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Economic Trends

No 489
July 1994

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London: HMSO

Contents

ECONOMIC UPDATE - JULY 1994

(includes data published up to 22 July 1994)

Summary

- **GDP at constant factor cost** rose by 0.9 per cent between 1994 Q1 and 1994 Q2.

- The annual change in the **retail prices index** (excluding mortgage interest payments) fell from 2.5 per cent in May to 2.4 per cent in June.

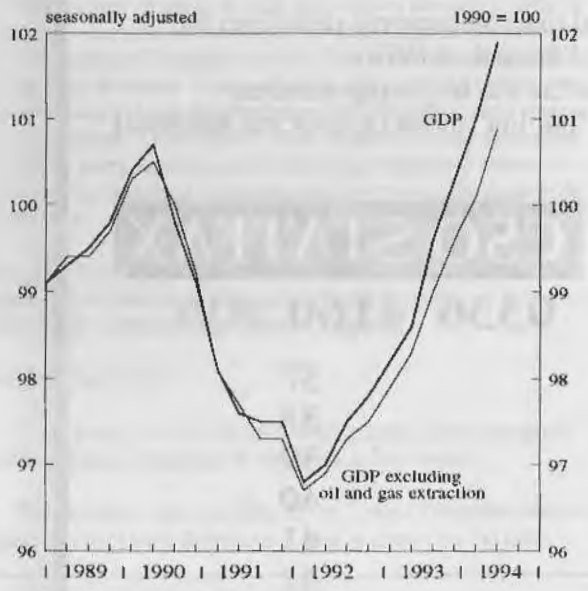
- **UK claimant unemployment** fell by 18,800 in June.

- The annual growth of **M0** fell from 6.9 per cent in May to 6.8 per cent in June.

Output and expectations

The preliminary estimate of **GDP at constant factor cost** showed a rise of 0.9 per cent between 1994 Q1 and 1994 Q2. In 1994 Q2 it was 5.3 per cent above its most recent low point of 1992 Q1. **Excluding oil and gas extraction, GDP** rose by 0.8 per cent between 1994 Q1 and 1994 Q2. These aggregates are plotted in Chart 1. Within GDP it is estimated that the output of both the **production industries** and **service sector** has continued to grow.

Chart 1
Gross domestic product
at constant factor cost



2. The latest estimates for the trend in growth of output are 5 per cent a year for **production industries** and 4½ per cent a year **for manfacturing.**

3. The June CBI Monthly Trends Enquiry for manufacturing suggested future growth in output. It reveals, in Chart 2, that the **output expectations** balance (those reporting ups less those reporting downs) in the next 4 months, seasonally adjusted, remained at 18 per cent in June.

Chart 2
CBI output expectations

4. The CSO's **coincident cyclical indicator** has risen from its trough in 1992 Q2. Partial information suggests that the **shorter leading index** has declined but the **longer leading index** is rising slowly.

Indicators of domestic demand

5. In the three months to June, the **volume of retail sales** was 1.0 per cent higher than in the three months to March and 3.9 per cent higher than in the same three months a year earlier.

6. **Net lending to consumers**, on the narrower coverage, seasonally adjusted, rose slightly from £1,109 million in the three months to February 1994 to £1,133 million in the three months to May. This was despite a sharp fall in lending in May.

Prices and wages

7. The **retail prices index** (RPI), plotted in Chart 3, rose by 2.6 per cent in the year to June. **Excluding mortgage interest payments**, it rose by 2.4 per cent in the year to June - down from a 2.5 per cent rise in the year to May. It remained within the government's target range of 1-4 per cent.

Chart 3
Retail prices index

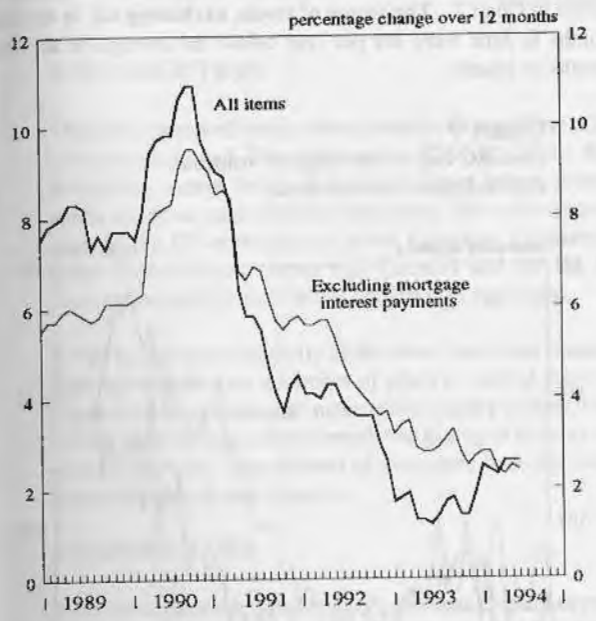


Chart 4
Whole economy underlying earnings in GB

8. Annual producer price rises remained low. The rise in the **output price index for manufactured products** (home sales), excluding food, beverages, tobacco and petroleum, fell from 2.1 per cent in the year to May to 1.9 per cent in the year to June - the lowest annual rise since November 1967. The rise in **input prices** (all manufacturing) increased from 0.9 per cent in the year to May to 1.6 per cent in the year to June.

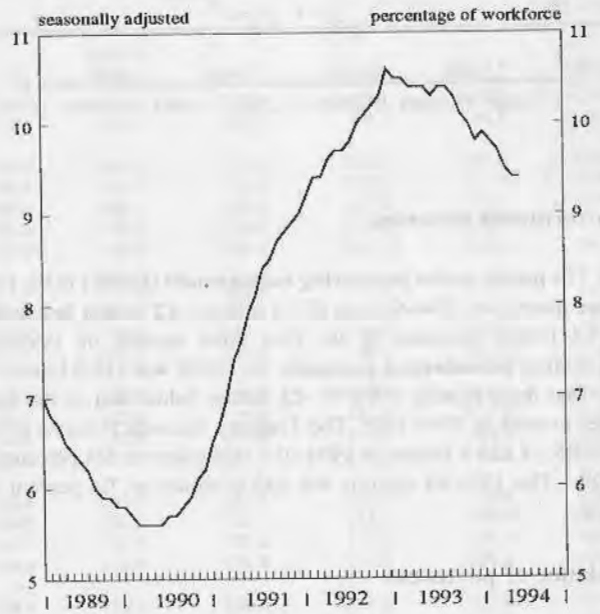
9. **Expectations of price increases** rose in June. The CBI Monthly Trends Enquiry for manufacturing showed a balance of 16 per cent (those expecting price rises less those expecting falls), seasonally adjusted, in the next four months, compared to 4 per cent reported in May.

10. The annual rise in **underlying whole economy average earnings** is shown in Chart 4 for Great Britain. It remained at 3¾ per cent in May. Underlying earnings growth remained at 3½ per cent in **the service sector** but in **the manufacturing sector** fell from 4¾ per cent in April to 4¼ per cent in May.

Labour market and productivity

11. **UK claimant unemployment**, seasonally adjusted, fell in June by 18,800 to 2.642 million - equivalent to a rate of 9.4 per cent of the workforce which is plotted in Chart 5. In the three months to June the average monthly fall was 25,700 compared with an average fall of 17,200 in the three months to March. Unemployment is now 329,000 below its recent peak of December 1992.

Chart 5
UK claimant unemployment



12. Revised estimates show that the **UK workforce in employment**, seasonally adjusted, fell by 73,000 between 1993 Q4 and 1994 Q1. The number of **manufacturing employees** in Great Britain, rose by 2,000 in May.

13. In the three months to May, **productivity in manufacturing** was 2.9 per cent higher than in the three months to May 1993. **Unit and salary wage costs in manufacturing** rose by 1.7 per cent over the same period.

Monetary indicators

14. **The annual growth of narrow money (M0)**, seasonally adjusted, fell from 6.9 per cent in May to 6.8 per cent in June and remained outside the Government's monitoring range of 0-4 per cent. Annual growth of **broad money (M4)**, seasonally adjusted, rose provisionally from 5.4 per cent in May to 5.7 per cent in June, to remain well within the monitoring range of 3-9 per cent. These growth rates are shown in Chart 6.

