use. As the fuel is burnt smoke is emitted (C). This smoke discolours clothes and buildings, as a result households and businesses incur more cleaning costs (D). The plant might opt to install machinery to abate emissions (E). The pilot UKENA measure parts of A, C and E.

National Accounts and Welfare

The UK national accounts provide a coherent framework for recording economic activity. The accounts consist of flow accounts, which measure the value of transactions, for example income or expenditure, and stock accounts which describe the value of capital goods at the start and end of the year. The accounting framework allows crosschecks to be made to ensure the accounts are consistent. For example the difference between stocks at the beginning and the end of a year should be equal to net flows; and consistency in the estimates of production is ensured from measuring GDP using three

Figure I

Interactions between the environment and the economy

The environment

The economy

A) Energy and material resource inputs

B) Land use: effects on biodiversity and amenity

C) Emissions give rise to Environmental degradation

D) Environmental degradation increases costs

E) Environmental expenditure

approaches: income, expenditure, or output. Annual gross domestic product (GDP), possibly the most well known statistic from the national accounts, is an estimate of total production within the UK. Economic terms such as GDP are explained in Box 1.

Most analysts warn against using GDP as a measure of welfare. Instead GDP shows the extent of economic activity leading to welfare. One of its main gaps is that goods outside the production boundary (the definition of what production is included in the national accounts) contribute to welfare. For example, the following are excluded from estimates of gross national income:

- Household and voluntary work;
- Stocks of natural assets such as natural resources and wild animals; and
- Externalities - such as pollution - affecting third parties.

Some would argue that expenditure on environmental protection should be deducted from GDP since much of this spending is 'defensive' in nature, ie it is spending which is generally associated with the avoidance or reduction of pollutant emissions rather than positive benefits. This is not the view of the ONS. Defensive spending achieves beneficial results even though the damage is not included within the production boundary.

Satellite accounts

The SNA93 recognises the importance of activities taking place outside the production boundary. Instead of extending the boundary beyond commercial activity, it proposed the adoption of satellite accounts. Satellite accounts are accounting systems which present complimentary information alongside the traditional accounts in order to highlight issues such as the environment, health or crime. The SNA93 (Section 21.4) says that:

'Typically satellite accounts or systems allow for:

a) The provision of additional information on particular social concerns .... ;

b) The use of complimentary or alternative concepts, ... ;

c) Extended coverage of costs and benefits of human activities;

d) Further analysis of data by means of relevant indicators and aggregates;

e) Linkage of physical data sources and analysis to the monetary accounting system.'

There is a distinction between internal and external satellite accounts (see Neuburger 1996). Internal satellite accounts lie within the production boundary but rearrange data from the core accounts so that information pertaining to a policy interest is grouped together. For instance, a tourism satellite account would identify how much tourists spend on accommodation and food as distinct from spending by non-tourists. This type of satellite account could be used to analyse the impact of policies to promote tourism. External satellite accounts link activities inside and outside the production boundary.

Structure of the satellite environmental accounts

Figure 2 shows how the environmental accounts relate to the standard national accounts. These provide valuable complementary information to traditional national accounts presentations and can be linked directly to national accounts. The core accounts lie inside the box (the production boundary). Some components of the satellite account are inside the production boundary (ie expenditure on environmental protection), others are outside the production boundary (ie emissions and natural resource depletion).

The environmental accounts extend the core accounts by including:

- Emissions by UK households and industry groups shown in physical units (C in Figure 1). In the pilot UKENA these relate only to atmospheric emissions and are given in table 1.
- Natural resource usage in monetary terms (A in figure 1). In the pilot UKENA these relate to stock and depletion of oil and natural gas and are given in table 2.
- Expenditure on environmental protection in monetary terms (E in figure 1). In the pilot UKENA these relate to expenditure by a limited group of industries and are given in table 3.
- Pecuniary cost increases from environmental degradation (D in figure 1). These are not calculated in the pilot UKENA.
- Emissions abatement arise from investment or modifications in processes motivated by the desire to curb emissions, or from buying in goods and services from environmental technology industries. These are not calculated in the pilot UKENA.

Input/output tables can be used with information on environmental expenditure to provide a more detailed analysis of the economic impact of that expenditure. Many of these impacts will be felt in the environmental technology industries (eco-industries) which supply environmental protection equipment and services to other industries. Information on expenditure on environmental protection is also potentially useful in assessing the cost effectiveness of reducing emissions across industries and households, and in helping to design policies to abate emissions at least cost. However, at the moment emissions abatement information is not available which would enable the accounts to be used in this way. The full cost of abatement also reflects costs unlikely to be picked up in practice by the environmental expenditure estimates.

Links to the national accounts

The UKENA is built around an input-output depiction of the national accounts. Input-output tables are published annually (Tse, 1996); the tables consist of two matrices:
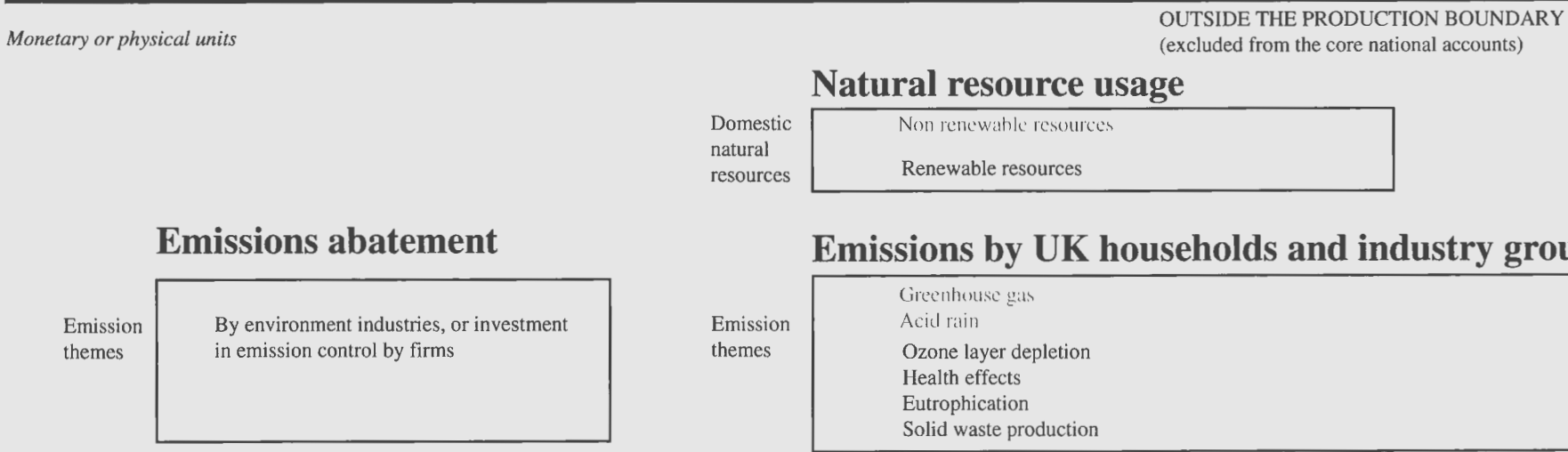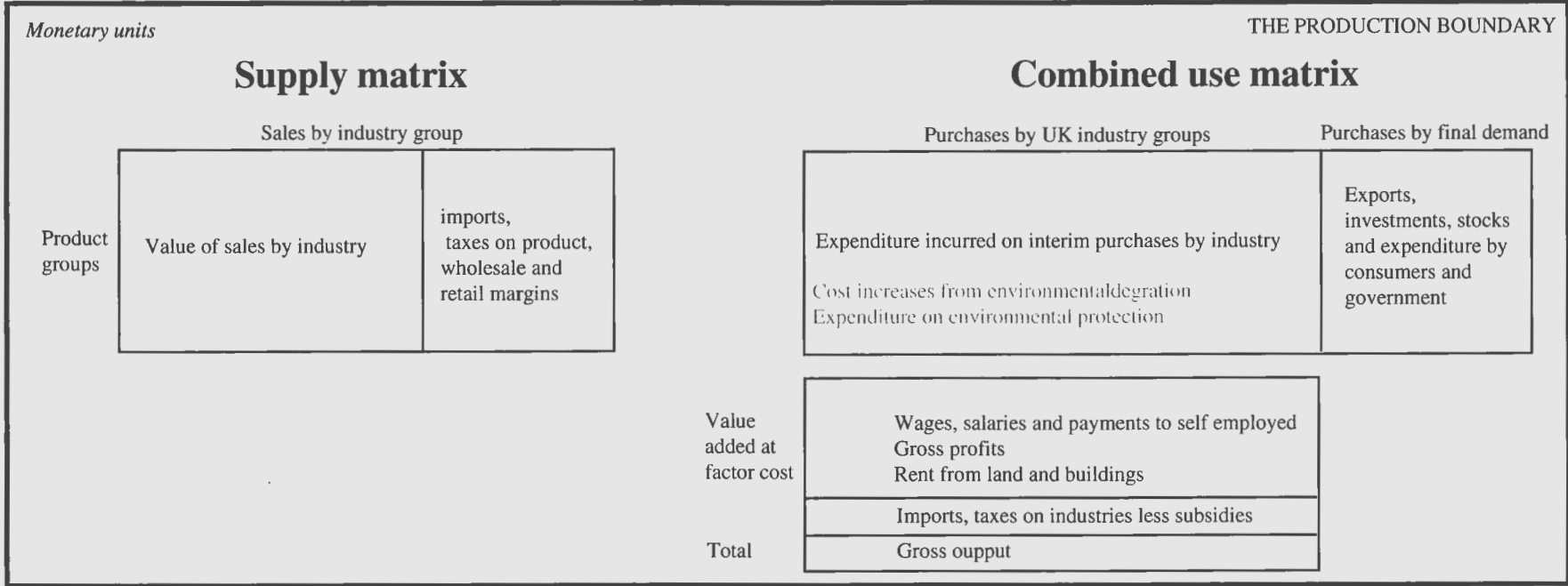
- The supply matrix shows which products (the rows) are made by which industries (the columns); extra columns show imports, taxes on products and distributer's margins,
- The combined use matrix shows which products are used by which industries, or meet final demand, like consumer spending.

Care should be taken to distinguish industries from products. For example, the 'agriculture' industry is the group of production units whose main output is agricultural produce; however, they may produce other products, such as bed and breakfast accommodation. Similarly, agricultural products may be produced by firms outside the 'agriculture' industry. In the supply and use matrices, the rows relate to products and the columns to industries.

The UKENA uses the Standard Industrial Classification (SIC92) to classify economic and environmental data. This system of classification is used internationally. In full 'square' input-output tables the supply and use matrices are combined so that the effects of changes in final demand can be fully traced back through production. At present there are no 'square matrices' using SIC92.

Figure 2

Links between the environmental accounts and the national accounts

Monetary units   THE PRODUCTION BOUNDARY

Supply matrix   ## Combined use matrix

Sales by industry group   Purchases by UK industry groups   Purchases by final demand

Product groups	Value of sales by industry	imports, taxes on product, wholesale and retail margins

Expenditure incurred on interim purchases by industry	Exports, investments, stocks and expenditure by consumers and government
Cost increases from environmentaldegration Expenditure on environmental protection	

Value added at factor cost	Wages, salaries and payments to self employed Gross profits Rent from land and buildings
	Imports, taxes on industries less subsidies
Total	Gross oupput

Monetary or physical units   OUTSIDE THE PRODUCTION BOUNDARY
                                                            (excluded from the core national accounts)

Natural resource usage

Domestic natural resources	Non renewable resources Renewable resources

Emissions abatement   ## Emissions by UK households and industry groups

Emission themes	By environment industries, or investment in emission control by firms

Emission themes	Greenhouse gas Acid rain Ozone layer depletion Health effects Eutrophication Solid waste production

The link between the inside of the production boundary (traditional national accounts) and the outside is by industry.
Columns in the tables can be read down to give both intermediate consumption and environmental impacts such as emissions

Box 1: Economic terms used in the UKENA

Gross domestic product (GDP) - is a measure of the total economic activity occurring in the UK. It can be estimated in three different ways:

- the total income earned from the production of goods and services;
- the total expenditure on all finished goods and services, work in progress, and stocks, less the cost of imports; or
- the sum of value added by activities that produce goods and services.

In the UK GDP is found by attempting to find the most accurate compromise between the results of these three methods (the balancing process).

Gross output - this is the total value of output by each establishment within an industry. Gross output is measured at market prices, ie the actual price payed for the output of an industry.

Value added - this is the contribution of an industry to gross domestic product. It consists of profits, wages and rent on land and buildings. It is measured at factor cost, that is after the payment of taxes on expenditure and the receipt of subsidies.

Employment - this is the number of people employed within an industry in September 1993 and the number of defence personnel working in April 1993. Self employed staff are excluded. Data were collected by the ONS's annual employment survey team.

Economic rent - within the UKENA this term refers to earnings by a firm from exploiting a natural resource in excess of costs of production and a reasonable rate of return on fixed capital.

Use matrix - this is a table showing the values of goods and services bought and sold within the economy. The names of the purchasing industries form the column headings and the names of the products being sold make up the row headings. Expenditure on imported and domestically produced goods are combined.

Asset boundary - this is the national accounts term for what is defined as an asset. Assets which lie inside the asset boundary, such as goods vehicles or a factory, are recorded on the national accounts stocks figures. Assets which lie outside the asset boundary, such as historic monuments or natural resources such as mineral deposits or a forest are not recorded in the core accounts.

Production boundary - this is a national accounting term that defines the extent of economic activity. Sales of goods and services within the production boundary contribute to GDP. Within it are goods and services sold on markets, and goods and services provided by government (public administration and defence). An estimate is also made of 'imputed rent' on owner occupied houses, ie the rent a home owner would be paying if they rented rather than owned their home.

Supply matrix - a table showing which industry makes what product. The names of the selling industry form the column titles and the products being sold the row titles. Extra columns are added to incorporate imports and price adjustments.

Standard Industrial Classification 1992 - SIC (92) A system of classifying economic activity used in the UK. It is consistent with the European Union's NACE Rev 1.

The figures in brackets refer to the SIC (92) codes

Agriculture - (01-05) agriculture, forestry and fishing

Extraction - (10-14) mining of fossil fuels and minerals

Manufacturing - (15-37) manufacture of food products, textiles, printing, fuel synthesis, chemicals, metals and machinery

Energy Production and water - (40-41) electricity, gas and water distribution

Construction - (45) Construction activities

Distribution - (50-55) Retailing, wholesaling, garages, hotels and restaurants

Transport and communication - (60-64) public transport, road hauliers, shipping, air, post and telecommunications

Financial and business services - (65-74) finance, real estate, computing, R&D and law

Public administration - (75) Public administration, defence and social security

Education and health - (80-85) education, health and social services

Other services - (90-99) sewage and refuse disposal, recreation, sports, cultural and personal services Box 2 - Atmospheric pollutants and environmental themes

Monetary valuation and Green GDP

The core national accounts are given in monetary terms. Although it would, in some ways, make analysis easier if the UKENA were also expressed solely in monetary terms it is not possible to find widely agreed prices for environmental damage. Because environmental accounts cover non-market transactions it is often difficult to put them into monetary terms. The UKENA uses a mixture of monetary and physical units.

Bryant and Cook (1992) describe three approaches of valuing damage caused by emissions: willingness to pay (what people say, or reveal through their behaviour, they would be willing to pay to avoid the degradation); prevention costs; and the cost of making good the degradation. These three methods can give very different results. There is no international agreement on which method is the most appropriate, so emissions are given in physical rather than monetary units.

Market prices for oil and gas, however, are readily available. The ONS has developed a methodology for valuing the depletion of natural resources. This is described in Vaze (1996). The method assumes that the difference between the commodity's market prices and full costs of production represents the value of the unexploited resource to the UK economy. The fossil fuels are valued in terms of the average 'economic rent' being earned from the resources. The rent is computed from the value of oil and gas sales less operating costs less a return on the industry's past investment in exploration and fixed capital. A real rate of return of 15% has been assumed - this is the rate safeguarded under the UK's oil and gas fiscal regime.

Ammonia

Ammonia is an acid rain precursor emitted from spreading of animal manure and some fertilisers. The main policy interest in ammonia arises from its role in eutrophication of inland waters - eutrophication is not discussed in the pilot accounts.

Benzene

Benzene is a NMVOC that is released largely from the distribution and combustion of petrol. Benzene is a carcinogen.

Black smoke

This is suspended solid matter arising from incomplete combustion of fossil fuels, it causes soiling of buildings and materials. Black smoke arises in urban areas primarily from diesel fuels. Particles whose diameter is less than 10 microns, known as PM10, have been linked to premature mortality from respiratory diseases. These fine particles are the primary reason for reduced visibility on hazy days.