Chart 6
Annual growth of monetary aggregates

Government finances

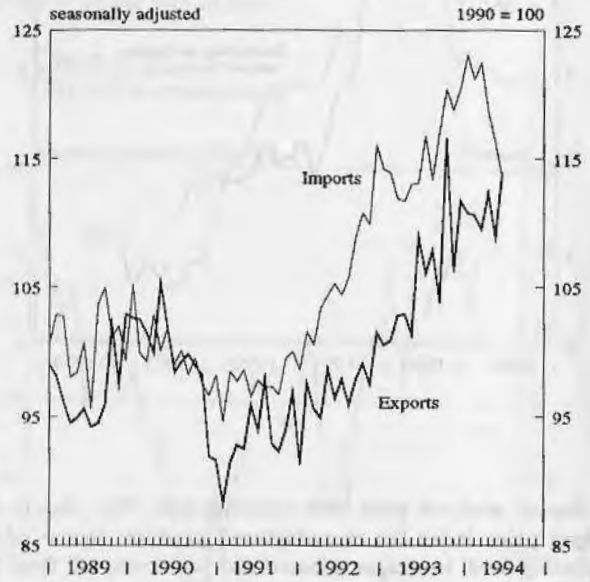
15. The **public sector borrowing requirement (PSBR)** in the first three months of 1994-95 was £11.4 billion - £2 billion below the £13.4 billion recorded in the first three months of 1993-94. **Excluding privatisation proceeds**, the PSBR was £11.9 billion in the first three months 1994-95 -£3 billion below that of the first three months of 1994-1995. The Treasury Summer Forecast is for a PSBR of £36.1 billion in 1994-95 - equivalent to 5¼ percent of GDP. The 1993-94 outturn was £45.9 billion or 7¼ percent of GDP.

Balance of payments

16. The deficit on the UK **balance for total visible trade** fell from £3.7 billion in the three months to January 1994 to £2.9 billion in the three months to April. **Excluding oil and erratics**, the fall was rather smaller - from £4.6 billion to £4.5 billion. Between the same periods, the **volume of total exports, excluding oil and erratics**, rose by 6 per cent. On the same basis **imports** rose by 4 per cent.

17. More timely data on **trade with non-EC countries** shows that the deficit narrowed from £2.1 billion in the three months to March, to £1.7 billion in the three months to June. The trend in the visible deficit suggests a narrowing over recent months. In the three months to June, **export volumes, excluding oil and erratics** rose by 1½ per cent compared with the previous three months. On the same basis **imports** fell by 5 per cent. These volumes are shown in Chart 7. **The terms of trade, excluding oil**, in the three months to June were 4½ per cent below the average in the three months to March.

Chart 7
Non-EC export and import volumes
(excluding oil and erratics)



INTERNATIONAL ECONOMIC INDICATORS

(includes data up to 20 July 1994)

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.

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. **Gross domestic product (GDP) at constant market prices** grew in all G7 economies between 1993 Q4 and 1994 Q1. Growth was strongest in North America - United States 0.8 per cent, Canada 1.1 per cent - where the recovery has been established longest. But the major EC economies also grew: the United Kingdom continuing its recovery and Germany, France and Italy demonstrating their emergence from the recent recession.

4. **Consumer price inflation** in the United Kingdom remained at 2.6 per cent for third successive month in June 1994. In most of the other G7 economies the trend continued downwards in this period, with the rate falling in Germany, Italy and Japan to 2.9 per cent, 3.7 per cent and 0.5 per cent respectively. In the United States, however, there was a slight rise from 2.2 per cent in May 1994 to 2.5 per cent in June 1994. In Canada zero inflation was recorded in June 1994 following on from the price decline of 0.1 per cent in May 1994.

5. In the United States there was a significant fall in the **standardised unemployment rate** from 6.4 per cent in April 1994 to 6.0 per cent in May 1994. Over the same period there were falls in the United Kingdom and Canada; to 9.5 per cent and 10.7 per cent respectively. France continued to have the highest rate of the G7 economies where it increased from 12.6 per cent in April 1994 to 12.7 per cent in May 1994. In Germany the rate rose to 6.6 per cent in April 1994; an increase of 1.0 percentage points on a year ago.

1 Gross domestic product at constant market prices: index numbers

1985 = 100

	United Kingdom[1]	Germany[2]	France	Italy	EC	United States	Japan[3]	Canada	Major 7	OECD
	FNAO	GABI	GABH	GABJ	GAEK	GAEH	GAEI	GAEG	GAEO	GAEJ
1980	90.5	94.3	92.7	93.3	92.9	88.2	82.9	86.7	88.7	88.9
1985	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1986	104.4	102.3	102.5	102.9	102.9	102.9	102.6	103.3	102.9	102.9
1987	109.3	103.7	104.8	106.1	105.9	106.1	107.1	107.6	106.3	106.4
1988	114.8	107.5	109.5	110.5	110.4	110.3	113.8	113.0	111.0	111.0
1989	117.3	111.4	114.2	113.7	114.3	113.0	119.3	115.7	114.5	114.6
1990	117.8	118.0	117.1	116.1	117.7	114.4	125.0	115.5	117.1	117.4
1991	115.2	123.4	118.0	117.5	119.4	113.6	130.3	113.3	118.0	118.3
1992	114.5	124.9	119.4	118.4	120.3	116.5	132.1	114.0	120.0	120.3
1993	116.7	122.5	118.2	117.6	119.7	120.0	132.2	116.6	121.6	121.8
1991 Q1	115.5	122.8	117.1	116.7	118.8	113.0	128.9	112.4	117.3	117.7
Q2	115.0	123.9	117.7	117.2	119.3	113.5	129.8	113.6	117.9	118.2
Q3	114.8	123.2	118.4	117.7	119.5	113.9	130.9	113.7	118.3	118.6
Q4	115.1	123.7	118.8	118.5	120.0	114.0	131.7	113.7	118.6	119.0
1992 Q1	114.0	125.5	119.6	118.8	120.8	115.0	132.5	113.9	119.4	119.9
Q2	114.1	125.4	119.4	119.0	120.6	115.8	132.1	114.0	119.7	120.1
Q3	114.6	124.7	119.4	118.1	120.1	116.8	132.0	114.0	120.1	120.4
Q4	115.0	123.8	119.1	117.8	119.9	118.4	131.8	114.2	120.8	120.9
1993 Q1	115.7	121.6	117.9	117.3	119.1	118.7	132.9	115.2	120.8	121.0
Q2	116.4	122.3	118.1	117.8	119.6	119.2	132.0	116.4	121.1	121.4
Q3	117.2	123.3	118.4	117.3	119.9	120.1	132.2	116.8	121.7	122.0
Q4	117.9	122.8	118.4	118.2	120.1	122.1	131.5	117.8	122.7	122.9
1994 Q1	118.7	123.5	119.0	119.1	..	123.1	132.5	119.1	..	..
Percentage change, latest quarter on corresponding quarter of previous year										
1993 Q4	*2.5*	*-0.8*	*-0.6*	*0.3*	*0.2*	*3.1*	*-0.2*	*3.2*	*1.6*	*1.7*
1994 Q1	*2.6*	*1.6*	*0.9*	*1.5*	..	*3.7*	*-0.3*	*3.4*	..	..
Percentage change, latest quarter on previous quarter										
1993 Q4	*0.6*	*-0.4*	*0.0*	*0.8*	*0.2*	*1.7*	*-0.5*	*0.9*	*0.8*	*0.7*
1994 Q1	*0.7*	*0.6*	*0.5*	*0.8*	..	*0.8*	*0.8*	*1.1*	..	..