CFCs - Chlorofluorocarbons, HCFCs - hydrochlorofluorocarbons, HFCs - hydrofluorocarbons, PFCs - perfluorocarbons, SF6 sulphur hexafluoride

These are artificial fluids that contain the halogens chlorine and / or fluorine. Because of their non-reactivity and non-toxicity they were widely used as refrigerants, foam blowing agents, aerosol propellants and solvents. CFCs are powerful ozone depleters (ie they have a high ozone depletion potential or ODP) and can no longer be produced in western Europe; HCFC are interim replacements for CFCs with ODPs 10-20 lower than that of CFCs. HFCs, PFCs and SF6 do not deplete the ozone layer. All of these compounds are potent greenhouse gases. PFCs and SF6 have particularly high global warming potentials.

Methane

Methane is produced when organic matter is broken down in the absence of oxygen. Large quantities are produced by enteric fermentation in cattle and sheep, by spreading of animal manures and landfill sites. Methane is also emitted from coal mines, oil extraction and gas distribution activities. Methane is an important greenhouse gas.

CO2 - carbon dioxide

Carbon dioxide is one of the major combustion products from burning fossil fuels. It is also produced in certain non-combustion chemical reactions, for instance in the manufacture of cement. Carbon dioxide is a long lived pollutant and will remain in the atmosphere for between 50 and 200 years. Carbon dioxide contributes to the greenhouse effect.

CO - carbon monoxide

Carbon monoxide is produced in small quantities when fossil fuel is burnt without sufficient oxygen being present. At high concentrations carbon monoxide is toxic.

Lead

Lead is a heavy metal that is emitted from petrol cars, coal combustion and metal works. Emissions of lead from petrol will continue to fall over the next few years as the stock of cars equipped with three way catalysts rises. Lead has been associated with the reduction in development of children's intelligence.

NMVOC - non-methane volatile organic compounds

Volatile organic compounds are a variety of chemicals with very different economic uses and environmental effects. Emissions of VOCs arise from the deliberate evaporation of solvents, from accidental spillage or non-combustion of petroleum products. The UKENA also include emissions of NMVOCs from forests. NMVOCs play a role in the formation of ground level ozone which can have an adverse effect on health. The NMVOCs emissions include benzene.

NO_x - oxides of nitrogen

Nitrogen oxides arise when fossil fuels are burnt under certain conditions. High concentrations are harmful to health and reduce plant growth. Like sulphur dioxide nitrogen oxides contribute to acid rain, nitrogen dioxide also plays a part in the formation of ground level ozone.

N_2O - nitrous oxide

Man-made nitrous oxide is created in a few industrial processes and from nitrogen fertilisers applied to agriculture. Nitrous oxide is a long lived pollutant, lasting about 120 years and is a potent greenhouse gas.

SO_2 - sulphur dioxide

Sulphur dioxide is produced when coal and some petroleum products containing sulphur impurities are burnt. Sulphur dioxide is an acid gas which can cause harm to people. It causes damage to ecosystems and buildings when deposited as acid rain.

Environmental themes

Depletion of the ozone layer

Ozone is a natural component of the atmosphere. Stratospheric ozone is necessary to protect the plants and animals on the Earth's surface from ultraviolet (UV) radiation. Over the last two decades scientists have observed a thinning in the ozone layer especially over the Antarctic ice cap. The depletion of the ozone layer has been linked to emissions of CFCs. In the upper atmosphere these, otherwise inert, compounds react in the presence of ultraviolet radiation to release free chlorine which destroys ozone. The relative ozone depleting strengths of different compounds are expressed in terms of ozone depletion potentials (ODPs); by definition CFC 11 has an ozone depleting potential of 1.

The Greenhouse effect (Climate change)

Greenhouses gases are transparent to visible light from the Sun but relatively opaque to infrared radiation from the Earth. Over the past two centuries man has caused the atmospheric concentrations of the greenhouse gases CO2, methane, CFCs and N2O to rise dramatically. This rise in concentration of greenhouse gases will affect the climate system. Researchers have found it difficult to separate the effects of climate change from natural variability, but in December 1995 the Intergovernmental Panel on Climate Change stated that 'the balance of evidence suggests that there is a discernible human influence on climate. The different greenhouse gases have different global warming potentials and different residence times in the atmosphere. To aggregate the different gases the 100 year Global Warming Potentials have been used. Carbon dioxide is used as the unit for comparison.

Acid Rain Precursors

The term 'acid rain' describes the various acidic gases and particles undergo chemical reactions in the atmosphere and may be transported long distances before being deposited as wet or dry deposition. When deposited the hydrogen ions may be released causing acidification. These dilute acids damage ecosystems and buildings. The gases included in the pilot accounts are SO_x, ammonia and NO_x. These have been aggregated by their acid forming potentials; results are expressed in tonnes of sulphur dioxide equivalent.

It has been suggested that environmental degradation and depletion of natural resources should be valued and subtracted from GDP as costs of production. This resultant 'green GDP' would then give a better measure of the 'true' value added through the economy. The ONS does not propose to calculate such a figure at this stage. Presently the accounts include only a small number of natural resources; a green GDP calculated on this basis would be partial and hence misleading. Further, values placed upon environmental damage are, to a degree, subjective. The ONS thinks it would be confusing to present such numbers along side data from the core accounts. The UKENA may in the long term provide a basis on which others can value environmental impacts.

In discussing sustainability analysts often differentiate between 'weak' sustainability, where environmental resources can act as effective substitutes for each other and man made capital, and strong sustainability which posits that there is only a limited scope for such substitution. Monetary accounts and green GDP in particular would not allow us to identify substitution between man-made and environmental capital, or the changing balance between economic growth and environmental degradation (see Aaheim and Nyborg 1995). The UKENA report environmental emissions in physical terms. These data are equally relevant under either the strong or the weak definition of environmental sustainability.

Emissions - aggregation of substances into themes

Most substances can harm human health and the environment depending on where and in what quantity they are emitted, and are therefore potential pollutants (i.e. emissions which cause harm). A comprehensive list of all such emissions would run to many pages, would be unmanageably large and difficult to interpret. The ONS has decided, where possible, to aggregate atmospheric emissions according to their contribution to a limited number of environmental themes. This is the first time that emissions have been aggregated into themes in this way. The themes used in the pilot accounts are climate change, acid rain precursors and ozone layer depletion. A single compound can contribute to more than one **environmental theme**, for instance, CFCs are both greenhouse gases and ozone depleters. Box 2 describes the emissions and themes that appear in the pilot UKENA. The advantage of the theme based approach is that data on economic activity are being linked to widely recognised environmental problems. The main disadvantage is a practical one. Though we might understand why a particular emission is of concern measures of relative damage are extremely uncertain. This uncertainty reflects limited scientific knowledge, or variability of impact due to factors such as the weather, variable susceptibility of people and ecosystems, or different persistence of emissions. The ONS has made use of the best scientific advice to weight different pollutants. Annex 2 discusses the weighting procedure.

Attributing emissions

Industries give rise to emissions either directly, for instance, by burning fossil fuels themselves, or indirectly by purchasing goods and services from industries which embody direct emissions. The railway industry produces emissions by burning diesel in its locomotives; indirect emissions arise in the refining industry and in the electricity generating industry. The existence of these indirect effects can make it difficult to see how changes in demand for particular goods impact over the entire economy. This is particularly an issue for the electricity and road freight industries which are important inputs in other areas of the economy. The section on 'Input-output and modelling' describes how the input-output framework can be used to reallocate emissions, using the electricity industry as an example. Further firms often have the choice whether

to carry out an activity themselves or to pay another firm to carry out the activity on their behalf. For example, if a firm hires a lorry, then the emissions will be attributed to the 'freight transport by road' industry. If the firm owns and operates the lorry itself, then the emissions will be attributed to that firm. This method of attributing emissions gives a consistent framework which is compatible with national accounts conventions.

International effects

GDP aims to measure value added from activities taking place within the UK. The UK economy can have an environmental impact on other countries by importing raw materials, goods and services. During the production of these goods and services emissions will have occurred in overseas economies. The UKENA excludes the 'ecological footprints' caused by this trade as it would be inconsistent with national accounting practices. Emissions and resource use arising from UK exports are accounted for in the UKENA.

The UK air, water and road freight industries, however, operate vehicles located outside the UK for some of the time. In order to be consistent with the definitions used in the compilation of GDP, the accounts include emissions overseas and into international territory. This means that the emissions totals differ from those reported elsewhere. For example, to be consistent with the guidelines developed by the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas inventories report emissions from international maritime and aviation fuel separately from the national total, in the UKENA this is reported as 'Total excl. international transport'.

Results and discussion of the pilot UK Environmental Accounts

This section reports and discusses the main findings from the pilot accounts.

Figures 3 and 4 show greenhouse gas and acid rain precursor emissions, in 1993, from different industries. Tables 1.1-1.6 detail atmospheric emissions disaggregated across households and industry groups. The pilot accounts report greenhouse gases, acid rain precursors and air quality emissions. Recently published data on the consumption of halogenated compounds (such as CFCs) are reported separately.

Table 2 presents information on the stocks and depletion of oil and gas in 1993. Data are presented in physical and monetary terms. Table 3 presents disaggregated data on environmental expenditure by industry. These are for 1994 and relate to a limited number of industries.

Tables 1.1 - 1.6 Atmospheric emissions

Table 1.1	emissions over the whole economy.
Table 1.2	as Table 1.1, except emissions from the electricity generating industry are reattributed to the industries purchasing the electricity
Table 1.3	emissions from the extraction and manufacturing industries
Table 1.4	emissions from the electricity generating industry by fuel
Table 1.5	emissions from the whole economy by transport
Table 1.6	supply, global warming and ozone depletion of halogenated compounds in 1994

Data on emissions contributing to an environmental theme were calculated by the ONS in three steps. First, the ONS assisted by the DTI and DOT carried out a detailed break down of fuel use by households and industries. Transport fuels were handled separately. Fuel related emissions were calculated by multiplying fuel use by emission factors. Secondly, to this were added emissions unrelated to fuel use. In the case of ammonia emissions are entirely unrelated to fuel use. Thirdly, emissions were aggregated to themes.

Tables present value added, gross output, and the number of people employed for each industry. Gross output is often the best variable for modelling emissions: in general, changes in an industry's emissions will be most closely related to changes in gross output. However, gross output is subject to double counting and 'superficial' changes in the production process (eg whether a firm does work itself or subcontracts it to another firm). To provide a consistent measure of economic activity value added (or net output) is used, as it avoids the problems associated with gross output. The number of people employed gives each industry's contribution to employment; this information is useful for placing emissions into an economic and social context.

Self-employed people are excluded from the data source used in the pilot UKENA. This omission affects agriculture, construction, certain parts of the transport industry and distribution (retail, hotels and catering) disproportionately. For instance, MAFF estimate that the total workforce in agriculture including self-employed farmers was 544,000, significantly greater than the number of workers employed by the 'Agriculture, Forestry and Fishing' industry classes.

It should not be assumed that emissions should be proportionate to value added; economic data (such as value added) is presented along side data on emissions in order to give an indication of economic size. Some industrial processes, by their very nature, produce more emissions than others. It is also the case that some industries, though not major emitters themselves, may purchase inputs from a highly emitting industry. Also, simply because an industry has less than the average emissions per value added does not mean opportunities for reducing emissions do not exist.

- According to ONS estimates, in 1993, 'Energy production and water' (mainly electricity) produced the most greenhouse gas and acid rain precursor emissions in relation to its value added.
- Agriculture is not a major emitter in absolute terms but is the second largest emitter of greenhouse gases and acid rain precursors in relation to its value added.
- Manufacturing is the second largest emitter of greenhouse gases and acid rain precursors however it the largest industry group generating 21% of value added.
- Distribution, Education and health, Construction and Finance produce small quantities of direct emissions and produce about 60% of economic output.
- Households are also major direct emitters but are excluded from figures 2 and 3.

Figures 3 and 4 combine information on emissions from particular industry groups along side data on value added. Information on numbers of employees could equally well be used (and gives similar results). The area of each column is proportional to total direct emissions, the width to the industry's share of UK value added. The height of each block is industry's direct emissions per £billion of value added. The industries have been ordered according to quantity of total emissions.

Aside from the 'Energy production and water', emissions in relation to value added are highest in the primary industries (extraction and

agriculture) and quite a lot less in the Manufacturing industry group. The service industries (including distribution, public administration, finance) emit an order of magnitude less relative to their value added than the primary and manufacturing industries.

Table 1.1 - Emissions across the whole economy

- Energy production and water (almost entirely the Electricity industry) produces 26% of greenhouse gas and 44% of acid rain precursor emissions.
- Manufacturing produces 20% of greenhouse gas and 16% of acid rain precursor emissions.
- Private households (which includes cars and domestic fuel use) produce 22% of greenhouse gas emissions, 11% of acid rain emissions and between 34% and 77% of the local air emissions - the latter are mainly due to private use of cars.
- Transport emissions are distributed throughout the economy and should be read from Table 1.5.

Agriculture emissions of greenhouse gases consist mainly of methane from livestock and N_2O from fertilisers, manure and certain crops. N_2O emissions from agriculture are highly uncertain. The 'Other services' industry produces almost half the UK's emissions of methane, this is mostly from landfill sources. The quantity of methane emitted from landfill is highly uncertain. Waste incineration within 'Other services' explains the high levels of black smoke emissions.

Table 1.2 - Emissions over the whole economy from Electricity industry reattributed

- Manufacturing and Private Households are the main users of electricity.
- Several industrial groups with low direct emissions, such as Distribution and Financial & business services have had very large proportionate increases in pollution once electricity emissions are reattributed.

The electricity industry supplies a large proportion of the rest of the economy's energy needs and is often used as a substitute for direct use of fossil fuels. Table 1.2 shows the effect of reattributing emissions to the electricity purchasing industry group using the input-output tables. A description of how the electricity emissions were reattributed is given in the section on input-output and modelling.

This table also reattributes gross output, value added and employment from the electricity industry to purchasing industries including the household sector.

Table 1.3 - Emissions from Extraction and Manufacturing industries

- Within the Manufacturing industry, the 'Solid and nuclear fuels, oil refining', 'Chemicals and man-made fibres', and 'Basic metals and metal products' industries are all major emitters of greenhouse gases and acid rain precursors.
- The Extraction industry produces about 5% emissions of greenhouse gases and 3% of acid rain precursors, mainly in the form of methane and NOX respectively.
- The Chemicals industry makes extensive use of industrial solvents producing over 15% of total NMVOC emissions.
- 'Solid and nuclear fuels, oil refining' industry produce 3.4% of greenhouse gas and 4.4% of acid rain precursor emissions.

The Chemical industry's biggest single contribution to greenhouse

gas emissions is due to emissions of nitrous oxide (produced during the manufacture of nylon and nitric acid). Iron and steel, within the 'Basic metal' industry, and coke manufacture, within the 'Solid and nuclear fuels, oil refining' industry, both consume large quantities of coal causing acid rain precursor and greenhouse gas emissions.

Table 1.4 - Electricity generation

- The electricity supply industry produced a quarter of greenhouse gas emissions and a little under a half of acid rain precursor emissions.
- Coal fired generation produces more emissions per unit of electricity for all themes than either oil or gas; natural gas is the cleanest of the fossil fuels used in electricity generation

Table 1.4 examines the electricity industry by fuel. The first column is the ONS's estimate of the proportion of electricity generated by the different energy sources. The column was calculated from fuel input data and the relative efficiencies of generation. A number of assumptions have been made to arrive at this number and it should be regarded as indicative. Nuclear electricity does not generate atmospheric emissions but contributes to other environmental concerns not discussed in the pilot UKENA. There has been a switch away from coal to gas fired electricity plants over the last few years; this and major expenditure on flue gas desulphurisation equipment at two major coal plants will reduce emissions of acid rain precursors.

Table 1.5 - Transport emissions

- The ONS estimates transport produced more than a fifth of greenhouse gas and acid rain precursor emissions, a third of NMVOC emissions, over half of black smoke and benzene emissions and nearly all of CO emissions.
- Privately owned cars produce almost a tenth of greenhouse gas emissions, a quarter of NMVOC emissions, 70% of CO emissions and over half of benzene emissions.
- ONS estimates the movement of freight by road produced 30% of black smoke and almost 5% of acid rain precursor emissions.

Table 1.5 examines emissions from transport over the whole economy, broken down by mode of transport and industry group (for industries with large own account transport use). Table 1.5 is unusual in that it looks at emissions from a process, ie transport, used by most industries, rather than emissions from specific industries, as is done in other tables. Almost all industries have some form of own account transport, where no economic transaction is reported when people or goods are moved. It is therefore not possible to estimate the specific contribution transport makes to an industry's output. Due to this, economic data in the above table are only presented for industries where the majority of value added arises directly from transport services, for example railways, and public haulage, but not distribution (which includes hotels and retail activities). Similarly expenditure by households on private transport (purchases of fuel, car insurance, etc) is not given in the environmental accounts, as it cannot be easily traced in the national accounts, whereas expenditure on public transport is recorded.