1 Estimates due to rebasing to 1990
2 Western Germany (Federal Republic of Germany before unification)
3 GNP

2 Consumer prices[1]
Percentage change on year earlier

	United Kingdom	Germany[2]	France	Italy	EC	United States	Japan	Canada	Major 7	OECD
1980	18.0	5.5	13.6	21.0	13.7	13.5	8.0	10.2	12.7	13.7
1985	6.1	2.2	5.8	8.6	6.2	3.5	2.0	4.0	4.0	4.8
1986	3.4	-0.1	2.7	6.1	3.7	1.9	0.4	4.2	2.1	3.0
1987	4.2	0.2	3.1	4.6	3.4	3.6	-0.2	4.3	2.9	3.6
1988	4.9	1.3	2.6	5.0	3.6	4.1	0.5	4.0	3.3	4.3
1989	7.8	2.8	3.7	6.6	5.2	4.8	2.3	5.0	4.6	5.4
1990	9.5	2.7	3.4	6.0	5.6	5.5	3.1	4.8	5.0	5.8
1991	5.9	3.5	3.2	6.5	5.1	4.2	3.3	5.6	4.3	5.2
1992	3.7	4.0	2.4	5.3	4.2	3.0	1.6	1.5	3.1	4.1
1993	1.6	4.2	2.0	4.2	3.3	3.0	1.1	1.8	2.7	3.6
1993 Q2	1.3	4.2	1.9	4.1	3.3	3.2	1.0	1.7	2.7	3.6
Q3	1.7	4.2	2.2	4.3	3.5	2.7	1.6	1.7	2.7	3.7
Q4	1.6	3.8	2.1	4.1	3.2	2.7	1.2	1.9	2.5	3.5
1994 Q1	2.4	3.3	1.7	4.2	3.3	2.6	1.4	0.6	2.4	3.5
Q2	2.6	3.0	1.8	4.0	..	2.3	0.6	0.0	..	..
1993 Jun	1.2	4.2	1.9	4.1	3.2	3.0	0.9	1.6	2.6	3.5
Jul	1.4	4.3	2.1	4.4	3.4	2.8	1.6	1.6	2.7	3.8
Aug	1.7	4.2	2.2	4.5	3.5	2.7	1.8	1.7	2.7	3.7
Sep	1.8	4.0	2.3	4.2	3.3	2.7	1.3	1.9	2.6	3.5
Oct	1.4	3.9	2.2	4.2	3.2	2.7	1.3	1.9	2.6	3.6
Nov	1.4	3.6	2.2	4.1	3.1	2.7	0.9	1.9	2.4	3.4
Dec	1.9	3.7	2.1	4.0	3.3	2.7	1.3	1.7	2.6	3.6
1994 Jan	2.5	3.5	1.9	4.2	3.3	2.5	1.4	1.3	2.5	3.5
Feb	2.4	3.4	1.8	4.2	3.3	2.6	1.4	0.2	2.4	3.5
Mar	2.3	3.2	1.5	4.2	3.2	2.5	1.3	0.1	2.4	3.5
Apr	2.6	3.1	1.7	4.1	3.2	2.3	0.8	0.2	2.2	3.9
May	2.6	3.0	1.7	4.0	3.2	2.2	0.6	-0.1	2.2	4.2
Jun	2.6	2.9	1.8	3.7	..	2.5	0.5	0.0	..	..

1 Components and coverage not uniform across countries
2 Western Germany (Federal Republic of Germany before unification)

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	2.9	6.2	7.5	6.4	7.0	2.0	7.4	5.5	5.8
1985	11.2	7.1	10.2	9.6	10.8	7.1	2.6	10.4	7.2	7.8
1986	11.2	6.4	10.4	10.5	10.8	6.9	2.8	9.5	7.1	7.7
1987	10.3	6.2	10.5	10.9	10.6	6.1	2.8	8.8	6.7	7.3
1988	8.6	6.2	10.0	11.0	9.9	5.4	2.5	7.7	6.1	6.7
1989	7.2	5.6	9.4	10.9	9.0	5.2	2.3	7.5	5.7	6.2
1990	6.8	4.8	8.9	10.3	8.4	5.4	2.1	8.1	5.6	6.1
1991	8.8	4.2	9.4	9.9	8.7	6.6	2.1	10.2	6.3	6.8
1992	10.0	4.6	10.4	10.5	9.5	7.3	2.2	11.2	6.9	7.5
1993	10.3	5.8	11.7	10.2	10.7	6.7	2.5	11.1	6.9	7.8
1993 Q1	10.5	5.3	11.1	9.1	10.1	7.0	2.3	11.0	6.8	7.6
Q2	10.3	5.6	11.5	10.7	10.6	6.9	2.4	11.3	7.0	7.9
Q3	10.4	5.9	11.9	10.3	10.9	6.7	2.5	11.3	6.9	7.9
Q4	10.0	6.3	12.3	10.7	11.1	6.5	2.8	11.0	7.0	7.9
1994 Q1	9.9	6.5	12.5	10.8	11.3	6.5	2.8	11.0	7.0	8.0
1993 May	10.3	5.6	11.6	–	10.6	6.9	2.5	11.3	7.0	7.8
Jun	10.3	5.7	11.7	–	10.7	6.8	2.5	11.2	7.0	7.9
Jul	10.4	5.8	11.8	10.3	10.8	6.7	2.5	11.4	7.0	7.9
Aug	10.4	5.9	11.9	–	10.9	6.7	2.5	11.2	7.0	7.9
Sep	10.3	6.1	12.1	–	11.0	6.6	2.6	11.1	7.0	7.9
Oct	10.2	6.2	12.2	10.7	11.1	6.6	2.7	11.1	7.0	8.0
Nov	10.1	6.3	12.4	–	11.1	6.4	2.7	10.9	6.9	7.9
Dec	9.9	6.3	12.4	–	11.2	6.3	2.8	11.1	6.9	7.9
1994 Jan	10.0	6.4	12.5	10.8	11.3	6.6	2.7	11.3	7.0	8.0
Feb	9.9	6.5	12.5	..	11.3	6.4	2.9	11.0	7.0	8.0
Mar	9.7	6.5	12.6	10.8	11.3	6.5	2.8	10.5	7.0	8.0
Apr	9.6	6.6	12.6	..	11.3	6.4	2.8	10.9	6.9	7.9
May	9.5	..	12.7	..	..	6.0	..	10.7	..	..

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 Western Germany (Federal Republic of Germany before unification)
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	–1.0	–0.6
1985	0.6	2.7	–0.1	–0.9	–3.1	3.6	–1.3
1986	–0.2	4.5	0.3	0.4	–3.5	4.3	–2.8
1987	–1.2	4.1	–0.6	–0.2	–3.7	3.6	–2.8
1988	–3.5	4.2	–0.5	–0.7	–2.6	2.7	–3.5
1989	–4.4	4.9	–0.5	–1.2	–2.0	2.0	–4.1
1990	–3.3	3.1	–0.8	–1.3	–1.7	1.2	–3.8
1991	–1.3	–1.2	–0.5	–1.9	–0.1	2.3	–4.1
1992	–1.8	–1.2	0.3	–2.3	–1.1	3.1	–3.8
1993	–2.0	–1.2	0.8	..	–0.2	0.3	–4.4
1993 Q2	–2.4	–0.2	0.1	0.2	–1.6	3.0	–4.1
Q3	–1.4	–0.6	0.4	0.4	–1.7	2.9	–4.1
Q4	–1.7	–0.2	0.3	..	–1.9	2.8	–4.1
1994 Q1	..	–1.6	..	..	–1.9	3.1	–3.9

1 Balance as percentage of GNP
2 Western Germany (Federal Republic of Germany before unification)

5 Total industrial production: index numbers

1985 = 100

	United Kingdom[1]	Germany[2]	France	Italy	EC	United States	Japan[3]	Canada[4]	Major 7	OECD[5]
	DVZI	HFGA	HFFZ	HFGB	GACY	HFGD	HFGC	HFFY	GAES	GACX
1980	92.6	97.3	101.8	103.6	97.6	89.1	84.4	86.2	91.0	91.3
1985	100.0	100.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1986	102.4	102.3	100.9	103.6	102.3	100.9	99.8	99.3	101.1	101.2
1987	106.5	102.7	102.8	107.6	104.7	105.9	103.3	104.1	104.9	104.9
1988	111.6	106.3	107.7	114.1	109.4	110.6	113.7	109.6	110.8	110.5
1989	114.0	111.4	112.1	117.6	113.9	112.3	120.3	109.4	114.1	114.1
1990	113.6	117.2	114.2	117.6	116.0	112.3	125.4	106.0	115.7	115.8
1991	109.1	120.7	114.2	115.4	115.7	110.2	127.8	102.2	115.0	115.1
1992	108.6	118.4	112.9	114.8	114.2	112.8	120.5	102.6	114.4	114.5
1993	111.3	109.7	108.6	111.6	110.3	117.5	115.3	107.4	114.4	114.3
1993 Q1	109.8	109.8	109.1	113.3	110.7	116.2	117.8	106.0	114.3	114.0
Q2	110.5	109.4	108.5	109.9	110.0	116.9	115.9	106.7	113.9	113.7
Q3	111.8	110.0	109.1	110.9	111.0	117.7	115.7	107.8	114.6	114.7
Q4	113.2	109.7	107.8	112.1	111.2	119.6	112.0	109.0	114.8	114.9
1994 Q1	114.1	109.5	110.3	..	111.9	121.9	114.1	109.3	116.4	116.5
1993 May	111.6	109.6	109.8	112.3	110.8	116.6	114.3	106.1	113.8	113.7
Jun	110.3	109.6	109.5	109.8	110.0	117.0	116.2	107.9	114.1	113.8
Jul	111.8	108.7	110.4	112.3	110.8	117.5	115.6	106.9	114.4	114.5
Aug	111.8	110.7	110.4	110.4	111.1	117.7	114.6	107.7	114.4	114.5
Sep	111.8	110.6	110.0	110.1	111.1	117.9	117.0	108.7	114.9	115.0
Oct	113.1	110.0	109.3	112.5	111.1	118.5	110.9	108.7	114.2	114.3
Nov	113.5	109.3	110.2	114.2	111.6	119.5	113.4	109.4	115.3	115.4
Dec	112.8	109.9	109.1	109.5	110.8	120.8	111.6	109.0	115.0	115.2
1994 Jan	113.9	107.9	110.5	..	110.5	121.4	112.7	109.3	115.4	115.5
Feb	114.2	110.1	110.2	..	112.6	121.8	112.6	108.8	116.2	116.4
Mar	114.0	110.6	110.7	..	112.7	122.6	117.0	109.9	117.5	117.5
Apr	115.8	112.5	113.0	..	..	122.8	115.4	111.3	..	..
May	115.9	111.6	..	..	..	123.0	..	..	..	..
Percentage change: average of latest three months on that of corresponding period of previous year										
1994 Apr	*4.5*	*1.6*	*0.9*	..	..	*4.9*	*–2.7*	*3.3*	..	..
May	*4.6*	*1.8*	..	..	..	*5.2*	..	..	..	..
Percentage change: average of latest three months on previous three months										
1994 Apr	*1.2*	*1.9*	*1.2*	..	..	*1.5*	*2.2*	*0.7*	..	..
May	*1.3*	*2.1*	..	..	..	*1.2*	..	..	..	..