As three way catalyst converters become more widespread emissions from cars of NMVOCs, benzene, CO and NOx are expected to fall however, emissions of the greenhouse gas N_2O from cars will rise. About two-thirds of heavy goods vehicles emissions are from the public hauliers, a further third are from 'own account' movements, that is from vehicles owned and operated by industries producing or purchasing the goods. Emissions from heavy goods vehicles owned by public hauliers have been attributed to the road freight haulage

industry. Emissions of own account work are attributed to the industry owning the vehicle. All emissions from light goods vehicles and a significant proportion of car emissions (business miles) could not be attributed to specific industries.

The ONS estimates Water transport produces 5% of acid rain precursor emissions and over 1% of greenhouse gas emissions. The commercial Air transport industry produces about 3% of greenhouse gas emissions. A large proportion of emissions from these industries arise outside the UK. The Air transport industry is a small but growing industry. Total greenhouse emissions are 22 $MtCO_2$ greater than emissions excluding international transport.

Railways use electricity and fossil fuels as a source of energy. The 'tubes and trams' industry does not cause significant direct atmospheric emissions since they use electricity as their energy source. The railway industry also uses electricity as a major energy source. Table A2 reattributes emissions from electricity generation to the purchasing industry. Allowing for these indirect emissions, railway's greenhouse gas emissions increase by 80% and acid rain precursor emissions by 150%. Emissions from tubes and trams rise from zero to 1.3 million tonnes (CO2 equivalent) of greenhouse gases, and 19 thousand tonnes (SOx equivalent) of acid rain precursors.

Table 1.6 - Halogenated compounds

Table 1.6 breaks down use of halogenated compounds by application. Some halogenated compounds (CFCs and HCFCs) contribute both to ozone depletion and global warming. Others (HFCs and SF6) contribute to global warming. The weights have significant margins of uncertainty since simplifying assumptions were made about the mix of fluids purchased by different users. The data on greenhouse gas emissions in Table 1.6 do not contribute to total greenhouse gas emissions in the main tables. The supply of a halogenated compound in a particular year is not comparable to emissions since some of the compounds will be stored in equipment and may eventually be recycled or destroyed rather than emitted. The table also omits methyl bromide (an ozone depleting substance), since separate data are not available on the supplies of this compound within the UK.

It was not possible to link the quantity of fluid used to the SIC code of the purchasing industry. These fluids are used as refrigerants in fridges and air conditioning, in the manufacture of plastics by the Chemicals industry, in aerosols, throughout the economy, and as solvents in several specialised industries including electronics, precision cleaning, metal cleaning and dry cleaning. Some CFC and HCFC substitutes have global warming potentials significantly greater than the chemicals they are replacing. It should be stressed there has been a significant reduction in the volume of halocarbons used over the past ten years.

Table 2 - Depletion of oil and gas reserves

- About 100 million tonnes of oil and 66 million cubic metres of gas were extracted in 1993.
- At 1993 rates of extraction, remaining oil and gas reserves would last for forty years.
- The ONS estimates that pre-tax profits from exploiting these resources are £1.8 billion in excess of a normal rates of return.
- Due to the discovery of new oil and gas fields and changes in market prices estimates of remaining stocks of oil and gas, and life expectancy of reserves is subject to large revisions.

Table 2 presents data on the stock of oil and gas reserves and their depletion over the year 1993. Depletion of oil and gas was more than

Figure 3

Emissions of greenhouse gases relative to value added, 1993

Area	Industry	Thousands tonnes CO_2
a	Energy production and water	177700
b	Manufacturing	139000
c	Transport	50000
d	Other services	42450
e	Extraction	34300
f	Agriculture	29800
g	Distribution	12500
h	Education and health	10600
i	Public Administration	9100
j	Construction	3300
k	Finance	2600

Note:
Emissions from households and 'unattributed', and value added from financial services adjustments are excluded.
Acid rain precursors aggregated by summing SOx, NOx and ammonia according to potential hydrogen ions production.
Value added is given at factor cost, that is after payment of taxes on expenditure and receipt of subsidies.

Figure 4

Emissions of acid rain precursors in relation to value added

Area	Industry	£ millions acid rain precursors tSOx
a	Energy production and water	2500
b	Manufacturing	912
c	Agriculture	553
d	Transport	552
e	Extraction	152
f	Public Administration	58
g	Education and health	57
h	Distribution	55
i	Other services	23
j	Construction	13
k	Finance	8

Note:
Emissions from households and 'unattributed', and value added from financial services adjustments are excluded.
Acid rain precursors aggregated by summing SOx, NOx and ammonia according to potential hydrogen ions production.
Value added is given at factor cost, that is after payment of taxes on expenditure and receipt of subsidies.

offset by upward revisions in the volumes of 'proven' and 'probable' stocks for both oil and gas. The life expectancy is based on prevailing prices. Life expectancy will increase if oil and gas prices rise (making currently uneconomic wells profitable) or if the rate of production falls. The ONS estimates in 1993 the UK economy benefitted by £1.8 bn in excess of normal rates of wages and profits from exploiting these resources. The average amount of excess profit (economic rent) being earned per unit of oil is very low compared the rates earned in the fifteen years prior to 1993 because of low oil prices. Gas rents have risen since the start of the decade but are low relative to earnings in the 1980s.

Table 3 - Environmental expenditure

- Total environmental expenditure by the Extraction, Manufacturing and 'Energy production and Water' industries was estimated as £2.3 bn. Total purchases by these industries was £416 bn and their combined value added was £152 bn.
- The industries that spent most on environmental protection were 'Chemicals', 'Paper and publishing' and 'Food manufacturing'. Together these industries accounted for almost half of spending by industry on pollution control.
- Water protection accounted for 43% of spending, air pollution control 28%, and waste management 22%.

Table 3 presents data on expenditure by the Extraction, Manufacturing, Energy production and Water industries on environmental protection for 1994. The information is based on a DoE survey (1996b). The information relates to pollution control spending by these industries for all media (air, water, waste, etc). Only around a quarter of spending is estimated to be on reducing atmospheric emissions, so the environmental expenditure figures are not directly comparable with the physical emissions data given in the pilot accounts. Also, environmental expenditure by households and several industry groups (including agriculture, transport, and public administration) is not included.

Environmental expenditure covers capital and operating expenditure which have been incurred by companies and can be attributed to an environmental objective. Expenditure includes 'end-of-pipe' investments which generally treat or control emissions or waste materials at the end of the production process and 'clean technologies' where the production process is adapted or changed so that it generates fewer emissions or waste materials. Operating expenditure includes spending by companies on their own account (for example for staff working on waste treatment plants) and on payments to others for the purchase of environmental services, principally for waste management and waste water treatment. In some instances industries might react to environmental regulations by limiting their output, or withdrawing a product from the market. This sort of cost to the industry will not be picked up by the enquiry.

Input-output and modelling

This section describes how input-output was used to reallocate emissions from the electricity industry and could be further developed for more sophisticated policy analysis.

In Tables 1.2 and A2 emissions from the Electricity industry were reallocated to the purchasing industry to show how the combined use matrix can be used. The reallocation was performed in the following steps:

i. The Electricity row in the use table gave the value of electricity purchased by each industry.

ii. Data on average price paid for electricity by different industries, available from DTI, were used to scale the purchases to estimate volumes of consumption.

iii. Emissions (and economic data) from the electricity sector were then reallocated according to the proportion of total electricity consumed.

Emissions from other industries, for example road haulage could be similarly reallocated.

Tables derived from the supply and use tables (and incorporating adjustments to exclude overseas production) can be used to perform more sophisticated analyses.

Economic or environmental policies can effect the emissions in two ways. Changes in relative prices of goods and services (for instance through an environmental tax) can change the demand for goods and hence effect the pattern of industrial output. The *derived tables* can be used to analyse how changes in demand ripple through the economy, affecting economic output, and hence emissions, though they cannot handle the changes in production techniques which are also likely to occur. Secondly, regulations, improvements in technology or fuel substitution can directly alter the amount of emissions generated by an industry. Within the input-output framework this would be simulated by changing the ratio of emissions to outputs for an industry, although regulations can also affect the scale of output. These two effects can be analysed simultaneously. Leontief (1986) and McNicoll and Blackmore (1993) describe how input-output tables can be used to analyse environment-economy interactions.

Considerable care therefore has to be taken when using data from input-output matrices to analyse policy. Important assumptions about constant returns to scale and use of inputs in fixed proportions generally need to be made. Such assumptions will not often be valid, and input-output analysis generally need to be supplemented by an analysis of the determinates of production coefficients.

The ONS is in the process of developing social accounting matrices (SAM). Like the UKENA these use the input-output tables as their skeleton. The UKENA and SAM can be used together to analyse social and environmental issues on a consistent basis.

Future developments

This section looks at the areas where the accounts can be developed and their scope extended. The pilot accounts cover only a limited number of environmental themes, and only a single year's data.

The ONS plans to develop the input-output tables further to aid policy analysis. The full accounts and the enhanced input-output tables will be released on to the Internet sometime during Winter 96/97. Work is underway to bring emissions into water and generation of nuclear waste into the accounts for next year. Work is also underway to calculate emissions accounts for earlier years. The ONS also wishes to aggregate air quality emissions into a theme as soon as scientifically robust weights become available.

The table below suggests ideas for further environmental themes and natural resources that might be developed over time.

Themes	Constituent substances
Inland water and ground-water	
Nutrients	nitrates, phosphates, ammoniacal nitrogen
Deoxygenation	biological and chemical oxygen demand
Heavy metals	zinc, copper, lead, nickel, chromium, arsenic
Pesticides	variety of pesticides
Coastal water/marine	
Nutrients	nitrates, phosphates
Heavy metals	cadmium, mercury, copper, lead, zinc
Sea dumping	sewage sludge, industrial waste, dredging
Waste	
Radioactive waste	high, intermediate and low
Other solid waste	
Natural resources	
Coal	
Timber	
Fish	
Water	abstractions from surface and ground water
Soil	
Land	
Amenity from land	loss of green field sites
Habitats	
Soil	

The ONS is interested in receiving feedback on the pilot accounts and ideas for future work. We would also like to be contacted if use is made of the data. The authors can be reached at:

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Acknowledgements

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Annex 1
Data: Sources and Methods

1. This Annex details the data sources which were used in the pilot UK environmental accounts.

Economic data

- Gross output and value added date were obtained from national accounts sources. Data for 1993, where applicable, is consistent with the 1995 ONS Blue Book.
- The Number of people employed for each industry was taken from the ONS Annual Employment Survey.

Carbon dioxide (CO_2), carbon monoxide (CO), Sulphur oxides (SO_x), oxides of nitrogen (NO_x), particulates, non-methane volatile organic compounds (NMVOCs), methane, nitrous oxide (N_2O)

2. The National Environmental Technology Centre (NETCEN) annually produces the National Atmospheric Emissions Inventory (NAEI) for the DoE. Only a small proportion of emissions are monitored at source. NETCEN maintains a database of emissions factors derived from measurements of a number of representative sources. For the electricity industry NETCEN uses data collected to monitor the Large Combustion Plant Directive for certain substances. A fuller description of the NETCEN methodology, including details on non-fuel emissions, is available (Salway A G, 1995). Details on the emissions of NMVOCs were based on a survey carried out in 1988 (Passant N R, 1993).

3. The UKENA industrially disaggregates emissions further than NETCEN. Most of the data were drawn from the Digest of UK Energy Statistics 1995 (DUKES). This was supplemented with data collected on behalf of the ONS by the DTI. Data published by the Building Research Establishment were used to estimate fuel use in commerce and government. Emissions were estimated by multiplying fuel consumption with emissions factors and adding releases unrelated to fuel use such as, methane arising from landfill. The accounts exclude carbon removal by vegetation. The accounts also omit positive environmental benefits associated with industries; for example the amenity provided by agricultural and forest landscapes.

Transport emissions

4. The emissions coefficients and the direct emissions were supplied by the National Environmental Technology Centre (NETCEN).

5. Total fuel use was drawn from DUKES. Road transport emission factors are quoted per vehicle kilometre travelled. NETCEN provided the ONS with data on the distance travelled by goods vehicles, buses, cars and motor cycles; this data was originally collected by DoT. For each pollutant the fuel use or kilometres travelled is multiplied by a coefficient to obtain the total emissions. Several data sources were used to allocate vehicle kilometres travelled by industry:

- DoT's continuing survey of road goods transport for HGVs (vehicles over 3.5 tonnes);
- DoT's national travel survey to split private and business miles by cars;
- DoT data for taxis;

- DUKES for fuel use by railways;
- DTI data for the split of marine fuel between fishing, oil exploration and coastal and international shipping; and
- MoD data on fuel use by the armed forces.

It was not possible to allocate travel by light goods vehicles and non-domestic use of cars by industry. In Tables 1.1 and 1.2 emissions from these sources are included within 'unattributed'.

Halogenated compounds - CFCs, HCFCs, HFCs, PFCs and SF6

6. The UKENA uses data gathered by March Consulting Group on behalf of the Global Atmosphere division of the DoE. This study was based on in-depth interviews of the suppliers and users of the halogenated compounds (CFCs, HCFCs, HFCs, PFCs). The study reports the amount of fluid supplied to users in 1994 rather than emissions in 1993. In most cases there is a time lag of several years between supply and eventual atmospheric release, and *some chemicals will be destroyed thus preventing release into the atmosphere.* halogenated compounds are used in relatively few commercial applications and data on supply are commercially sensitive.

Ammonia

7. The UK ammonia inventory was calculated by the Institute of Terrestrial Ecology, Imperial College and the Institute of Grassland and Environmental Research. The data are provisional.

Data on oil and gas depletion

8. Information on the volumes of stocks, extraction and new discoveries of oil is drawn from Oil and Gas Resources of the United Kingdom (DTI, 1995). There is considerable uncertainty about the magnitude of reserves. Indeed it is common for revisions to exceed the amount being depleted. The ONS has defined oil and gas reserves as the average of the upper and lower estimates of total discovered and undiscovered resource. This estimate of reserves includes statistically derived estimates of future oil and gas discoveries using data on past discoveries and geology.

Data on environmental expenditure

9. The DoE recently funded a survey of environmental expenditure by industry (DoE, 1996b). The survey covered 10,000 firms in the Extraction, Manufacturing, Energy production and Water industries. All expenditure refers to spending in financial year 1994/95. Respondents provided data on "end of pipe" capital expenditure (new technology specifically added to existing plant to reduce emissions). The survey also asked some respondents about revenue arising from environmental activities, running costs of environmental activities (mainly staff costs), expenditure on 'Green' products and the capital costs of plant that integrates environmental and operational concerns into the core design.

10. This was the first time there been a detailed official questionnaire on environmental expenditure by industry in the UK. Although the overall results are thought to be reasonably reliable, estimates of spending for individual industries are subject to greater error and should be regarded as approximate only. Questions about environmental spending had previously been included in the ONS's Annual Census of Production enquiries for the years 1990-92, but these are thought to have significantly under-recorded spending by industry.

Annex 2

Raw data on the atmospheric emissions and technical details about aggregation into themes and data quality

11. Tables A1 and A2 give the raw data that were used to compute the summary Tables 1.1 - 1.6.

Global warming

12. The table below shows the weights of each greenhouse gas

	CO_2	CH_4	N_2O	halogenated compounds
weight - relative to CO_2	1	21	310	90 - 23900
total emissions Mt	577	4.1	0.1	0.021*
weighted emissions $MtCO_2$	577	86	25	83*

*data on the halogenated compounds refers to supply to industry in 1994 rather than emissions.

13. The weights used are the 100 year time horizon Global Warming Potentials (GWP), referenced to the absolute GWP for CO_2. The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapour. The indirect effects of CO_2 are not included (IPCC, 1995).

14. In 1993 non-CO_2 greenhouse gases contributed the equivalent of 16% of greenhouse gas emissions. The greenhouse gas effects from halogenated compounds were not used to compute total greenhouse effect since they relate to 1994 supply rather than 1993 emission. From the above table it can be seen the eventual contribution of their 1994 purchases to the greenhouse effect will be of the same order as those from methane despite the small physical quantity supplied. A proportion of CFCs are recovered and destroyed rather than emitted. There are a variety of different CFCs and HCFCs and they vary significantly in their GWPs. The weighting used in this study has made the simplifying assumption that all users of CFCs use the average mix of CFCs. This same assumption has been made for HCFCs and the other halogenated compounds. This simplifying assumption also affects the ozone depletion weights.

15. The IPCC report uncertainties in the GWP of the greenhouse gases are typically ±35% relative to the CO_2 reference.

Acid rain precursors

16. The acid rain precursor theme was created by weighting SOx, NOX and ammonia together. This is a simple approach and takes no account of the location of the emissions or their transport through the atmosphere. The weights used were calculated using the assumption about the number of H+ ions deposited per tonne of gas emitted. The weights are based on the molecular weights of SO_2, NO_2 and ammonia, and the assumption that the gases would dissociate causing acidity in the ratio 2:1:1. SO_2 was given the weight of 1.