1 Estimates due to rebasing to 1990
2 Western Germany (Federal Republic of Germany before unification)
3 Not adjusted for unequal number of working days in a month
4 GDP in industry at factor cost and 1986 prices
5 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
1980	*15.9*	*7.1*	*9.2*	..	*11.3*	*13.5*	*14.8*	*13.3*	*13.2*	*13.2*
1985	*6.2*	*2.1*	*4.4*	*7.8*	*4.9*	*0.9*	*−0.8*	*2.8*	*1.9*	*3.0*
1986	*1.4*	*−2.3*	*−2.8*	*0.2*	*−0.8*	*−1.4*	*−4.7*	*0.9*	*−1.5*	*−1.1*
1987	*3.4*	*−0.5*	*0.6*	*3.0*	*1.3*	*2.1*	*−2.9*	*2.8*	*1.1*	*1.5*
1988	*3.7*	*1.6*	*5.2*	*3.5*	*3.4*	*2.5*	*−0.2*	*4.4*	*2.4*	*3.5*
1989	*4.8*	*3.4*	*5.3*	*5.9*	*5.0*	*5.1*	*2.1*	*1.9*	*4.4*	*5.3*
1990	*6.2*	*1.5*	*−1.1*	*4.2*	*2.4*	*5.0*	*1.6*	*0.3*	*3.4*	*3.9*
1991	*5.4*	*2.1*	*−1.3*	*3.3*	*2.1*	*2.1*	*1.0*	*−1.1*	*1.8*	*2.6*
1992	*3.1*	*1.7*	*−1.6*	*1.9*	*1.3*	*1.2*	*−0.8*	*0.5*	*0.9*	*1.6*
1993	*3.9*	*0.0*	*−2.9*	*3.8*	*1.0*	*1.3*	*−1.7*	*3.3*	*0.7*	*1.9*
1993 Q4	*3.9*	*−0.3*	*−2.2*	*3.9*	*1.3*	*0.3*	*−2.1*	*3.0*	*0.3*	*1.7*
1994 Q1	*3.3*	*0.0*	*−1.5*	*3.4*	*1.5*	*0.3*	*−2.1*	*3.3*	*0.3*	*2.1*
Q2	*2.1*	..	..	..	..	..	..	..	..	..
1993 Jun	*4.0*	*−0.3*		*4.1*	*0.9*	*1.3*	*−1.5*	*2.9*	*0.8*	*1.9*
Jul	*4.2*	*−0.3*		*4.2*	*1.0*	*1.3*	*−1.7*	*2.8*	*0.8*	*1.9*
Aug	*4.3*	*−0.2*		*4.4*	*1.2*	*0.5*	*−1.8*	*3.4*	*0.4*	*1.8*
Sep	*4.3*	*−0.4*		*4.3*	*1.1*	*0.4*	*−2.0*	*3.0*	*0.3*	*1.6*
Oct	*4.0*	*−0.4*		*4.1*	*1.3*	*0.3*	*−2.1*	*2.9*	*0.2*	*1.6*
Nov	*3.6*	*−0.4*		*3.8*	*1.3*	*0.4*	*−2.1*	*3.0*	*0.3*	*1.8*
Dec	*4.0*	*−0.2*		*3.7*	*1.3*	*0.3*	*−2.2*	*3.2*	*0.3*	*1.8*
1994 Jan	*3.7*	*−0.1*		*3.6*	*1.5*	*0.3*	*−2.1*	*2.7*	*0.3*	*1.8*
Feb	*3.4*	*0.1*		*3.6*	*1.6*	*0.2*	*−2.2*	*3.4*	*0.3*	*2.1*
Mar	*2.8*	*0.1*		*3.2*	*1.4*	*0.3*	*−2.3*	*3.8*	*0.3*	*2.3*
Apr	*2.2*	*0.3*		*3.0*	*1.5*	*−0.4*	*−2.2*	*4.2*	*0.0*	*3.4*
May	*2.1*	..		..	..	*−0.4*	*−2.0*	*4.6*	..	..
Jun	*2.0*	..		..	..	..	..	..	..	..

1 Western Germany (Federal Republic of Germany before unification).
2 Producer prices in intermediate goods

7 Total employment: index numbers[1]

1985 = 100

	United Kingdom[2]	Germany[3,4]	France[4]	Italy	EC	United States[4]	Japan	Canada[4]	Major 7	OECD
	DMBC	GAAR	GAAU	GAAS	GADW	GADT	GADU	GADS	GAEU	GADV
1980	103.4	102	101.1	100	100	93	95	95	..	..
1985	100.0	100	100.0	100	100	100	100	100	100	100
1986	100.1	101	100.5	101	101	102	101	103	101	101
1987	102.1	102	100.9	100	102	105	102	106	103	103
1988	105.4	103	102.0	102	104	107	104	109	105	105
1989	108.1	104	103.5	101	106	109	106	111	107	107
1990	108.8	107	104.6	103	107	110	108	112	108	109
1991	105.9	109	104.6	104	108	109	110	110	108	108
1992	103.2	110	103.8	103	106	110	111	109	108	108
1993	102.0	108	102.5	99	104	111	111	110	108	108
1992 Q3	102.7	110	104.2	104	106	111	112	112	109	109
Q4	102.1	110	102.9	102	105	110	111	109	108	108
1993 Q1	101.7	108	102.5	100	104	109	109	107	107	106
Q2	101.7	108	102.8	98	104	111	112	111	109	108
Q3	102.2	108	102.7	99	104	113	112	113	109	109
Q4	102.2	107	101.8	97	103	113	111	110	109	108
1994 Q1	102.0	106	102.0	96	103	112	109	108	108	107
1994 Mar	..	106	102.0	–	103	113	110	109	108	108
Apr	..	106	..	96	103	113	112	110	109	..
May	..	106	..	..	103	115	113	113	110	..
Percentage change, latest quarter on that of corresponding period of previous year										
1993 Q4	*0.1*	*−2.7*	*−1.1*	*−4.9*	*−1.9*	*2.7*	*0.0*	*0.9*	*0.9*	*0.0*
1994 Q1	*0.3*	*−1.9*	*−0.5*	*−4.0*	*−1.0*	*2.8*	*0.0*	*0.9*	*0.9*	*0.9*
Percentage change latest quarter on previous quarter										
1993 Q4	*0.0*	*−0.9*	*−0.9*	*−2.0*	*−1.0*	*0.0*	*−0.9*	*−2.7*	*0.0*	*−0.9*
1994 Q1	*−0.2*	*−0.9*	*0.2*	*−1.0*	*0.0*	*−0.9*	*−1.8*	*−1.8*	*−0.9*	*−0.9*