	SO_x, (SO_2)	NO_x, (NO_2)	ammonia
weight	1	0.6957	1.8824
total emissions Mt	3.3	2.6	0.32
weighted emissions $MtSO_2$	3.3	1.8	0.8

17. The weights being used inevitably represent a simplification of the chemistry. NO_x and ammonia have a fertilising effect on agricultural soils, natural vegetation and forests at low rates of deposition. This effect varies from receptor to receptor. As a result there maybe an upward bias on NO_x and ammonia weights in terms of damage to ecosystems.

Ozone depletion

18. The ozone depletion theme refers to the amount of CFCs and HCFCs supplied to users in 1994. It has therefore been calculated on a slightly different basis to other data in the UKENA. More information is available on halocarbons under the global warming theme.

	CFCs	HCFCs
weight	0.52 - 1.0	0.02 - 0.1
total supply tonnes	9477	10353
weighted supply tonnes CFC 11	7980	668

Precision of the emissions data

19. The national atmospheric emissions inventory and the ammonia inventory both have a degree of statistical uncertainty. The ONS's industrial disaggregation will have increased the uncertainty. The figures reported below combine these two effects.

CO_2 ±5% systematic error, though the scatter from year to year will be much less than this.

Methane   total UK emissions ± 20-40% Emissions from land fill are particularly uncertain. with a margin of uncertainty of ± 70%

N_2O uncertain

SO_x ±20-25%, uncertainty linked to sulphur retention in the fly ash. ONS industrial disaggregation will have increased uncertainty because industries might selectively differ in the sulphur contents of their diesel and coal purchases.

NO_x ± 40%, emissions factors vary between apparently similar combustion plants

Ammonia   to the nearest 10 kt/yr

Blacksmoke ± 30 - 35%

CO   ± 50%, emissions factors have been derived from relatively few vehicles, industries and may differ in the age profile of their car fleet

NMVOC   ± 50%, emissions factors based on measurement techniques with large errors. Data for individual processes and solvent use are incomplete

Benzene   ± 50%

Lead   ± 25%, margins of error arise from uncertainty in lead content of fuel, retention of lead within the engine and industries differ in the age profile of vehicle fleet which affects the proportion of vehicles using unleaded petrol.

The ozone depleting substance methyl bromide is not covered by the UKENA because separate supply data for the UK were not available.

Table 1.1
Economic data and atmospheric emissions in 1993, expressed as percentage of UK totals

Industry Group	Gross Output	Value Added	Employees	Green house gas (1)	Acid Rain (2)	Air quality emissions				
						Blacksmoke	CO	NMVOC	Benzene	Lead
Agriculture (3)	2	2	2	4	10	0	0	4	0	0
Extraction	2	2	0	5	3	0	0	4	0	0
Manufacturing	28	21	18	20	16	8	2	29	22	28
Energy production and water	3	3	0	26	44	5	0	1	0	2
Construction	6	5	4	0	0	0	0	1	0	0
Distribution	13	14	22	2	0	5	0	6	4	0
Transport and Communication (4)	7	8	6	7	10	27	3	2	0	5
Financial and Business services	20	26	16	0	0	0	0	0	0	0
Public administration	6	7	8	1	1	0	0	0	0	0
Education and health	10	12	19	2	0	0	0	0	0	0
Other services	4	4	4	6	0	10	0	1	0	4
Private households				22	11	34	77	30	60	46
Unattributed (5)				3	4	8	15	21	14	14
Adjustment for financial services (6)		-4.5								
Totals	100	100	100	100	100	100	100	100	100	100
	£bil	£bil	000s	MtCO2	MtSOx	Mtonnes	Mtonnes	Mtonnes	Ktonnes	ktonnes
Total (absolute figure)	1147	547	21380	689	5.69	0.45	5.33	2.29	40.6	2.76
Total excl. international transport (7)				667	5.42	0.44	5.30	2.29	40.6	2.76

Source: ONS, NETCEN

Emissions are expressed as a proportion of total UK emissions including international transport. Slight differences from emissions reported elsewhere are due to rounding errors.

(1) Greenhouse gas theme calculated by summing emissions of CO2, Ch4 and N2O using the Global Warming Potentials from IPCC (see Annex 2).
(2) Acid rain precursors aggregated by summing SOx, NOx and ammonia according to potential hydrogen ions production
(3) Agriculture includes emissions of VOCs from forestry, these are excluded from the IPCC inventory but included in the NAEI
(4) This row only includes emissions from transport and communication industries, see table 1.5 for transport emissions from all industries
(5) Most unattributed emissions are from non-private household use of cars and use of light goods vehicles
(6) The adjustment for financial services arises from our inability to attribute income from lending money to different industry groups.
(7) Excludes emissions from marine and aviation bunker fuels, as required under IPCC guidelines for the UK's submission to the Framework Convention on Climate Change.

Table 1.2
Economic data and atmospheric emissions in 1993, expressed as percentage of UK totals

With output and emissions of electricity industry reallocated to purchasing industry.

Industry Group	Gross Output	Value Added	Employees	Green house gas (1)	Acid Rain (2)	Air quality emissions Blacksmoke	CO	NMVOC	Benzene	Lead
Agriculture (3)	2	2	2	4	10	0	0	4	0	0
Extraction	2	2	0	5	3	0	0	4	0	0
Manufacturing	29	21	18	28	30	9	2	29	22	28
Energy production and water	1	1	0	2	0	0	0	0	0	0
Construction	6	5	4	0	0	0	0	1	0	0
Distribution	13	15	22	3	3	5	0	6	4	0
Transport and Communication (4)	7	8	6	8	11	27	3	2	0	5
Financial and Business services	20	26	16	1	2	0	0	0	0	0
Public administration	6	7	8	2	2	1	0	0	0	0
Education and health	10	12	19	2	3	0	0	0	0	0
Other services	4	4	4	7	1	10	0	1	0	4
Private households (5)	0	0	0	30	25	35	77	30	60	47
Unattributed (6)	0	0	0	5	7	8	15	21	14	14
Adjustment for financial services (7)		-4.5								
Totals	100	100	100	100	100	100	100	100	100	100
	£bil	£bil	000s	MtCO2	MtSOx	Mtonnes	Mtonnes	Mtonnes	Ktonnes	ktonnes
Total (absolute figure)	1147	547	21380	689	5.69	0.45	5.33	2.29	40.6	2.76
Total excl. international transport (8)				667	5.42	0.44	5.30	2.29	40.6	2.76

Source: ONS, NETCEN

Emissions are expressed as a proportion of total UK emissions including international transport. Slight differences from emissions reported elsewhere are due to rounding errors.

(1) Greenhouse gas theme calculated by summing emissions of CO2, Ch4 and N2O using the Global Warming Potentials from IPCC (see Annex 2).
(2) Acid rain precursors aggregated by summing SOx and NOx according to potential hydrogen ions production
(3) Agriculture includes emissions of VOCs from forestry, these are excluded from the IPCC inventory but included in the NAEI
(4) This row only includes emissions from transport and communication industries, see table 1.5 for transport emissions from all industries
(5) Economic information as well as emissions from the electricity industry have been reattributed, thus output, value added and employees have been allocated to Private households.
(6) Most unattributed emissions are from non-private household use of cars and use of light goods vehicles
(7) The adjustment for financial services arises from our inability to attribute income from lending money to different industry groups.
(8) Excludes emissions from marine and aviation bunker fuels, as required under IPCC guidelines for the UK's submission to the Framework Convention on Climate Change.

Table 1.3
Economic data and atmospheric emissions in 1993, expressed as percentage of UK totals

Extraction, and manufacturing industrial groups

Industry Group	Gross Output	Value Added	Employees	Green house gas (1)	Acid Rain (2)	Air quality emissions				
						Blacksmoke	CO	NMVOC	Benzene	Lead
Mining of coal	0.2	0.3	0.2	1.7	0.3	0.1	0.0	0.0	0.0	0.0
Extraction of mineral oil and natural gas	1.2	1.8	0.1	2.9	2.3	0.2	0.9	4.1	0.0	0.0
Other mining and quarrying	0.3	0.2	0.1	0.4	0.1	0.3	0.0	0.0	0.0	0.1
Food, beverages and tobacco	5.3	3.2	2.1	1.6	1.6	1.8	0.2	3.8	0.0	0.3
Textiles and leather products	1.4	1.2	1.8	0.5	0.5	0.3	0.0	0.8	0.0	0.0
Wood and wood products	0.3	0.3	0.4	0.1	0.0	0.1	0.0	1.0	0.0	0.0
Pulp, paper, printing and publishing	2.7	2.5	2.1	1.0	1.0	0.6	0.1	1.9	0.0	0.0
Solid and nuclear fuels, oil refining	1.8	0.5	0.2	3.4	4.4	0.8	0.2	4.5	6.5	0.2
Chemicals and man-made fibres	3.0	2.3	1.2	5.0	2.8	0.9	0.2	14.8	11.2	0.0
Rubber and plastic products	1.2	1.1	0.9	0.7	0.7	0.5	0.1	1.9	0.0	0.0
Other non-metallic mineral products	0.7	0.7	0.7	2.2	1.3	0.8	0.1	0.1	0.0	3.3
Basic metals and metal products	2.7	2.2	2.5	4.3	2.8	0.9	0.6	0.6	4.2	23.8
Machinery and equipment	1.9	1.6	1.6	0.3	0.2	0.2	0.0	0.0	0.0	0.0
Electrical and optical equipment	3.3	2.6	2.1	0.3	0.2	0.1	0.0	0.0	0.0	0.0
Transport equipment	3.0	2.2	1.5	0.6	0.4	0.3	0.1	0.0	0.0	0.0
Other manufacturing	0.8	0.6	0.8	0.2	0.1	0.3	0.0	0.0	0.0	0.0
Total extraction and manufacturing	30.0	23.1	18.3	25.2	18.7	8.1	2.5	33.5	22.0	27.9
Total extraction and manufacturing	£bil	£bil	000s	MtCO2	MtSOx	Ktonnes	Ktonnes	Ktonnes	Ktonnes	Ktonnes
(Absolute figure)	344	126	3904	173	1.06	37	133	767	8.9	0.77

Source: ONS,NETCEN

Emissions are expressed as a proportion of total UK emissions including international transport. Slight differences from emissions reported elsewhere are due to rounding errors.

(1) Greenhouse gas theme calculated by summing emissions of CO2, Ch4 and N2O using the Global Warming Potentials from IPCC (see Annex 2).
(2) Acid rain precursors aggregated by summing SOx, NOx and ammonia according to potential hydrogen ions production

Table 1.4
Economic data and atmospheric emissions in 1993, expressed as percentage of UK totals

Electricity generators, by fuel

Fuel used	Electricity generated of total UK supply (1)	Gross Output	Value Added	Employees	Green house gas (2)	Acid Rain (3)	Air quality emissions				
							Blacksmoke	CO	NMVOC	Benzene	Lead
Gas	14				2.3	0.2	0.0	0.0	0.1	0.0	0.0
Coal	51				20.2	39.2	3.5	0.3	0.1	0.0	1.5
Nuclear	28				0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil	6				2.0	4.4	1.0	0.1	0.0	0.0	0.2
Other (4)	2				0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total	100 GWHr	1.5 £bil	1.5 £bil	0.4 000s	24.5 MtCO2	43.9 MtSOx	4.6 Ktonnes	0.4 Ktonnes	0.2 Ktonnes	0.0 Ktonnes	1.6 tonnes
Total (absolute figure)	323383	17.5	8.4	92.3	169	2.50	20.8	22.7	5.5	0.0	45.6

Source: ONS, NETCEN

Emissions are expressed as a proportion of total UK emissions including international transport. Slight differences from emissions reported elsewhere are due to rounding errors.

(1) ONS estimate of electricity generation by fuel. Refer to text.
(2) Greenhouse gas theme calculated by summing emissions of CO2, Ch4 and N2O using the Global Warming Potentials from IPCC (see Annex 2).
(3) Acid rain precursors aggregated by summing SOx, NOx and ammonia according to potential hydrogen ions production
(4) Includes coke oven gas, blast furnace gas, waste products, natural flow hydro, gas from landfill and wind

Table 1.5
Economic data and atmospheric emissions in 1993, expressed as percentage of UK totals

Transport emissions, by mode of transport

Mode of transport - further divided by industry	Gross Output	Value added	Employees	Green house gas (1)	Acid Rain (2)	Air quality emissions				
						Blacksmoke	CO	NMVOC	Benzene	Lead
Total Road Transport				16.5	15.2	49.9	88.4	34.7	70.7	64.1
- Cars				10.8	9.0	7.5	80.8	29.4	66.9	52.3
of which: private				9.2	7.7	5.9	69.5	25.3	56.2	45.4
business				1.6	1.3	1.6	11.3	4.1	10.7	6.9
- Motor cycles				0.1	0.0	0.0	1.3	0.9	0.4	0.0
- HGVs				3.5	4.5	30.3	1.9	2.0	0.5	5.7
of which: public haulage	1.2	1.1	0.9	2.2	2.8	18.7	1.1	1.1	0.3	3.3
own account				1.3	1.7	11.6	0.8	0.9	0.2	2.4
- distribution				0.6	0.7	4.8	0.3	0.4	0.1	0.9
- food processing and tobacco				0.2	0.2	1.5	0.1	0.1	0.0	0.3
- construction				0.1	0.1	0.7	0.1	0.1	0.0	0.1
- other own account				0.5	0.7	4.6	0.3	0.4	0.1	1.1
- LGVs				1.4	0.8	6.2	3.2	1.7	2.8	4.8
- Buses and coaches	0.3	0.5	0.2	0.7	0.9	6.0	1.2	0.7	0.1	1.1
- Taxis	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Railways	0.3	0.5	0.6	0.3	0.3	0.1	0.2	0.3	0.0	0.4
Tubes and trams	0.1	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air transport (not defence) (3)	0.7	0.6	0.3	2.8	1.0	1.3	0.7	0.2	0.0	0.0
Water transport (not defence)				1.6	5.8	1.1	0.1	0.0	0.0	0.0
of which: fishing				0.1	0.2	0.0	0.0	0.0	0.0	0.0
oil exploration				0.3	1.0	0.2	0.0	0.0	0.0	0.0
other water transport	0.4	0.2	0.1	1.2	4.6	0.9	0.1	0.0	0.0	0.0
All defence				0.6	0.6	0.7	0.3	0.1	0.0	0.0
Total transport				21.7	22.9	53.1	90.2	35.4	70.7	64.5
Total excl. international transport (4)				18.6	18.3	51.3	89.6	35.2	70.7	64.5
				MtCO2	MtSOx	Mtonnes	Mtonnes	Mtonnes	ktonnes	ktonnes
Total transport emissions (Absolute figure)				149	1.3	0.2	4.8	0.8	28.7	1.8
Total excl. international transport (4)				128	1.0	0.2	4.8	0.8	28.7	1.8

Source: ONS, NETCEN

Emissions are expressed as a proportion of total UK emissions including international transport. Slight differences from emissions reported elsewhere are due to rounding errors.

(1) Greenhouse gas theme calculated by summing emissions of CO2, Ch4 and N2O using the Global Warming Potentials from IPCC (see Annex 2).
2) Acid rain precursors aggregated by summing SOx, NOx and ammonia according to potential hydrogen ions production
(3) These exclude emissions from private, civil aircraft, these are included in total transport
(4) This total excludes missions from international marine and aviation bunker fuels loaded in the UK, as required under IPCC guidelines for submission to the Framework Convention on Climate Change.
Economic data is only included for industries where the vast majority of business is transport related (eg air transport or railways but not distribution).

Table 1.6
Supply, global warming and ozone depletion effects of halogenated compounds in 1994

	Total tonnes	Global warming 000 tC	Ozone depletion t CFC 11
Refridgeration	9189	7235	2470
Solvents	3155	4781	2294
Aerosols	3136	4725	2259
Foams	5596	4400	1541
Electrical	187	1058	0
Other uses	110	174	85
Total supply	21407	22374	8648

Table A1
Economic data and atmospheric emissions in 1993, 000s tonnes, unless otherwise specified

	Economic variables				Emissions												
	Gross Output	Final Expendi -ture	Value added	Number empl -oyees	Green -house	Acid Rain	Air quality emissions					Greenhouse gases			Acid rain precursors		
Industry Group							Black smoke	CO	NMVOC	Benzene	Lead	CO2 (3)	Methane	N2O	SO2	NOx	Ammonia
	£bil	£bil	£bil	000s	mil. tonnes (1)	(2)					tonnes	mil. tonnes					
Agriculture, forestry and fishing (4)	20		11	328	29.8	553	2.8	6	81	0.0	3	3.5	1107	10	13	19	280
Coal extraction	2		2	33	11.8	16	0.3	1	0	0.0	0	0.8	521	0	15	2	0
Oil and gas extraction	14		10	27	20.0	129	1.0	46	93	0.0	0	17.6	116	0	18	161	0
Other extraction	3		1	26	2.5	7	1.4	1	0	0.0	2	2.5	0	0	3	6	0
Food processing and tobacco	61		18	443	10.7	88	8.3	10	87	0.0	8	10.7	0	0	65	33	0
Textiles and leather	16		7	383	3.6	29	1.2	3	19	0.0	0	3.6	0	0	23	8	0
Timber, wood products	4		1	86	0.4	2	0.4	0	22	0.0	0	0.4	0	0	0	1	0
Pulp, paper, printing and publishing	31		14	449	6.9	58	2.6	7	43	0.0	1	6.8	0	0	48	15	0
Coke ovens, oil refining, nuclear fuel	21		3	40	23.7	248	3.7	8	103	2.6	5	23.6	1	0	213	51	0
Chemicals	34		13	252	34.5	159	4.2	8	339	4.6	1	14.9	0	63	131	40	0
Rubber and plastic products	14		6	188	4.8	39	2.2	5	44	0.0	1	4.8	0	0	31	10	0
Building materials	9		4	143	15.4	73	3.7	7	2	0.0	91	15.3	0	0	60	19	0
Metal products	31		12	544	29.6	162	3.9	30	14	1.7	658	29.6	3	0	123	56	0
Machinery and equipment	22		9	343	2.2	12	0.8	0	0	0.0	0	2.2	0	0	9	5	0
Electrical and optical equipment	38		14	458	1.9	13	0.6	0	0	0.0	0	1.9	0	0	10	4	0
Transport equipment	35		12	325	4.0	21	1.2	4	0	0.0	0	4.0	0	0	15	9	0
Other manufacturing	9		3	164	1.3	8	1.2	0	0	0.0	1	1.3	0	0	5	4	0
Electricity	18		8	92	168.6	2496	20.8	23	6	0.0	46	167.6	10	2	2093	579	0
Gas and water	13		6	105	9.0	3	0.5	0	18	0.0	0	1.3	370	0	1	3	0
Construction	74		29	842	3.3	13	3.7	3	26	0.0	4	3.3	0	0	5	11	0
Distribution	144		79	4698	12.5	55	22.0	24	140	1.6	25	12.5	0	0	14	60	0
Railways	4		3	135	2.1	17	0.6	12	8	0.0	12	2.1	0	0	2	21	0
Coaches and buses	3		3	41	4.8	54	27.0	64	16	0.0	30	4.7	0	0	6	69	0
Tube, trams	0		0	106	0.0	0	0.0	0	0	0.0	0	0.0	0	0	0	0	0
Taxis	2		2	17	0.0	0	0.0	0	0	0.0	5	0.0	0	0	0	0	0
Freight transport by road	14		6	186	15.0	157	84.3	57	25	0.1	92	14.9	1	0	18	200	0
Transport via pipelines	0		0	1	0.0	0	0.0	0	0	0.0	0	0.0	0	0	0	0	0
Water transport	4		0	20	8.3	263	4.1	5	0	0.0	0	8.3	0	0	103	230	0
Air transport	8		3	60	19.3	58	6.0	37	5	0.0	0	19.3	0	0	5	76	0
Transport services	19		10	313	0.1	0	0.2	0	0	0.0	0	0.1	0	0	0	0	0
Post and telecommunications	25		17	419	0.4	2	1.2	1	0	0.0	1	0.4	0	0	0	3	0
Finance and business services	227		140	3434	2.6	8	1.9	2	0	0.0	2	2.6	0	0	4	6	0
Public administration	73		38	1672	9.1	58	4.2	19	3	0.0	10	9.0	0	0	26	47	0
Education, health and social work	112		67	4056	10.6	57	1.7	3	0	0.0	0	10.6	0	0	48	13	0
Other services	42		21	950	42.5	23	44.9	52	33	0.2	108	2.7	1891	0	13	14	0

Table A1(continued)
Economic data and atmospheric emissions in 1993, 000s tonnes, unless otherwise specified

	Economic variables				Emissions		Air quality emissions					Greenhouse gases			Acid rain precursors		
Industry Group	Gross Output £bil	Final Expenditure £bil	Value added £bil	Number employees 000s	Green-house mil. tonnes (1)	Acid Rain (2)	Black smoke	CO	NMVOC	Benzene	Lead tonnes	CO2 (3) mil. tonnes	Methane	N2O	SO2	NOx	Ammonia
Households		405			153.6	599	153.2	4094	688	24.2	1270	151.1	70	4	127	679	0
General government final consumption		138															
Gross domestic fixed capital formation		95															
Stocks		0															
Exports		159															
Adjustment for financial services			-24														
Unattributed					23.6	204	36.3	793	470	5.5	381	23.1	6	1	17	161	40
Total	1147	798	547	21380	689	5686	452	5328	2290	41	2761	577	4105	82	3264	2616	320
Total excl. international transport (5)	1147	798	547	21380	667	5421	444	5299	2286	41	2761	555	4104	81	3172	2367	320

Source: *ONS, NETCEN*

(1) Greenhouse gas theme calculated by summing emissions of CO2, Ch4 and N2O using the Global Warming Potentials from IPCC (see Annex 2).
(2) Acid rain precursors aggregated by summing SOx, NOx and ammonia according to potential hydrogen ions production
(3) Emissions of CO2 expressed in 000 tonnes of carbon dioxide, to convert to tonnes carbon multiply by 12/44
(4) Agriculture includes emissions of VOCs from forestry, these are excluded from the Intergovernmental Panel on Climate Change (IPCC) inventory but included in the NAEI, this adds 81m tonnes to emissions
(5) This total excludes emissions from international marine and aviation bunker fuels loaded in the UK, as required under IPCC guidelines for submission to the Framework Convention on Climate Change.

Table A2
Economic data and atmospheric emissions in 1993, 000s tonnes, unless specified
With output of electricity industry reallocated to purchaser.

	Economic variables				Emissions												
							Air quality emissions					Greenhouse gases			Acid rain precursors		
Industry Group	Gross Output	Final Expendi-ture	Value added	Number empl-oyees	Green-house	Acid Rain	Black smoke	CO	NMVOC	Benzene	Lead	CO2 (3)	Methane	N2O	SO2	NOx	Ammonia
	£bil	£bil	£bil	000s	mil. tonnes (1)	(2)					tonnes	mil. tonnes					
Agriculture, forestry and fishing (4)	20	11	328		30.8	567.6	2.9	6	80.9	0.0	3.0	4.5	1107.3	9.7	25.1	22.1	280.0
Coal extraction	2	2	34		13.2	36.8	0.4	1	0.2	0.0	0.7	2.2	521.5	0.0	32.1	6.7	0.0
Oil and gas extraction	14	10	27		20.0	129.4	1.0	46	93.2	0.0	0.0	17.6	115.8	0.0	17.6	160.6	0.0
Other extraction	3	1	26		3.1	16.6	1.5	1	0.6	0.0	1.9	3.1	0.1	0.0	11.0	8.0	0.0
Food processing and tobacco	62	18	448		19.9	224.7	9.4	11	86.9	0.0	10.1	19.8	1.3	0.2	179.6	64.9	0.0
Textiles and leather	17	7	385		6.7	73.8	1.6	3	19.0	0.0	1.5	6.6	0.4	0.1	61.1	18.2	0.0
Timber, wood products	4	1	87		1.0	10.0	0.5	0	21.8	0.0	0.6	1.0	0.1	0.0	7.7	3.4	0.0
Pulp, paper, printing and publishing	31	14	451		11.0	119.2	3.1	7	42.7	0.0	2.3	10.9	0.8	0.1	99.1	28.9	0.0
Coke ovens, oil refining, nuclear fuel	22	3	43		28.4	317.6	4.3	9	102.8	2.6	6.4	28.3	1.7	0.1	271.0	67.0	0.0
Chemicals	35	13	257		42.3	275.0	5.2	9	339.0	4.6	3.4	22.7	1.4	63.2	228.5	66.9	0.0
Rubber and plastic products	14	6	190		7.7	80.7	2.5	6	44.6	0.0	1.9	7.6	0.6	0.1	66.7	20.3	0.0
Building materials	9	4	144		18.2	114.8	4.1	8	1.7	0.0	92.1	18.1	0.8	0.1	94.9	28.5	0.0
Metal products	32	12	548		36.6	264.5	4.7	31	14.5	1.7	660.0	36.5	3.1	0.2	208.9	80.0	0.0
Machinery and equipment	22	9	345		5.5	60.7	1.2	1	0.5	0.0	1.5	5.5	0.3	0.1	49.4	16.2	0.0
Electrical and optical equipment	39	14	461		6.5	81.6	1.2	1	0.4	0.0	1.7	6.5	0.4	0.1	67.6	20.1	0.0
Transport equipment	35	12	327		7.2	68.2	1.6	5	0.8	0.0	1.5	7.1	0.5	0.1	54.7	19.4	0.0
Other manufacturing	9	4	165		2.4	23.4	1.3	1	0.5	0.0	1.4	2.4	0.1	0.0	18.1	7.6	0.0
Electricity																	
Gas and water	13	6	107		12.6	56.4	0.9	0	18.5	0.0	1.5	4.9	370.1	0.1	45.9	15.1	0.0
Construction	74	29	843		5.6	47.0	4.0	3	26.6	0.0	4.6	5.6	0.2	0.1	33.8	19.0	0.0
Distribution	145	79	4703		22.1	196.5	23.2	26	140.1	1.6	27.4	21.9	1.4	0.3	132.3	92.4	0.0
Railways	4	3	136		3.8	42.7	0.8	12	8.0	0.0	12.6	3.7	0.2	0.1	23.7	27.3	0.0
Coaches and buses	3	3	41		4.8	53.6	27.0	64	15.8	0.0	30.1	4.7	0.3	0.1	5.7	68.8	0.0
Tube, trams	0	0	106		1.3	19.2	0.2	0	0.0	0.0	0.4	1.3	0.1	0.0	16.1	4.5	0.0
Taxis	2	2	17		0.0	0.0	0.0	0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0
Freight transport by road	14	6	186		15.0	157.1	84.3	57	25.5	0.1	91.5	14.9	1.0	0.5	17.9	200.2	0.0
Transport via pipelines	0	0	1		0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water transport	4	0	20		8.5	265.7	4.1	5	0.0	0.0	0.0	8.4	0.0	0.2	105.5	230.3	0.0
Air transport	8	3	61		19.9	67.7	6.1	37	4.9	0.0	0.2	19.9	0.7	0.0	13.0	78.7	0.0
Transport services	19	10	313		0.9	11.1	0.3	0	0.1	0.0	0.5	0.8	0.1	0.0	8.9	3.1	0.0
Post and telecommunications	25	17	420		2.4	31.7	1.5	1	0.6	0.0	1.9	2.3	0.1	0.0	24.9	9.9	0.0

Table A2 (Continued)
Economic data and atmospheric emissions in 1993, 000s tonnes, unless specified
With output of electricity industry reallocated to purchaser.

Industry Group	Economic variables				Emissions		Air quality emissions					Greenhouse gases			Acid rain precursors		
	Gross Output	Final Expenditure	Value added	Number empl-oyees	Green-house	Acid Rain	Black smoke	CO	NMVOC	Benzene	Lead	CO2 (3)	Methane	N2O	SO2	NOx	Ammonia
	£bil	£bil	£bil	000s	mil. tonnes (1)	(2)					tonnes	mil. tonnes					
Finance and business services	228		141	3438	10.0	117.2	2.8	3	1.1	0.0	4.0	10.0	0.6	0.1	95.2	31.6	0.0
Public administration	73		38	1674	13.0	116.7	4.7	20	3.1	0.0	10.6	13.0	0.6	0.1	74.6	60.6	0.0
Education, health and social work	113		67	4059	16.9	149.9	2.4	4	1.0	0.0	1.7	16.8	1.0	0.2	125.9	34.4	0.0
Other services	42		21	952	44.9	58.0	45.2	52	33.4	0.2	108.6	5.1	1891.5	0.1	42.4	22.5	0.0
Households (5)	6	405	3	31	210.0	1433.7	160.1	4101	690.1	24.2	1285.6	207.1	73.4	4.3	826.9	872.7	0.0
General government final consumption		138															
Gross domestic fixed capital formation		95															
Stocks		0															
Exports		159															
Adjustment for financial services			-24														
Unattributed	1		0	7	36.5	396.7	38.0	794	470.8	5.5	385.0	36.0	7.2	1.3	178.3	205.8	40.0
Unattributed																	
Total	1147	798	547	21380	688.5	5686	451.9	5328	2290	40.6	2761	577.0	4105	82	3264	2616	320
Total excl. international transport (6)	1147	798	547	21380	666.6	5421	443.8	5299	2286	40.6	2761	555.2	4104	81	3172	2367	320

Source: ONS, NETCEN

(1) Greenhouse gas theme calculated by summing emissions of CO2, Ch4 and N2O using the Global Warming Potentials from IPCC (see Annex 2).
(2) Acid rain precursors aggregated by summing SOx and NOx according to potential hydrogen ions production
(3) Emissions of CO2 expressed in 000 tonnes of carbon dioxide, to convert to mass of Carbon multiply by 12/44
(4) Agriculture includes emissions of VOCs from forestry, these are excluded from the Intergovernmental Panel on Climate Change (IPCC) inventory but included in the NAEI, this adds 81m tonnes to emissions
(5) Economic information as well as emissions from the electricity industry have been reattributed to Private households
(6) This total excludes emissions from international marine and aviation bunker fuels loaded in the UK, as required under IPCC guidelines for submission to the Framework Convention on Climate Change.

Table 2
Stock and depletion of oil and gas 1993

The stock of oil and gas is computed from the proven, probable, possible and undiscovered reserves.
Volumes of oil in million tonnes, gas in million cubic metres

Volumes

	Oil	Gas
Opening stocks 1st Jan	4025	2639
Depletion	-100	-66
Other volume changes	134	143
closing stocks	4059	2716

Source: DTI Brown Book

Net present value of oil reserves £bn
Assumes constant levels of real rents over time

	Oil	Gas
Opening stocks - 1993 rents	18.1	14.6
Depletion	-1.2	-1.0
Other volume changes	1.6	2.1
Closing stocks - 1993 rents	17.7	13.5
Revaluation - real price change	2.2	1.4
Revaluation - other+	8.7	5.1
Closing stock - 1994 rents	24.1	17.2

Source: ONS

Duration of rents

Life expectancy start	40	40
Life expectancy at end year*	32	38

* based on 1994 levels of resource exploitation

Average rent over year, 1993 prices

1993 unit rent £/T or £/m3	12	15
1994 unit rent £/T or £/m3	14	16

+ revalation arising from discounting and changed
expectation of reserve life

Table 3 Environmental protection expenditure in extraction, manufacturing, energy production and water industries in 1994. UK.

	Environmental Expenditure	Value Added	Gross Output
	£m	£m	£m
Mining of coal	2	972	1953
Extraction of mineral oil, natural gas and nuclear fuel	39	11305	16044
Other mining and quarrying	5	1166	3109
Food beverages and tobacco	327	18 09	463130
Textiles and leather products	114	6970	17195
Wood and wood products	10	1526	4767
Pulp, paper and products, printing and publishing	367	14817	33268
Solid and nuclear fuels, oil refining	2	2416	21273
Chemicals and man-made fibres	503	13477	37022
Rubber and plastic products	87	6234	14840
Other non-metallic mineral products	187	4426	9902
Basic metals and metal products	197	13181	35372
Machinery and equipment	178	10663	23935
Electrical and optical equipment	51	15316	41888
Transport equipment	62	12994	40167
Other manufacturing	13	4227	11157
Energy production and water	196	14983	41415
Total	2340	152765	416437

Source: Department of the Environment, ECOTEC for environmental expenditure; ONS for value added, and gross output.

Input-output 'Use' table -1993 current prices, £million.