1 Not seasonally adjusted except for the United Kingdom
2 Estimates due to rebasing to 1990
3 Western Germany (Federal Republic of Germany before unification)
4 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	*17.8*	*6.5*	*15.2*	*18.7*	*10.3*	*8.6*	*7.5*	*10.9*	*9.0*	*10.9*
1985	*9.1*	*4.2*	*5.7*	*11.2*	*7.5*	*4.2*	*3.1*	*4.2*	*5.3*	*5.3*
1986	*7.7*	*4.0*	*3.9*	*4.8*	*5.0*	*2.0*	*1.4*	*3.0*	*3.0*	*4.0*
1987	*8.0*	*3.8*	*3.2*	*6.5*	*5.7*	*2.0*	*1.7*	*2.9*	*2.9*	*2.9*
1988	*8.5*	*4.6*	*3.1*	*6.1*	*5.4*	*2.9*	*4.6*	*3.8*	*4.7*	*4.7*
1989	*8.8*	*3.5*	*3.8*	*6.1*	*6.0*	*2.8*	*5.8*	*5.5*	*4.5*	*5.4*
1990	*9.3*	*5.1*	*4.5*	*7.2*	*7.3*	*3.6*	*5.4*	*5.2*	*5.2*	*5.9*
1991	*8.2*	*5.7*	*4.3*	*9.8*	*7.5*	*2.6*	*3.5*	*4.9*	*4.9*	*4.8*
1992	*6.6*	*6.2*	*3.6*	*5.4*	*6.3*	*2.6*	*1.0*	*3.1*	*3.9*	*3.8*
1993	*4.5*	..	*2.6*	*3.4*	*4.6*	*2.5*	*0.2*	*2.3*	*2.3*	*2.9*
1993 Q2	*5.0*	..	*2.6*	*3.1*	*4.6*	*2.5*	*0.7*	*2.3*	*3.1*	*3.0*
Q3	*4.4*	..	*2.3*	*4.1*	*4.6*	*2.5*	*0.4*	*1.5*	*3.0*	*2.9*
Q4	*4.0*	..	*2.2*	*3.8*	*4.5*	*3.3*	*−0.1*	*1.5*	*2.8*	*2.8*
1994 Q1	*4.8*	..	*2.0*	*4.3*	*4.5*	*3.3*	*2.9*	*2.2*	*3.9*	*3.8*
1993 Jun	*4.8*	..	..	*4.1*	*4.6*	*2.5*	*−0.9*	*2.3*	*2.8*	*2.8*
Jul	*5.0*	..	*2.3*	*4.1*	*4.6*	*2.5*	*−1.2*	*2.3*	*2.0*	*2.7*
Aug	*3.6*	..	..	*4.1*	*3.9*	*2.5*	*2.3*	*2.3*	*3.1*	*3.0*
Sep	*4.5*	..	..	*4.2*	*5.3*	*2.5*	*1.5*	*1.5*	*3.2*	*3.1*
Oct	*3.8*	..	*2.2*	*3.9*	*3.9*	*3.3*	*0.6*	*1.5*	*3.2*	*3.0*
Nov	*4.0*	..	..	*3.9*	*4.5*	*2.5*	*1.7*	*1.5*	*3.1*	*3.8*
Dec	*4.0*	..	..	*3.6*	*3.8*	*3.3*	*−1.1*	*1.5*	*1.8*	*1.8*
1994 Jan	*4.8*	..	*2.0*	*4.0*	*4.5*	*2.5*	*4.5*	*1.5*	*3.9*	*3.8*
Feb	*4.4*	..	..	*4.3*	*3.9*	*3.3*	*1.7*	*1.5*	*3.1*	*3.0*
Mar	*5.3*	..	..	*4.5*	*4.5*	*3.3*	*2.4*	*1.5*	*3.1*	*3.0*
Apr	*4.6*	..	..	*4.6*	..	*2.4*	*1.9*	*2.2*	*2.3*	..
May	..	..	..	*4.6*	..	*2.4*	..	..	..	..

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

1985 = 100

	United Kingdom[2]	Germany[1]	France	Italy	EC	United States	Japan	Canada	Major 7	OECD
	FAAM	GADD	GADC	GADE	GADH	GADA	GADB	GACZ	GAEW	GADG
1980	86.4	103.3	101.0	83.1	94.5	84.0	103.2	83.6	89.9	90.7
1985	100.0	100.0	100.0	100.0	99.9	100.0	99.9	100.0	100.0	99.9
1986	105.3	103.4	102.4	106.8	104.5	105.5	101.5	104.6	104.5	104.4
1987	110.6	107.5	104.5	112.0	108.8	108.4	107.1	110.3	108.3	108.1
1988	117.5	111.1	107.9	109.5	111.8	112.6	111.4	114.6	112.0	111.8
1989	119.9	114.1	109.5	117.1	116.1	115.6	115.8	114.5	115.4	115.3
1990	120.8	123.7	110.3	114.4	119.2	116.4	121.7	112.0	117.3	117.4
1991	119.4	130.7	110.3	111.3	120.0	114.0	124.2	100.4	116.3	116.6
1992	120.2	128.2	110.5	117.0	120.4	117.6	120.8	101.6	117.8	117.8
1993	124.4	122.8	110.7	113.3	118.1	123.8	114.9	104.7	119.8	118.9
1994 Q1	127.3	123.2	112.5	..	117.5	129.3	114.3	110.6	122.4	121.4
Q2	128.5	..	..	..	..	..	..	..	..	..
1993 Sep	125.2	125.9	111.8	118.9	120.5	124.8	114.9	105.8	121.1	120.2
Oct	125.6	121.8	108.8	110.3	116.6	126.7	113.2	105.7	120.7	119.5
Nov	126.1	122.1	109.1	114.2	117.7	127.4	112.7	105.8	121.3	120.2
Dec	126.1	121.2	110.1	105.2	116.2	129.0	111.3	106.5	121.3	120.1
1994 Jan	127.3	122.0	112.9	..	117.8	127.3	116.0	107.4	121.8	120.7
Feb	126.8	123.2	110.7	..	116.5	129.4	113.0	110.8	122.0	120.9
Mar	127.7	124.4	113.9	..	118.3	131.4	113.9	113.4	123.5	122.7
Apr	128.4	113.5	108.6	..	..	130.1	..	111.4	121.7	..
May	128.4	..	110.8	..	..	..	..	..	..	..
Jun	128.7	..	..	..	..	..	..	..	..	..
Percentage change average of latest three months on that of corresponding period of previous year										
1994 May	*4.1*	..	*0.4*	..	..	..	..	..	..	..
Jun	*3.9*	..	..	..	..	..	..	..	..	..
Percentage change average of latest three months on previous three months										
1994 May	*1.2*	..	*−0.1*	..	..	..	..	..	..	..
Jun	*1.0*	..	..	..	..	..	..	..	..	..

1 Western Germany (Federal Republic of Germany before unification)
2 Estimates due to rebasing to 1990

Chart I: Gross domestic product

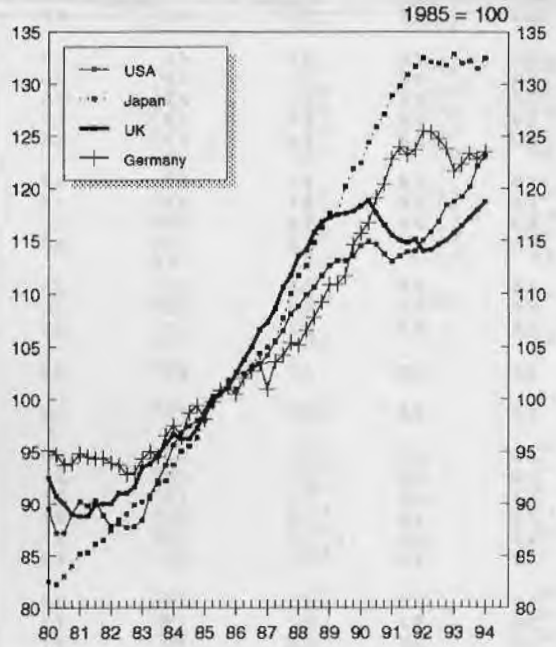


Chart II: Consumer price index

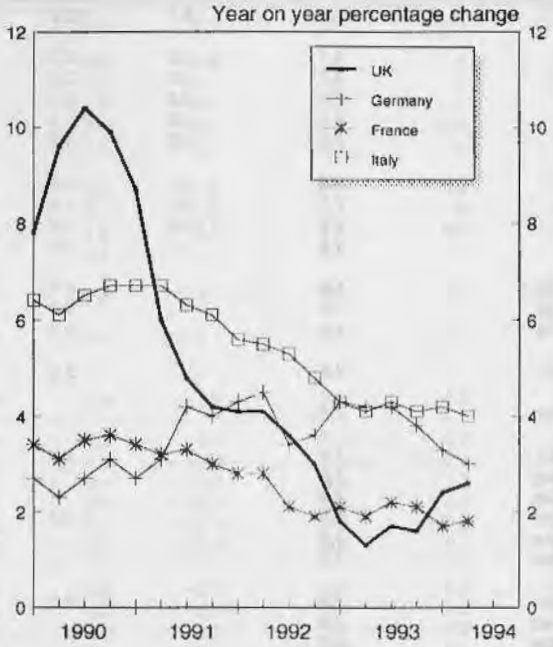
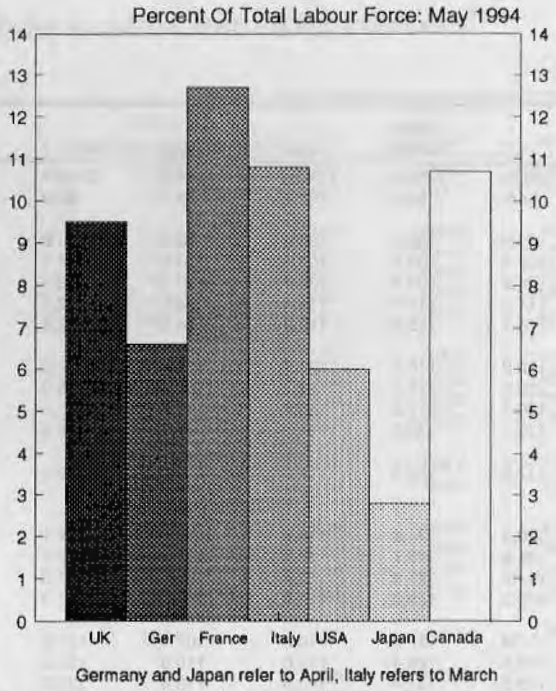


Chart III: Standardised unemployment



Germany and Japan refer to April, Italy refers to March

Chart IV: Current account balance - percentage of GDP at market prices

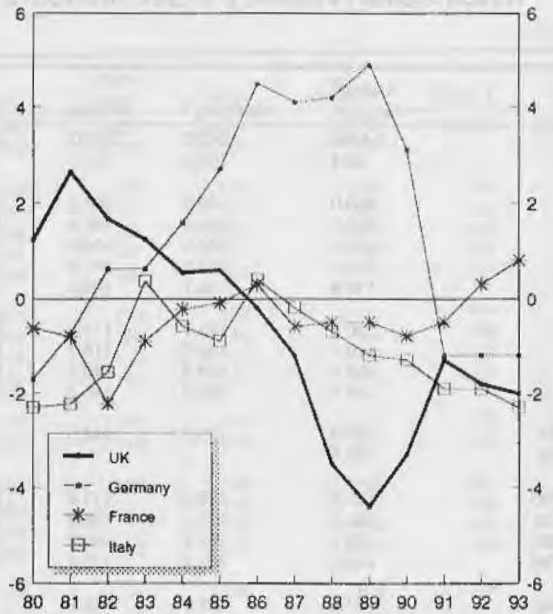


Chart V: Industrial production

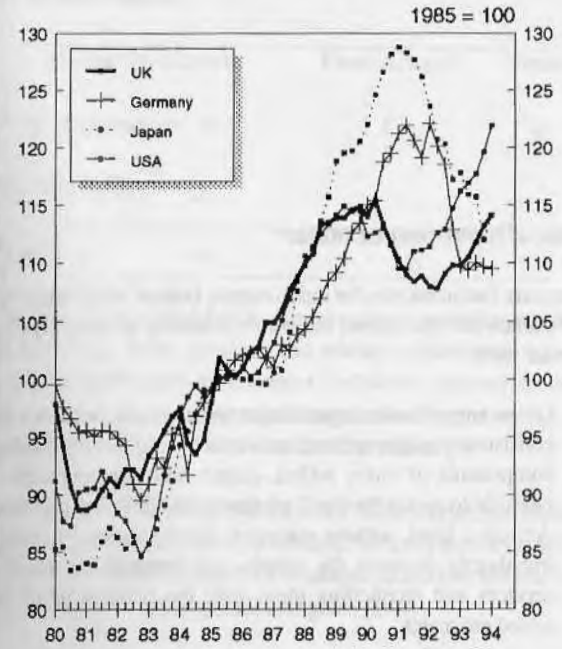


Chart VI: Producer price inflation

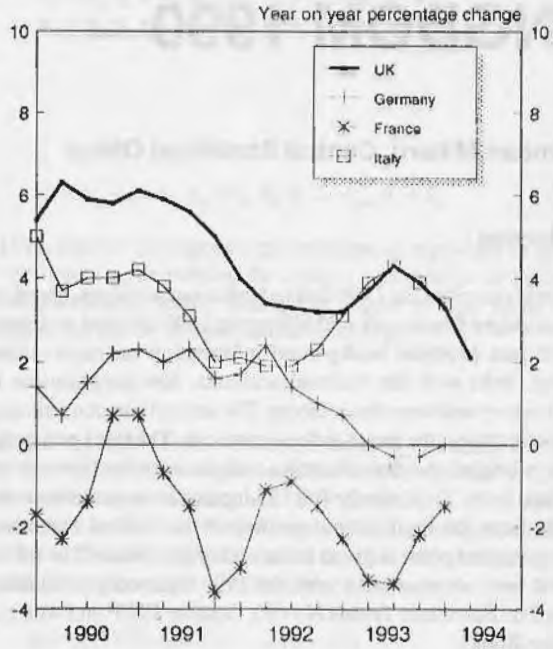


Chart VII: Employment

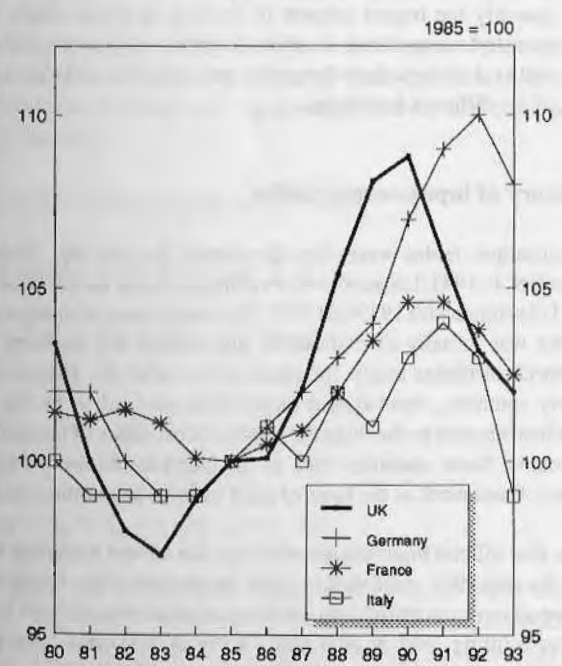
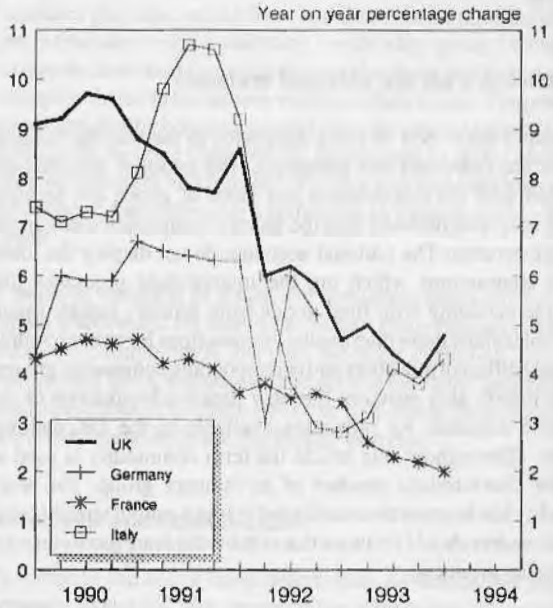


Chart VIII: Wage earnings (manufacturing)



INPUT-OUTPUT TABLES FOR THE UNITED KINGDOM 1990

by Duncan Millard, Central Statistical Office

Introduction

This article describes the 1990 derived input-output tables, based on the input-output framework underlying the 1990 national accounts. The first part provides background information on input-output including, links with the national accounts, how input-output is used, its history and some basic theory. The second part concentrates on the basic tables, the make and use matrices. The third part gives the theory behind the derived tables and presents the tables in an aggregated form. Tables in the full 123 input-output group form are available from the input-output section of the Central Statistical Office - a contact point is given at the end of the article. The tables presented here are consistent with the 1990 input-output balances published in Economic Trends No 480, October 1993[1] and with the 1993 blue Book[2].

What are input-output tables?

Input-output tables display the flow of goods and services in the economy in matrix form. They illustrate the relationship between producers and consumers and the interdependence among the different industries.

Relationship with the national accounts

Input-output tables add an extra dimension to the way the national accounts are complied and presented. The national accounts are concerned with the composition and value of goods and services entering into final demand, and the factor incomes generated in the economic process. The national accounts do not display the inter-industry transactions which are the intermediate processes that supply the economy with final goods from primary inputs. Input-output tables show these intermediate transactions for over a hundred and twenty different industries and corresponding commodity groups. The use matrix also provides the only detailed breakdown of the production accounts for industries available in the UK national accounts. (Throughout this article the term commodity is used to mean the characteristic product of an industry group. The word commodity has become the established in input-output terminology, however readers should be aware that commodities are more correctly described as products).

In the 1984[3] and earlier input-output tables, the figures used to compile the tables were constrained to those already published in the national accounts. For 1990 and subsequent years the situation has changed: the input-output framework is now integrated with the national accounts. Annual input-output balances are the mechanism used to ensure consistency between the output, income and expenditure components of GDP in the compilation of the accounts (see below).