Product Sales	SIC(92)	Agriculture	Coal	Oil & gas	Minerals	Food	Textiles	Wood	Paper	Fuel manuf	Chemicals	Plastic
Agriculture, forestry and fishing	01-05	2944			14	12284	248	249	28	0	16	165
Coal extraction	10	0	34	0	0	16	8	0	24	49	41	5
Oil and gas extraction	11-12			2175						6723		
Other extraction	13-14	29	0	0	275	34	10	8	43	3	442	18
Food processing and tobacco	15-16	2806	4	35	24	10140	191	9	93	29	583	29
Textiles and leather	17-19	123	0	0	22	91	4546	46	192	2	233	268
Timber, wood products	20	32	21	9	10	27	38	1053	131	2	25	112
Pulp, paper, printing and publishing	21	190	25	4	52	690	383	44	6571	52	639	239
Coke ovens, oil refining, nuclear fuel	23	400	34	0	99	375	36	28	99	795	1921	70
Chemicals	24	1287	16	15	86	613	1135	132	1053	393	7874	2894
Rubber and plastic products	25	130	21	4	18	1934	425	70	315	28	1064	853
Building materials	26	72	0	1	134	681	19	36	22	17	295	116
Metal products	27-28	125	154	267	68	1906	168	195	370	233	1240	610
Machinery and equipment	29	147	335	498	42	341	121	28	323	70	344	152
Electrical and optical equipment	30-33	79	165	15	69	161	55	29	368	47	280	119
Transport equipment	34-35	90	17	81	9	38	25	10	15	3	27	47
Other manufacturing	36-37	48	4	14	3	100	131	114	85	8	84	105
Electricity	40.1	132	116		54	542	192	46	328	385	674	226
Gas and water	40.2-41	56	3		11	244	67	7	93	67	275	41
Construction	45	203	0	0	27	140	33	18	172	0	174	41
Distribution	50-55	671	7	135	34	307	59	21	118	50	137	50
Railways	60.1	9	8	3	46	48	14	0	90	19	44	8
Coaches and buses	60.21/1, 60.23											
Tube, trams	60.21/2											
Taxis	60.22											
Freight	60.24	133	128		105	940	195	65	747	26	597	262
Transport via pipelines	60.3			19								
Water transport	61	4	5	243	29	30	9	0	55	12	27	5
Air transport	62	9	7	86	39	41	12	0	75	16	37	7
Transport services	63	47	7	599	19	255	54	7	172	31	249	49
Post and telecommunications	64	110	10	0	37	137	81	14	436	13	171	58
Finance and business services	65-74	1272	263	89	282	3638	1246	235	2753	459	3420	1033
Public administration	75											
Education, health and social work	80-85	222	7		19	258	52	8	166	32	229	50
Other services	90-95	87	13	0	17	211	49	7	1897	30	193	43
Total intermediate purchases		11458	1404	4296	1647	36222	9602	2479	16838	9595	21338	7676
Sales by final demand		12	4	11	3	3	9	4	155	15	8	6
Taxes on expenditure less subsidies		-2025	-771	-3	35	7209	100	21	217	9071	211	100
Value added (net output)		10718	1613	9628	1302	17502	6648	1447	13648	2521	12696	5823
Total inputs		20164	2250	13931	2987	60936	16358	3950	30858	21202	34253	13604

Notes: column headings are often abbreviated, refer to row headings for full description of industry

Input-output 'Use' table -1993 current prices, £million.

Product Sales	Ceramics	Metal products	Machinery	Electricals	Vehicles	Other manuf	Electricity	Gas & water	Construction	Distribution	Railways	Buses
Agriculture, forestry and fishing	0	6	3	2	0	84			4	985		
Coal extraction	47	338	4	10	12	3	2166	0	5	0	0	
Oil and gas extraction	3							4091				
Other extraction	713	903	57	32	37	11		0	1162	123	8	0
Food processing and tobacco	25	48	33	63	48	16	46	17	64	6587	50	9
Textiles and leather	48	79	50	113	397	438	16	3	339	1624	22	11
Timber, wood products	43	219	123	185	184	694	1	1	2072	99	5	0
Pulp, paper, printing and publishing	170	321	377	832	377	191	179	83	468	2503	32	50
Coke ovens, oil refining, nuclear fuel	226	319	81	101	180	57	1888	29	205	1557	101	272
Chemicals	288	632	349	1071	485	258	6	76	747	495	28	8
Rubber and plastic products	73	410	446	1125	1805	409	17	69	901	1309	36	91
Building materials	741	343	157	330	549	61	1	0	4879	357	52	4
Metal products	195	8546	3863	3106	4204	995	28	102	3259	330	50	15
Machinery and equipment	103	849	2722	705	1557	92	67	65	1115	401	7	3
Electrical and optical equipment	228	643	1267	10635	2764	133	810	151	760	520	31	66
Transport equipment	21	231	396	238	5485	59	48	21	224	1498	25	106
Other manufacturing	27	191	112	195	171	533	41	6	425	320	12	6
Electricity	236	539	276	301	261	78	15	280	203	932	167	2
Gas and water	114	216	122	87	82	19	556	222	95	383	33	9
Construction	51	111	46	69	133	17	5	26	19037	538	14	5
Distribution	49	137	73	122	147	31	89	41	81	3972	262	188
Railways	33	65	16	40	49	8	0	0	29	172	18	1
Coaches and buses												
Tube, trams												
Taxis												
Freight	519	605	193	266	364	164	10	4	520	6569	61	84
Transport via pipelines												
Water transport	21	40	10	26	32	5	0	0	19	109	11	2
Air transport	28	55	14	35	43	7	0	0	16	144	6	3
Transport services	28	91	92	176	132	42	56	33	71	5321	85	147
Post and telecommunications	45	132	151	247	113	64	128	58	276	2163	48	43
Finance and business services	569	2093	1915	3324	2770	827	792	375	7741	16060	442	354
Public administration												
Education, health and social work	28	92	93	178	141	43	57	31	109	332	21	8
Other services	25	99	86	157	140	37	56	28	73	424	26	10
Total intermediate purchases	4696	18352	13126	23770	22662	5378	7077	5816	44900	55827	1652	1499
Sales by final demand	4	807	25	14	10	23	0	6	88	79	35	2
Taxes on expenditure less subsidies	96	268	222	241	167	95	2069	775	131	9519	-1050	-734
Value added (net output)	**3719**	**11936**	**8500**	**14057**	**11975**	**3467**	**8397**	**6007**	**28851**	**78924**	**2973**	**2545**
Total inputs	**8516**	**31363**	**21873**	**38083**	**34814**	**8963**	**17545**	**12604**	**73970**	**144349**	**3610**	**3311**

Notes: column headings are often abbreviated, refer to row headings for full description of industry

Input-output 'Use' table -1993 current prices, £million.

Product Sales	Tubes	Taxis	Freight	Pipelines	Shipping	Air	Transport services	Communic.	Finance	Public	Education	Other serv
Agriculture, forestry and fishing					40		0	0	11	25	148	53
Coal extraction						0	0	0	0	20	50	2
Oil and gas extraction											30	
Other extraction	0	0	0	0	0	0	3	3	8	24	10	54
Food processing and tobacco	0	3	44	0	64	80	126	163	835	269	1691	617
Textiles and leather	0	3	53	0	2	37	24	65	628	280	710	591
Timber, wood products	0	0	3	0	2	0	10	10	91	29	97	68
Pulp, paper, printing and publishing	4	15	241	0	7	44	308	135	6277	792	1031	968
Coke ovens, oil refining, nuclear fuel	22	82	1322	0	300	756	146	222	998	431	427	258
Chemicals	0	3	40	0	3	13	41	27	311	406	4951	765
Rubber and plastic products	7	27	440	0	14	33	66	334	362	79	177	203
Building materials	0	1	19	0	2	14	12	32	16	157	437	254
Metal products	1	5	74	0	16	6	14	54	148	146	153	78
Machinery and equipment	0	1	16	0	5	2	5	41	79	1001	119	26
Electrical and optical equipment	5	20	322	0	16	49	65	1037	1000	4307	3250	350
Transport equipment	9	32	513	0	424	156	99	76	769	5168	159	163
Other manufacturing	0	2	28	0	5	2	15	35	393	414	580	323
Electricity	125				16	63	70	194	898	449	716	272
Gas and water	0	3	45	0	15	32	40	50	377	371	768	199
Construction	0	2	25	0	9	11	40	44	2782	3778	925	797
Distribution	15	57	914	0	84	204	218	236	2322	237	498	366
Railways	0	0	7	0	5	3	27	83	148	206	150	49
Coaches and buses					3	5	59	47	276	103	61	33
Tube, trams					0	0	7	6	33	12	7	4
Taxis					6	14	150	120	700	261	155	85
Freight	7	25	407	0	7	15	162	130	758	283	168	92
Transport via pipelines												
Water transport	0	0	8	0	386	19	35	21	57	59	47	17
Air transport	0	0	13	0	10	232	75	69	558	83	98	67
Transport services	12	45	715	0	1184	1067	4058	243	2417	141	349	371
Post and telecommunications	4	13	210	0	65	160	320	1507	9223	1191	892	764
Finance and business services	29	107	1719	0	673	1752	2354	1948	46744	5796	5483	7265
Public administration										408		
Education, health and social work	0	2	38	0	15	68	72	171	1711	6868	18989	381
Other services	0	3	47	0	29	56	124	190	1088	440	1353	4661
Total intermediate purchases	247	452	7265	2	3407	4894	8747	7293	82019	34234	44679	20193
Sales by final demand	0	1	8		12	40	3	16	1513		9	32
Taxes on expenditure less subsidies	-456	131	756	0	23	61	494	456	3187	213	833	400
Value added (net output)	905	1874	6131	16	931	3266	10171	17178	140248	38140	66523	20876
Total inputs	697	2458	14160	19	4374	8260	19414	24943	226966	72587	112043	41500

Notes: column headings are often abbreviated, refer to row headings for full description of industry

Abbreviations:CE - consumer expenditure,   GGFC - general government final consumption   GDFCF - Gross domestic fixed capital formation

Input-output 'Use' table 1993 current prices, £million.

Product Sales	Fin Adj	Total intermediate	CE	CE - travel -excl travel	GGFC	GDFCF	Stocks	Exports	Total Final	Total
Agriculture, forestry and fishing	0	17312	7649	0	0	0	107	1916	9672	26984
Coal extraction	0	2834	603	0	0	0	-63	135	675	3510
Oil and gas extraction	0	13022	0	0	0	0	-6	5680	5674	18696
Other extraction	0	4014	0	0	0	0	35	3180	3215	7229
Food processing and tobacco	0	24840	78222	0	0	0	119	9134	87475	112316
Textiles and leather	0	11059	29127	0	0	0	84	7294	36505	47564
Timber, wood products	0	5399	715	0	0	314	-181	188	1036	6435
Pulp, paper, printing and publishing	0	24294	10216	0	0	0	388	4324	14928	39222
Coke ovens, oil refining, nuclear fuel	0	13836	654	11457	0	0	25	4119	16255	30092
Chemicals	0	26500	10960	8	0	35	-129	19703	30577	57077
Rubber and plastic products	0	13296	1565	281	0	130	-108	3132	5000	18296
Building materials	0	9812	1364	28	0	347	223	1639	3601	13413
Metal products	0	30724	1744	0	0	6754	74	8083	16655	47379
Machinery and equipment	0	11382	863	234	0	9594	-13	12287	22965	34347
Electrical and optical equipment	0	29818	12812	291	0	14962	-128	25745	53682	83500
Transport equipment	0	16281	472	15692	0	12883	303	17627	46977	63258
Other manufacturing		4533	14024	0	0	1272	49	2498	17843	22376
Electricity	0	8787	7969	0	0	0	-44	287	8212	16999
Gas and water	0	4703	7629	0	0	0	-55	0	7574	12277
Construction	0	29276	4613	0	0	43506	-351	60	47828	77104
Distribution	0	11932	30226	8748	0	0	0	6382	45356	57288
Railways	0	1403	99	1817	0	22	0	428	2366	3769
Coaches and buses	0	587	58	2634	0	0	0	159	2851	3438
Tube, trams	0	70	13	608	0	0	0	37	658	728
Taxis	0	1490	31	1391	0	0	0	84	1505	2995
Freight	0	14611	7	328	0	607	0	890	1832	16443
Transport via pipelines	0	19	0	0	0	0	0	0	0	19
Water transport	0	1344	57	1050	0	244	0	3280	4631	5975
Air transport	0	1888	363	5142	0	15	0	3872	9392	11280
Transport services	0	18368	38	898	0	0	0	1654	2590	20958
Post and telecommunications	0	18885	7796		0	0	0	1246	9042	27927
Finance and business services	24423	150244	72788	6892	0	8041	0	8280	96001	246245
Public administration	0	408	0	0	0	72587	0	0	72587	72995
Education, health and social work	0	30489	13673	173	66712	0	0	698	81256	111745
Other services	0	11703	24790		5548	0	0	1467	31805	43508
Total intermediate purchases	24423	565163	341140	57672	144847	98726	329	155507	798221	1363384
Sales by final demand	0	2958	2705	2101	-6882	-4762	0	3880	-2958	0
Taxes on expenditure less subsidies	0	32063	-457	2301		680	0	0	2524	34587
Value added (net output)	-24423	546733	0	0	0	0	0	0	0	54673
Total inputs	0	1146917	343388	62074	137965	94644	329	159387	797787	1944704

Notes: column headings are often abbreviated, refer to row headings for full description of industry

Abbreviations: CE - consumer expenditure   GGFC - general government final consumption   GDFCF - Gross domestic fixed capital formation

TESTING FOR BIAS IN INITIAL ESTIMATES OF THE COMPONENTS OF GDP

U M Rizki, Office for National Statistics

Introduction

This article analyses the revisions to growth rates of the components of GDP, when examined in terms of income, expenditure, and output. It updates the results published in the July 1995 issue of Economic Trends. The first article in this series was published in the February 1993 issue of Economic Trends.

Main Results

- Out of the 23 GDP components tested only 4 showed an indication of bias, but only over the 10 year period. These were the total expenditure components in constant prices, GDFCF in both constant and current prices and manufacturing output.

- In the phase analysis over the whole 13 years, 3 out of the 23 components showed significant bias during the expansion phases of the economy. Only revisions to imports and to gross capital formation, both at constant prices, showed bias in the contraction phase.

The growth rates examined in this article relate to 40 quarters over a ten year period from Q4 1982 to Q3 1992 inclusive. These initial estimates were those published in April 1983 to January 1993 respectively. The revisions series are the difference between these and the corresponding "final" estimates published three years later in April 1986 to December 1995 respectively. The growth rates for each quarter are the percentage changes since the corresponding quarter a year earlier.

In addition to the usual factors for revisions, receipt of later data, methodology changes and statistician's judgment, the need to balance the three measures of GDP can also contribute to revisions in the components of GDP.

Since 1993, the estimates of the expenditure, income and output components of GDP are published in "UK Economic Accounts - The Quarterly National Accounts publication (UKEA)". Before this they were published in a quarterly article in Economic Trends. The data analysed in this article have been taken from successive quarterly issues.

Since this article is looking at revisions after three years, the latest figures which can be coveredrelate to estimates of growth rate into 1992. The analysis in this article, therefore, still does not take full account of recent improvements incorporated into the initial estimates of quarterly growths from 1989 onwards. The improvements include an increase in the use of statutory requirements for respondents to supply data to ONS. The results of these changes would only be seen in shorter term revisions, which are not covered in this article.

My thanks to Andy Bellis for the assembly of the data and detailed calculations.

Methods of Testing for Bias

The methods used for the present analysis are the same as described in the article published in the July 1994 issue of Economic Trends.

Revisions series for each item were arrived at by taking the difference between the first and the thirteenth estimates of percentage growth rates over four quarters. The same definition of bias is used here as in the last article; an indicator is considered to be biased if in the long run its mean revision is different from zero. However, we have to allow for the fact that the average revision over some finite period may be non-zero simply through random effects. Therefore, we need to test whether an observed mean differs from zero by more than could be expected due to random effects; in statistical terminology, whether the mean revision is significantly different from zero.

The most common statistical test of this kind is known as the t-test, which is based on the ratio of the mean revisions to an estimated standard error of the mean. There are standard tables to show how large a value of t is likely due to random variation only, taking account of the number of values used in calculating the mean. A standard t-test, however, requires that the revisions follow a normal distribution and the successive revision values are independent.

Examination of the individual revisions showed that while the values generally seemed to follow a normal distribution, serial correlation coefficients frequently indicated that successive values were not independent. Therefore, for all series with a positive coefficient the t-values were calculated after allowing for the serial correlation. For series with negative coefficient of correlation, raw t-values were used to test the significance of the means. The formulas used are given in the technical notes.

The revisions series were also tested for the effects of economic cycles. The expansion and contraction phases of the economy have been defined respectively as the period from a trough to a peak and from a peak to a trough. These are identified from the coincident index of the cyclical indicators published in the monthly issues of Economic Trends. The individual revision values were then associated with either of the two phases according to the quarter or the month of the initial estimate, thus obtaining two separate revisions series for each variable. Separate means were calculated respectively for the expansion and contraction phases and t-values, corrected forserial correlations, were obtained for each separate series to test for any evidence of bias due to the economic cycles.

The periods covered for the main analysis in this article are 10 years from 1986 to 1995 and 5 years from 1991 to 1995 inclusive. The dating here refers to publication of the revised data. For example, where the revision taken is three years after the first publication, the final value included relates to Q3 1992, the twelfth revision of which appeared in the quarterly GDP First Release (formerly called Press Notice) in December 1995.