A fuller description of the link between national accounts and input-output tables, including how all 3 measures of GDP can be calculated from the tables, is in the 1990 balance article[1] in Economic Trends.

Uses of input-output tables

There are two main uses for input-output, both of which make use of the framework that allows the whole economy to be analysed in a tabular form.

- On an annual basis, input-output balances are used to achieve consistency in the national accounts aggregates by linking the components of value added, output and final demand. It is possible to reconcile the 3 measures of GDP and produce the definitive level, without statistical discrepancies, by resolving imbalances between the supply and demand for goods and services and reconciling them with the corresponding value added estimates.

- Analytical input-output tables are used to model the economy through a disaggregated view of industrial behaviour. This allows economic questions to be answered such as: what will be the direct and indirect effect on the output of specific commodities given an increase in final demand? In addition, it is possible to quantify the import content of exports, to break down each industry's output into its ultimate primary input components, and to show how final demand is generated by the value added of the different industries.

History of input-output tables

Input-output tables were first developed in 1936 by Wassily Leontief. In 1941, Leontief produced the first input-output tables for the US economy for 1919 and 1929. The compilation of input-output tables was initially carried out by universities and planning and research institutes solely for input-output analysis. However, in many countries, input-output tables have evolved to be the key mechanism used in checking the internal consistency of the national accounts. Some countries such as the Netherlands use the input-output framework as the basis of their national accounting system.

The first official input-output tables for the United Kingdom were for the year 1954, published in 1961. Since then, tables based upon comprehensive inquiries into purchases of materials and fuels by the manufacturing (and in later years service) industries have been published at regular intervals for the years 1963[4], 1968[5], 1974[6], 1979[7], 1984[3] and now 1990. Input-output balances (a purchaser price use matrix and domestic output and total supply tables) have also been published for 1989[8] and 1990[1] and we are currently working on the balances for 1991 and 1992.

Input-output theory

The UK input-output tables follow the rules recommended by the United Nations in their System of National Accounts[9] and the subsequent volume Input-Output Tables and Analysis[10].

Input-output concentrates on the industry-production accounts, and a highly simplified accounting framework for input-output is shown in the diagram below:

Production sectors		Final demand	Totals
Production sectors	W	f	q
Primary inputs	y		
Totals	q		

To describe input-output theory at its simplest, consider an economy with no foreign trade, no taxes and where no distinction is made between industries and commodities. Industries, referred to here as production sectors, do not engage in any secondary production, and so produce only their own characteristic products.

Final demand (f) consists of consumers' expenditure, government final consumption and capital formation. Primary inputs (y) are the factor incomes generated in the production process ie. income from employment, self-employment and gross profits.

In the diagram, matrix W records the value of transactions between the production sectors in the economy and is known as a use matrix. A typical entry is w_{ij}, the amount bought by sector j of sector i's output. Commodity output is represented by q which, along with f and y, is a vector.

It is now possible to define the output of each production sector in terms of the amounts purchased by other production sectors (intermediate demand) and the amounts sold to final consumers (final demand).

For the whole economy we can write:

$$q_1 = w_{11} + w_{12} + w_{13} + ... + w_{1n} + f_1$$

$$q_2 = w_{21} + w_{22} + w_{23} + ... + w_{2n} + f_2$$

.
.
.

$$q_n = w_{n1} + w_{n2} + w_{n3} + ... + w_{nn} + f_n.$$

The above set of structural equations express the input-output relations in terms of the entries in the use matrix, but the matrix in coefficient form is more useful. A coefficient matrix records not the value of each transaction, but the amount of each commodity purchased per unit of output of the purchasing sector. To form such a matrix, each column of the use matrix W must be divided by the total gross output of the purchasing sector. This coefficient matrix is denoted by A where a typical cell a_{ij} is defined as the amount of commodity i used in the production of a unit of commodity j. In algebraic notation

$$w_{ij} = a_{ij} \hat{q}_j, \text{ or } A = W \hat{q}^{-1},$$

where $\hat{q}$ is the diagonal matrix form of the vector q.

A new set of structural equations can now be written as follows:

$$q_1 = a_{11} q_1 + a_{12} q_2 + a_{13} q_3 + ... + a_{1n} q_n + f_1$$
$$q_2 = a_{21} q_1 + a_{22} q_2 + a_{23} q_3 + ... + a_{2n} q_n + f_2$$

.
.
.

$$q_n = a_{n1} q_1 + a_{n2} q_2 + a_{n3} q_3 + ... + a_{nn} q_n + f_n.$$

Here, each of the input-output relations is expressed in terms of a coefficient a_{ij}, expressing the input as a proportion of the output of the purchasing sector, and q_j the output of that sector. These equations can be written in matrix form as:

$$q = Aq + f.$$

Equations in this form are suitable for model-building and analysis. If the values of the coefficients are known and the level of final demand known or assumed, it is possible to solve this set of equations to find the level of output of various commodities q. This leads to the well-known Leontief equation (of which more will be said later) where $(I-A)^{-1}$ is the Leontief inverse:

$$q = (I-A)^{-1}f \quad .....(1).$$

The basic tables

Valuation of transactions

All the matrices have been valued at basic prices, as distinct from purchasers' or producer prices. This means that the purchases in the purchaser price use matrix have had distribution margins deducted and reallocated to the distribution commodity groups. Commodity and production taxes less subsidies are also deducted from purchases and redistributed to the tax row within primary inputs. The production taxes have similarly been removed from the value of goods supplied in the producer price make matrix. Imports are recorded inclusive of carriage insurance and freight (cif). This is in line with international guidelines[10], but represents a difference in treatment from the 1984 tables[3].

A uniform valuation of goods and services is necessary so that the supply and demand for each input-output group balances. The basic price of a commodity is just that: the price excluding distribution margins and taxes. Because a basic price is the "true" price free from any impositions of taxation policy or non-production costs it is the preferred valuation to use for further analyses.

Industries and commodities

To simplify the above basic description, no distinction was made between industries and commodities (products). However, it is important that the actual difference is understood. Industries are defined using the 1980 version of the Standard Industrial Classification[11] and commodities are defined as the principle output of each industry. Producing units are classified to a particular industry according to which commodity they produce. If a unit produces more than one commodity, they are classified according to the commodity which accounts for the greatest part of their output. Because producing units also produce commodities that are the characteristic product of other industries, it is not possible to define the elements in the two classifications in such a way that there is a one-to-one correspondence between them. In tables 1 - 3 commodities are shown in the rows and industries are shown in the columns.

Table 1 - The 1990 make matrix

£ million

IO groups at 8 level (equivalent 123 groups)	Agric (1-3)	Energy (4-9)	Manuf (10-90)	Constrn (91)	Distribn (92-95)	Transport (96-102)	Business (103-114)	Other Ser (115-123)	Tot int
Agriculture	19,110	-	-	-	-	-	-	-	19,110
Energy	2	62,521	352	-	-	-	-	-	62,875
Manufacturing	23	207	270,902	-	-	-	-	-	271,133
Construction	155	1,140	417	88,389	-	-	-	-	90,101
Distribution	120	727	9,456	952	123,386	433	406	217	135,697
Transport	-	211	981	-	-	68,118	-	-	69,310
Business Services	227	478	6,217	378	1,768	1,403	150,779	2,043	163,294
Other services	73	26	324	147	355	129	1,770	154,996	157,821
Total intermediate	19,711	65,310	288,649	89,866	125,509	70,083	152,956	157,257	969,340

Table 1: the make matrix

This table provides a breakdown of domestic supply for each of the 123 commodities in terms of the producing industry (ie. "who makes what"). It shows for each commodity how much is produced by the industry for which it is the principal product (the diagonal entries) and how much is produced by other industries as secondary products (the off diagonal entries).

The nature (subsidiary or by-product) of the non-characteristic production is used in calculating the derived input-output tables. A subsidiary product is one with its own input structure and production process independent of the characteristic product of the industry in question. A by-product is produced as a part of the main production process (eg. sawdust from sawing logs). Using this structure industries can be transformed onto a commodity basis, so that commodity by commodity use matrices can be produced. The make matrix can also be used to transform commodities into industries to derive industry by industry use matrices.

Tables 2 and 3: the domestic and imports use matrices

Use matrices show the input structure of industries in terms of domestic and imported goods and services (ie. "who uses what"). They provide an analysis of primary inputs by industry, and show a commodity analysis of the categories of final demand. Sales are shown in the rows and purchases in the columns.

In the routine input-output balances, a combined use matrix is produced. This matrix makes no distinction between an input which is domestically produced or an imported one. However, for analytical work it is normal to isolate the use of domestic production. The use matrix is therefore split into a domestic use matrix (Table 2) and an imports use matrix (Table 3).