It was, however felt that to test the effects of the economic cycles properly, on the overestimation or the underestimation of the growth rates, a longer series of data should be used. Thirteen years of data were thus obtained for each indicator for this purpose. Out of the 52 values in these thirteen years, covering the initial estimates from Q4 1978 to Q3 1991, 28 values were associated with the expansion and 24 with the contraction phases.

The detailed results are shown in Tables 1 to 5 in the annex. The total of the relevant component is examined first, e.g. the total of the GDP expenditure components, and then the individual components are examined separately. Also included in the annex are separate charts for each indicator, showing the magnitude of individual revisions over the latest 10 year period.

Components of Total Expenditure

Estimates of the total expenditure components of GDP, at current and constant prices are now published in table A5 in the quarterly UK Economic Accounts. The individual expenditure components are published in table A2 in the same publication.

Total GDP expenditure components at current prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate
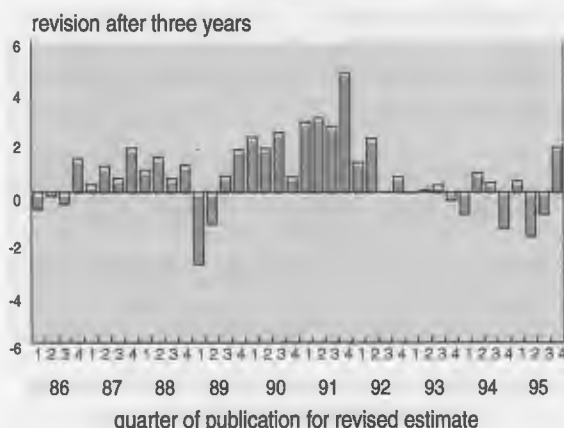
The mean revision to the growth rates of **total GDP expenditure components** at current prices was 0.7 percent over the 10 year period ending December 1994. Over the 5 year period it was 0.8 percent. The t-values were not significant.

Total GDP expenditure components at constant prices

four quarter per cent change

revision after three years
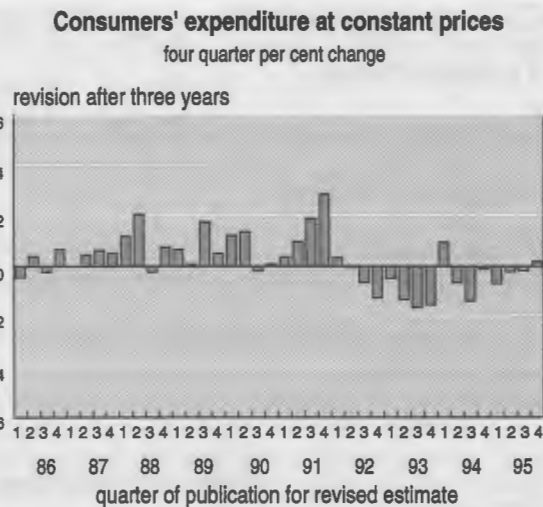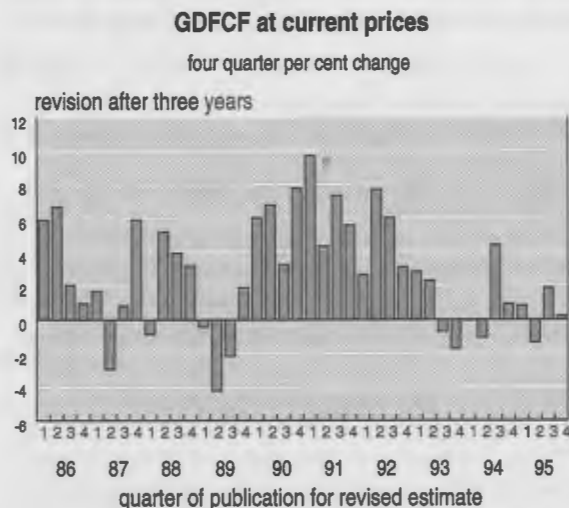

quarter of publication for revised estimate
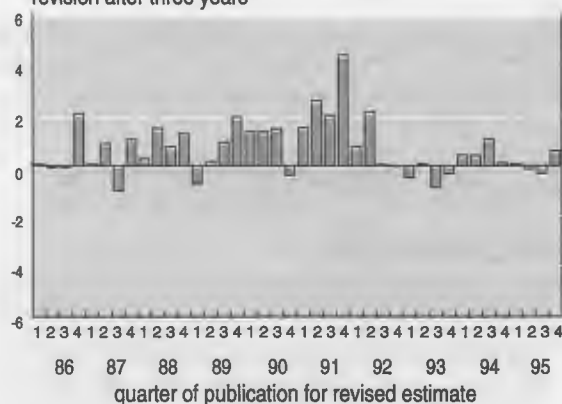
The corresponding figures in constant prices were 0.7 percentage points for both the 10 and the 5 year periods. The total expenditure at constant prices over the 10 year period showed a significant t-value, indicating a bias in the initial estimate.
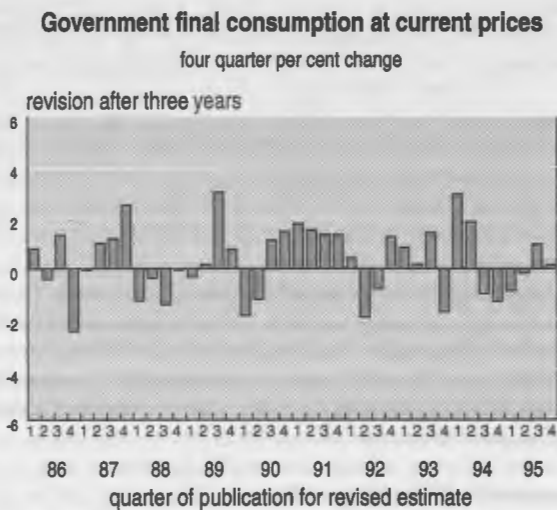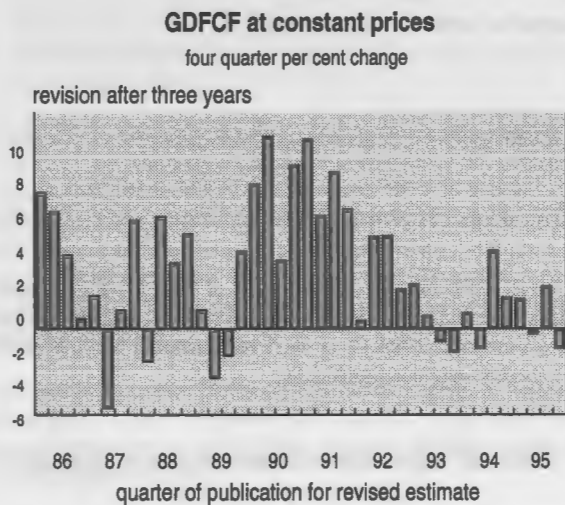
Among the components of the total expenditure, **gross domestic fixed capital formation (GDFCF)** showed the highest mean revisions, both in current and constant prices and for both the 10 and 5
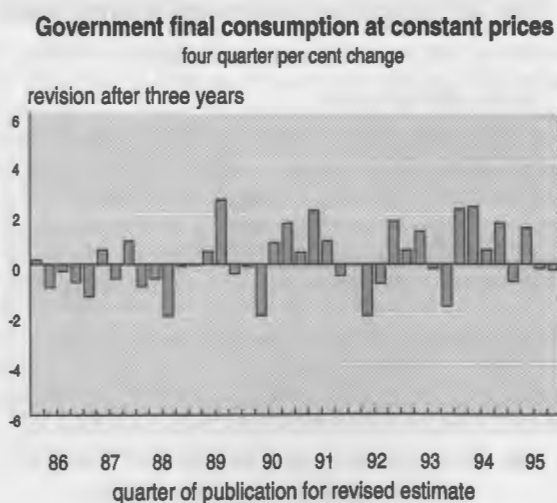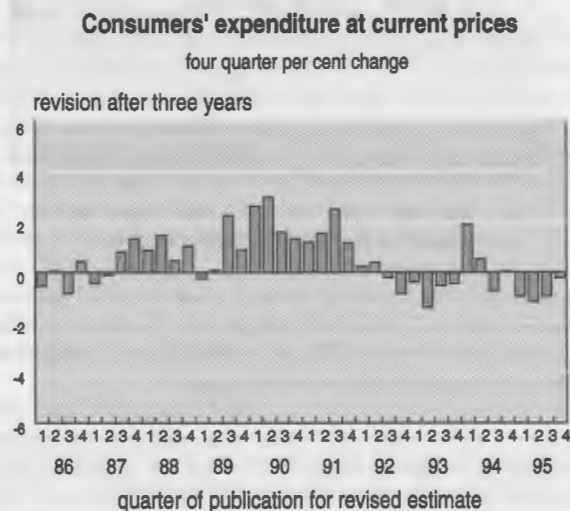
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year periods. The t-values were significant in both current and constant prices, but over the 10 year period only. The revisions were smaller in the recent years.

GDFCF at current prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Consumers' expenditure at constant prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

The mean revisions to the other components of total expenditure were small in both current and constant prices. Except for GDFCF, none of the t-values for expenditure components were significant.

GDFCF at constant prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Government final consumption at current prices

four quarter per cent change

revision after three years
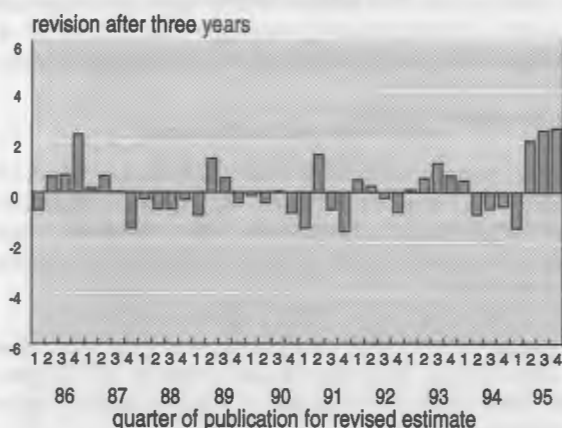

quarter of publication for revised estimate

The average revision to **consumers' expenditure** in constant prices over the 5 year period was close to zero, with revisions down in recent quarters counterbalancing upward revisions earlier.
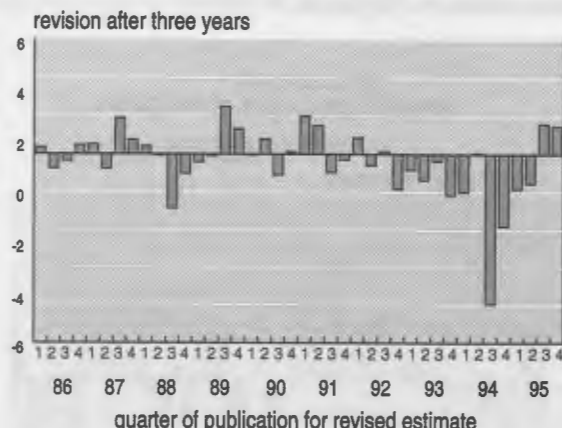
Consumers' expenditure at current prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Government final consumption at constant prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Exports at current prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Exports at constant prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Imports at current prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Imports at constant prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

The phase analysis showed that the revisions to total expenditure were high and significant in the expansion period. Among the components of expenditure, the mean revision to only GDFCF was significant at current prices in the expansion phase and at constant prices in the contraction phase of the business cycles.

The other total GDP expenditure components are **value of increase in works and stocks in progress, subsidies and taxes on expenditure.** These components have not been included in this study.
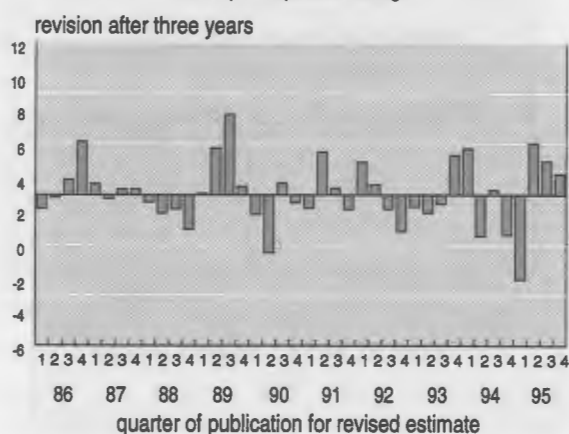
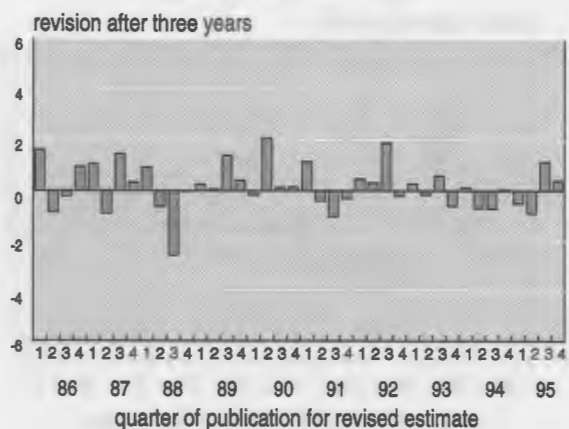**Components of Total Incomes**

The total income component of GDP is published in table A5 in the quarterly UK Economic Accounts. The individual income components are published in table A3 in the same publication.

The mean revision to the year on year growth rate of **total GDP income components** was under 0.5 percentage points for both the 10 year and the 5 year periods. The t-values were not significant.
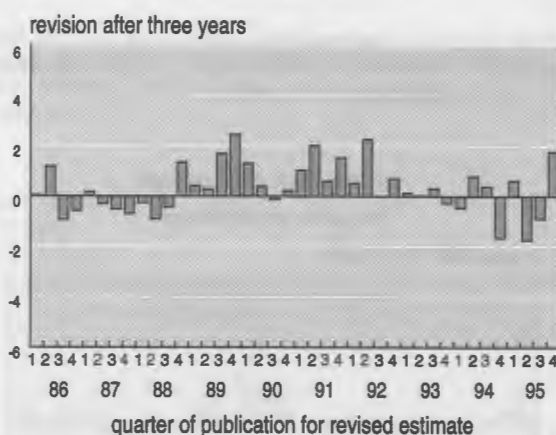
Total GDP income components at current prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate
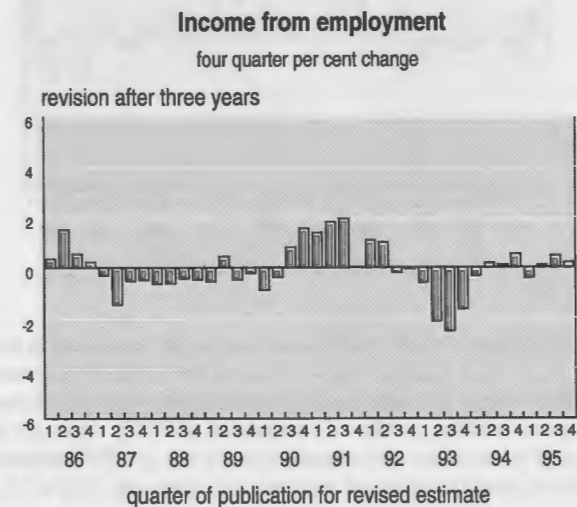
The components which contributed most to the overall mean revision were **other income (sum of income from self employment, inputed charge for non-trading capital consumption and rent)** and **gross trading profits of companies (GTPC).** Although the mean of the revisions to the annual growth rate of GTPC remained relatively small the range of revisions vary between -13.5 to 19.47

percentage points for the 10 year and between -13.5 and 12.74 percentage points over the 5 year periods. The t-values remained not significant for both components.

Gross trading profits of companies

four quarter per cent change

revision after three years

quarter of publication for revised estimate

Other income

four quarter per cent change

revision after three years

quarter of publication for revised estimate
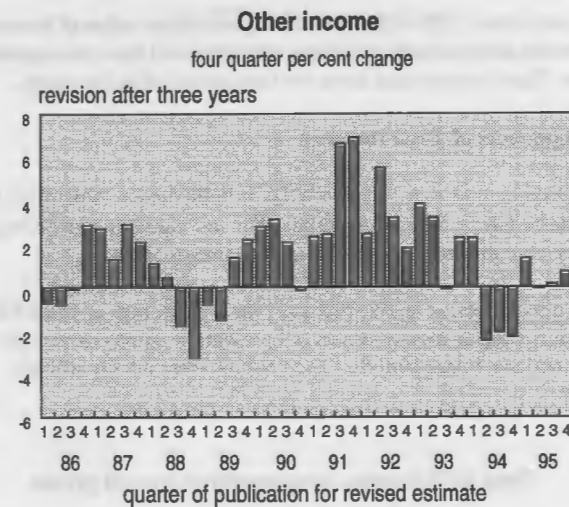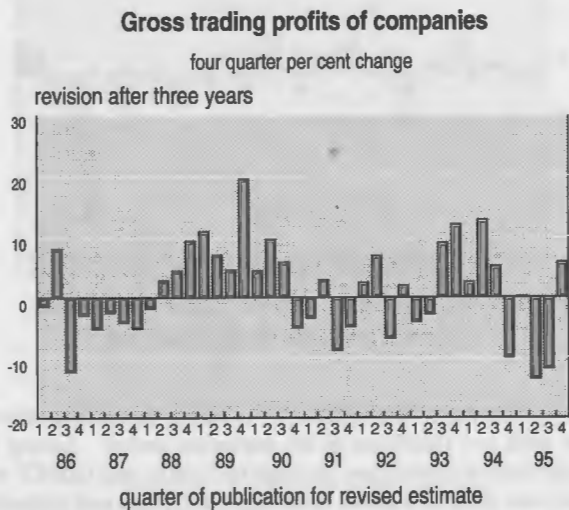
The mean revisions to **income from employment** over the 10 and 5 year periods were close to zero as before. The corresponding t-values were not significant.

Income from employment

four quarter per cent change

revision after three years

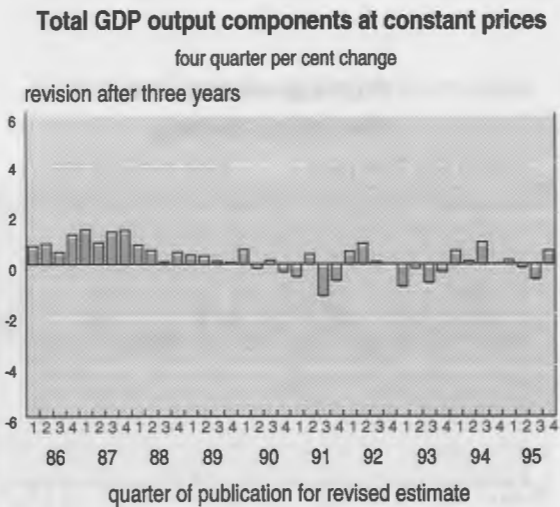quarter of publication for revised estimate

None of the income components showed any indication of bias in either the expansion or the contraction phases of the business cycle.. The other income components of GDP are **gross trading surpluses of public corporations and general government and stock appreciation.** These components have not been included in this study.

Components of Output

The total output components of GDP is published in table A5 in the quarterly UK Economic Accounts. The individual output components are published in table A4 in the same publication. Output by industry is measured and published only as index numbers at constant prices.
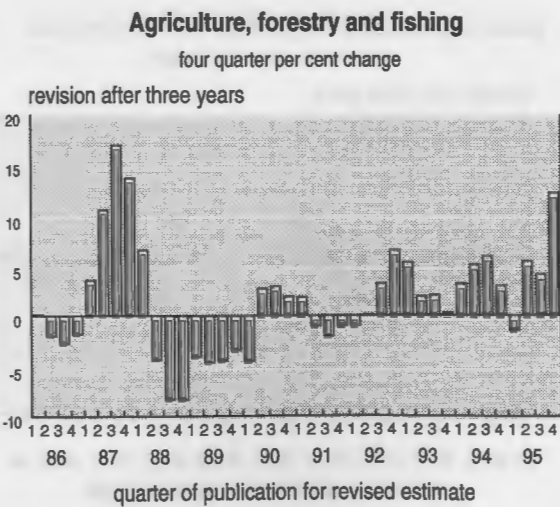
The mean revision to the annual growth rates of the **total output** of all industries was lower in the 5 year than in the 10 year period to 1995. The t-values for total output for both the 10 and 5 year period were not significant.

The component of output that showed the highest revisions in both

Total GDP output components at constant prices

four quarter per cent change

revision after three years

quarter of publication for revised estimate

the 10 and 5 year periods was **agriculture, forestry and fishing.** However all output components showed non-significant t-values over both periods.

The mean revisions to the annual growth rates for the output of

Agriculture, forestry and fishing

four quarter per cent change

revision after three years

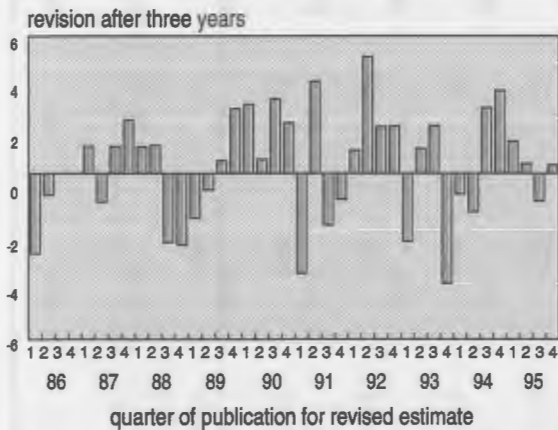quarter of publication for revised estimate

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Construction, distribution, hotel and catering and transport and communications remained not significant) for both the 10 year and 5 year periods ending in December 1995.

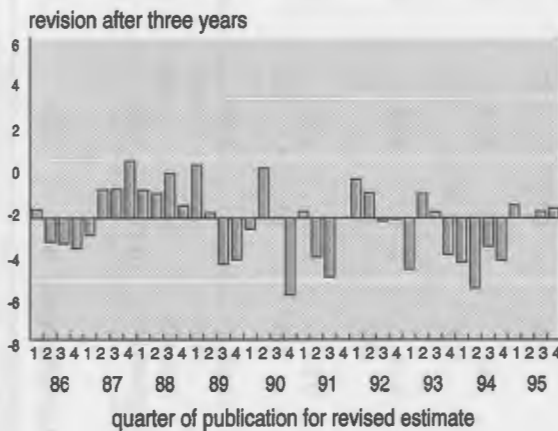In the expansion phase the revisions to manufacturing output

showed indication of bias with significant t-value.

The other output components are **oil and gas extraction** and **other**

Transport and communication

four quarter per cent change

Manufacturing

four quarter per cent change

Distribution, hotels and catering

four quarter per cent change
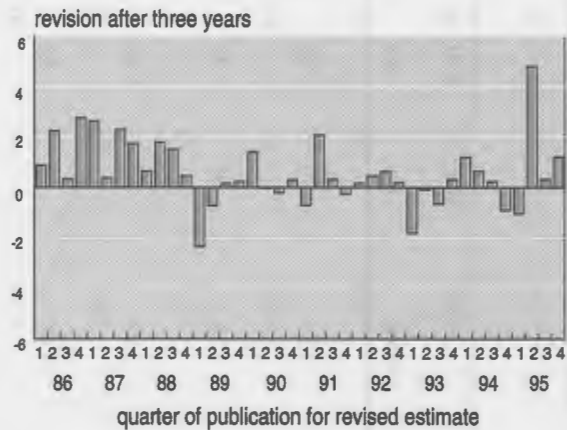
Other services

four quarter per cent change
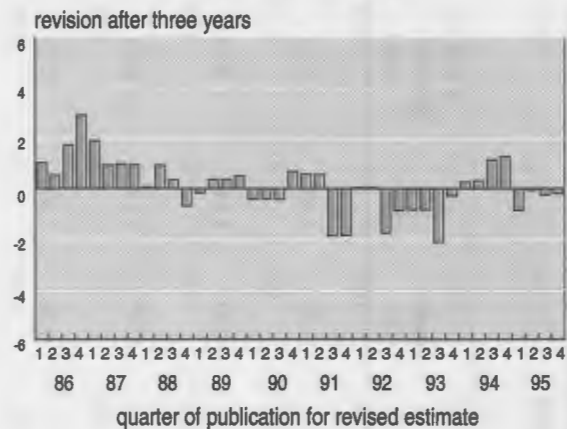
energy and water. These components were not included in this study because consistent data for the historical years were not available.

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         Fax   0171 270 6190

Construction

four quarter per cent change

Table 1

Revisions analysis: Expenditure components at current prices 1986-1995
Revision reference: Three years after the first publication
Four quarter percentage changes

Indicator	No. of yrs	No. of obs.	Mean rev. ignoring sign	Mean rev.	Std dev	Coeff. of serial corr.	SE of 1 of mean	t-value	% of + rev	% of - rev	Range of revision values From	to
Total GDP expenditure components	10	40	1.24	0.70	1.45	0.45	0.57	1.87	70	30	-2.86	4.76
	5	20	1.31	0.77	1.65	0.52	0.65	1.18	64	35	-1.76	4.76
Consumer expenditure	10	40	0.94	0.45	1.12	0.59	0.35	1.29	60	40	-1.39	2.98
	5	20	0.87	0.60	1.09	0.60	0.48	1.40	45	55	-1.39	2.49
General government final consumption	10	40	1.16	0.30	1.37	0.11	0.24	1.39	58	42	-2.48	3.01
	5	20	1.19	0.41	1.34	0.13	0.34	1.21	65	35	-1.93	2.93
Gross domestic fixed capital formation	10	40	3.44	2.65	3.35	0.49	0.91	2.91	75	25	-4.24	9.73
	5	20	3.24	2.74	3.28	0.55	1.37	2.00	75	25	-1.76	9.73
Exports	10	40	0.83	0.10	1.06	0.31	0.23	0.41	50	50	-1.54	2.54
	5	20	1.02	0.20	1.25	0.32	0.39	0.52	55	45	-1.54	2.54
Imports	10	40	0.70	0.17	0.92	-0.02	0.14	1.16	58	42	-2.56	2.08
	5	20	0.58	0.05	0.76	0.01	0.17	0.31	50	50	-1.02	1.89

Note: Ten year period runs from April 1986 to Jan 1996. The five year period runs from April 1991 to January 1996.
These dates relate to the publication dates; e.g. revision published in Jan 96 would relate to the the initial estimate for Q3 1992.
1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative.

Table 2

Revisions analysis: Expenditure components at constant prices 1986-1995
Revision reference: Three years after the first publication
Four quarter percentage changes

Indicator	No. of yrs	No. of obs.	Mean rev. ignoring sign	Mean rev.	Std dev	Coeff. of serial corr.	SE of 1 of mean	t-value	% of + rev	% of - rev	Range of revision values	
											From	to
Total GDP expenditure components	10	40	0.89	0.68	1.08	0.28	0.23	3.00	72	28	-0.98	4.39
	5	20	0.92	0.71	1.27	0.49	0.48	1.47	70	30	-0.85	4.39
Consumer expenditure	10	40	0.77	0.22	0.99	0.48	0.27	0.82	58	42	-1.63	2.85
	5	20	0.88	-0.12	1.15	0.56	0.48	-0.26	35	65	-1.63	2.85
General govmnt final consumption	10	40	0.96	0.16	1.21	0.11	0.21	0.74	45	55	-2.06	2.56
	5	20	1.07	0.45	1.25	0.06	0.30	1.51	60	40	-2.05	2.28
Gross domestic fixed capital formation	10	40	3.20	2.57	3.13	0.45	0.80	3.20	83	17	-3.69	8.88
	5	20	2.64	2.27	2.83	0.55	1.17	1.93	75	25	-1.08	8.76
Exports	10	40	0.98	0.07	1.30	0.20	0.25	0.43	50	50	-3.36	3.17
	5	20	1.14	0.02	1.41	0.06	0.33	0.05	50	50	-3.36	2.05
Imports	10	40	1.24	-0.42	1.82	0.36	0.42	-0.99	42	58	-7.92	2.46
	5	20	1.65	-0.90	2.23	0.32	0.69	-1.29	35	65	-7.92	1.98

Note: Ten year period runs from April 1986 to Jan 1996. The five year period runs from April 1991 to January 1996.
These dates relate to the publication dates; e.g. revision published in Jan 96 would relate to the the initial estimate for Q3 1992.
1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative.

Table 3

Revisions analysis: Expenditure components at current prices 1986-1995
Revision reference: Three years after the first publication
Four quarter percentage changes

Indicator	No. of yrs	No. of obs.	Mean rev. ignoring sign	Mean rev.	Std dev	Coeff. of serial corr.	SE of 1 of mean	t-value	% of + rev	% of - rev	Range of revision values From	to
Total GDP expenditure components	10	40	0.80	0.31	0.99	0.56	0.30	1.05	63	37	-1.73	2.45
	5	20	0.89	0.39	1.07	0.07	0.26	1.51	70	30	-1.73	2.26
Income from employment	10	40	0.74	-0.03	0.98	0.69	0.36	-0.07	48	52	-2.52	1.95
	5	20	0.84	0.05	1.17	0.71	0.64	0.08	60	40	-2.52	1.95
Gross trading profits of companies	10	40	6.63	1.01	7.59	0.30	1.64	0.62	55	45	-13.58	19.47
	5	20	6.38	-0.26	7.70	0.19	2.08	-0.12	55	45	-13.58	12.74
Other income	10	40	2.14	1.33	2.32	0.61	0.74	1.80	68	32	-3.26	6.89
	5	20	2.59	1.89	2.65	0.57	1.14	1.66	75	25	-2.47	6.89

Note: Ten year period runs from April 1986 to Jan 1996. The five year period runs from April 1991 to January 1996.
These dates relate to the publication dates; e.g. revision published in Jan 96 would relate to the the initial estimate for Q3 1992.
1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative.

Table 4

Revisions analysis: Expenditure components at constant prices 1986-1995
Revision reference: Three years after the first publication
Four quarter percentage changes

Indicator	No. of yrs	No. of obs.	Mean rev. ignoring sign	Mean rev.	Std dev	Coeff. of serial corr.	SE of 1 of mean	t-value	% of + rev	% of - rev	Range of revision values	
											From	to
Total GDP output components	10	40	0.53	0.24	0.61	0.51	0.17	1.41	70	30	-1.24	1.36
	5	20	0.46	-0.07	0.58	0.08	0.14	-0.47	50	50	-1.24	0.86
Agriculture, forestry and fishing	10	40	4.35	1.60	5.54	0.74	2.27	0.71	60	40	-8.33	16.96
	5	20	3.33	2.68	3.49	0.26	1.02	2.64	75	25	-2.04	12.19
Manufacturing	10	40	1.02	0.59	1.37	0.12	0.23	2.57	73	27	-2.35	4.82
	5	20	0.90	0.36	1.36	-0.12	0.27	1.32	65	35	-1.81	4.82
Construction	10	40	1.33	0.35	1.68	0.42	0.43	0.87	62	38	-4.23	3.96
	5	20	1.73	0.60	2.10	0.50	0.81	0.71	75	25	-4.23	3.96
Distribution, hotels and catering	10	40	0.92	-0.13	1.15	0.20	0.22	-0.60	55	45	-2.54	1.90
	5	20	0.83	-0.39	1.03	0.32	0.32	-1.23	50	50	-2.31	1.30
Transport and	10	40	1.62	0.25	1.96	0.10	0.34	0.75	65	35	-3.97	4.24
	5	20	1.82	0.29	2.20	-0.09	0.45	0.65	65	35	-3.97	4.24
Other services	10	40	0.81	0.11	1.05	0.59	0.32	0.33	58	42	-2.13	2.90
	5	20	0.80	-0.39	0.98	0.31	0.30	-1.27	40	60	-2.13	1.26

Note: Ten year period runs from April 1986 to Jan 1996. The five year period runs from April 1991 to January 1996.
These dates relate to the publication dates; e.g. revision published in Jan 96 would relate to the the initial estimate for Q3 1992.
1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative.

Table 5

Summary of tests for cyclical variation, 1982-1995

Series	Expansion Phase		Contraction Phase	
	Mean	t-value	Mean	t-value
Expenditure (Current Prices)				
Total	1.07	1.86	0.28	0.98
Consumer Expenditure	0.72	1.61	0.23	1.16
General Government Final Consumption	0.43	1.33	0.13	0.05
Gross Domestic Fixed Capital Formation	3.78	2.16	0.19	0.23
Exports	0.27	0.94	-0.09	-0.56
Imports	0.59	1.88	-0.20	-1.16
Expenditure (Constant Prices)				
Total	0.97	2.22	0.23	1.30
Consumer Expenditure	0.48	1.80	-0.15	-0.60
General Government Final Consumption	-0.14	-0.67	0.22	0.71
Gross Domestic Fixed Capital Formation	3.85	1.83	1.16	2.20
Exports	0.31	1.74	-0.27	-0.85
Imports	0.26	1.08	-1.44	-2.77
Income (Current Prices)				
Total	0.58	1.99	0.02	0.09
Income from Employment	0.60	1.44	-0.42	-1.29
Gross Trading Profits of Companies	0.23	0.13	1.14	0.55
Other Income	2.30	1.73	0.27	0.34
Output (Constant Prices)				
Total	0.30	0.16	0.18	0.91
Agriculture, Forestry and Fishing	2.62	1.50	2.13	1.02
Manufacturing	0.64	2.45	0.38	1.30
Construction	0.44	1.11	0.40	1.05
Distribution, Hotels and Catering	-0.04	-0.16	-1.06	-0.84
Transport and Communications	0.74	1.58	-0.26	-0.49
Other Services	0.55	1.04	0.59	1.03