Each column in a use matrix breaks down the inputs to an industry between intermediate and primary inputs. In the domestic use matrix, apart from purchasing inputs of the products of other industries in the economy, industries also buy imports which are shown as a row in primary inputs. An industry pays wages and salaries to workers and indirect taxes to government. The excess of its output over the payment for intermediate inputs, wages and salaries and indirect taxes yields the gross operating surplus.

On the other hand, each row shows how a particular commodity is distributed to other industries, as an intermediate purchase, or as final demand to consumers' expenditure, general government final consumption (GGFC), gross domestic fixed capital formation (GDFCF), change in stocks and exports.

Table 2 - The 1990 domestic use matrix

£ million

(equivalent 123 grps)	Agric (1-3)	Energy (4-9)	Manuf (10-90)	Constrn (91)	Distribn (92-95)	Transport (96-102)	Business (103-114)	Other Ser (115-123)	Adjustment	Tot int
Agriculture	2,874	-	9,130	3	444	31	-	88	-	12,571
Energy	554	22,494	5,608	596	2,326	2,209	1,658	711	-	36,157
Manufacturing	3,828	3,208	62,312	14,710	12,262	4,312	7,897	3,549	-	112,080
Construction	242	28	1,006	22,991	631	146	1,701	951	-	27,695
Distribution	887	1,267	12,633	2,869	4,131	2,681	2,266	773	-	27,507
Transport	273	1,345	8,896	888	11,498	8,145	10,129	1,392	-	42,564
Business Services	688	1,543	21,137	8,083	14,692	7,246	35,794	5,199	24,972	119,354
Other services	383	349	3,804	401	1,014	966	3,010	6,139	-	16,065
Total intermediate	9,729	30,234	124,526	50,541	46,999	25,736	62,454	18,801	24,972	393,993
Imports	1,470	8,069	48,013	4,318	2,705	3,028	2,472	1,421	-	71,495
Sales by f demand	22	61	1,949	159	143	211	1,240	95	-	3,881
Taxes less subs	-433	3,148	3,596	319	7,587	1,036	4,997	836	-	21,086
Income from empl	3,085	8,807	75,106	16,358	47,385	23,042	49,055	89,520	-	312,358
Gross profits etc	5,838	14,992	35,459	18,171	20,691	17,029	32,737	46,583	-24,972	166,527
Total inputs	19,711	65,310	288,649	89,866	125,509	70,083	152,956	157,257	-	969,340

Table 2 cont.

	Cons exp	GGFC	GDFCF	Stocks	Exports	Total FD	Total
Agriculture	4,702	146	-	94	1,597	6,539	19,110
Energy	15,464	2,465	-	-194	8,983	26,718	62,875
Manufacturing	41,651	11,697	22,732	-1,313	84,287	159,053	271,133
Construction	5,395	4,802	51,269	881	60	62,407	90,101
Distribution	88,287	1,869	2,376	-	15,657	108,189	135,697
Transport	14,344	2,503	612	-	9,287	26,745	69,310
Business Services	21,288	6,179	8,663	-	7,811	43,940	163,294
Other services	67,774	73,076	-	-	905	141,755	157,821
Total intermed	258,905	102,737	85,652	-533	128,586	575,348	969,340
Imports	43,968	10,091	21,294	-585	2,022	76,790	148,285
Sales by f demand	5,387	-7,584	-4,360	-	2,676	-3,881	-
Taxes less subs	42,323	4,634	4,190	-	-	51,146	72,232
Income from empl	-	-	-	-	-	-	312,358
Gross profits etc	-	-	-	-	-	-	166,527
Total inputs	350,583	109,878	106,776	-1,118	133,284	699,403	1,668,743

There is very little information on the domestic/imports split of the demand for goods and services. Trade data is used for total imports, which can in some cases be supplemented to allow an allocation of imported goods to a specific category of final demand such as capital formation. There is a limited amount of industry specific information on purchases (eg DTI data on the coal industry) which allows a more definite allocation to be made for those industries. In general, the sum of the two matrices (the combined use matrix) is significantly more reliable than the two separate analyses of the demand for domestic and imported goods and services.

Table 3 - The 1990 imports use matrix

£ million

(Equivalent 123 grps)	Agric (1-3)	Energy (4-9)	Manuf (10-90)	Constrn (91)	Distribn (92-95)	Transport (96-102)	Business (103-114)	Other Ser (115-123)	Tot int
Agriculture	644	-	1,930	-	387	6	-	-	2,967
Energy	63	6,284	1,342	-	59	502	10	22	8,282
Manufacturing	749	978	43,671	4,182	1,675	695	83	215	52,247
Construction	-	-	-	-	-	-	-	-	-
Distribution	-	-	-	-	5	7	-	-	13
Transport	4	757	322	29	494	1,725	259	29	3,619
Business Services	10	46	674	107	82	55	2,096	44	3,115
Other services	-	4	73	-	3	37	24	1,111	1,253
Total intermediate	1,470	8,069	48,013	4,318	2,705	3,028	2,472	1,421	71,495

	Cons exp	GGFC	GDFCF	Stocks	Exports	Total FD	Total
Agriculture	1,083	-	-	18	40	1,142	4,108
Energy	554	31	-	-29	-	556	8,838
Manufacturing	31,041	7,969	21,200	-574	1,982	61,619	113,865
Construction	-	-	-	-	-	-	-
Distribution	5,943	-	-	-	-	5,943	5,956
Transport	4,059	483	93	-	-	4,635	8,254
Business Services	191	899	-	-	-	1,090	4,205
Other services	1,096	710	-	-	-	1,805	3,058
Total intermediate	43,968	10,091	21,294	-585	2,022	76,790	148,285

The derived input-output tables

Symmetric tables

The text above describes the difference between commodities and industries and explains that because industries produce non-characteristic production there is not a one-one link between them. However, to transform the relationship between supply and demand for commodities from the one represented by the equation

$$q = Bg + f \quad \ldots\ldots(2)$$

into an equation that can be solved for q, ie

$$q = Aq + f \quad \ldots\ldots(3)$$

the vectors of commodity and industry output need to be identical.

In equations (2) and (3) the following notation is used:

- q is the commodity output vector;
- B is the coefficient form of the commodity by industry use matrix;
- g is the industry output vector; and
- f is the final demand vector.

To achieve the identity between commodity and industry output the use matrix needs to be transformed into a symmetric commodity by commodity (or industry by industry) version. In equation (3), A represents the coefficient form of the symmetric commodity by commodity matrix. Once equation (3) is established it can be solved to give equation (1), ie:

$$q = (I-A)^{-1}f.$$

It is possible to generate a symmetric matrix using the structure of the make matrix (to identify the non-characteristic, off-diagonal, production) together with some simple assumptions on the nature of the technology used in the production of non-characteristic products.

Two alternative basic assumptions are used - the commodity technology assumption and the industry technology assumption.

- The commodity technology assumption is that a commodity has the same input structure no matter which industry produces it (this sort of production can be thought of as subsidiary production).
- The industry technology assumption is that all commodities produced by an industry have the same input structure (this sort of non-characteristic production can be thought of as by-products). Under the industry technology assumption, commodities have a different input structure depending on which industry produces them.

If the make matrix is represented by M, the commodity output vector by q, the industry output vector by g, and the corresponding diagonal matrices by $\hat{q}$ and $\hat{g}$, then:

$$C = M\hat{g}^{-1} \quad \ldots\ldots\ldots\ldots\ldots (4)$$

and is known as the product mix matrix (each c_{ij} represents the amount of commodity i produced by industry j per unit level of industry j output). It is simply the make matrix with each cell divided by the industry output relevant to that column.

$$D = M'\hat{q}^{-1} \quad \ldots\ldots\ldots\ldots\ldots (5)$$

is known as the market shares matrix (each d_{ij} is the proportion of commodity j output produced by industry i per unit level of commodity j output). It is the make matrix transposed with each cell divided by the commodity output relevant to the new columns.

In order to treat the various elements of production according to the different technology assumptions, the make matrix has to be split into two matrices M_1 and M_2:

- M_1 consists of all the diagonal elements plus those off-diagonal elements for which a commodity technology assumption seems most appropriate.
- M_2 contains those off-diagonal elements for which an industry technology assumption seems most appropriate.

The coefficient form of the commodity by commodity version of the use matrix is then given by:

$$A = B\,[C_1^{-1}\,(I - \widehat{D_2'i}) + D_2] = BR \quad \ldots\ldots (6)$$

where i is the unit vector and

$$C_1 = M_1\hat{g}_1^{-1}$$

$$D_2 = M_2'\hat{q}^{-1}.$$

R is known as the hybrid technology transformation matrix, because it encompasses both technology assumptions. A full description of the underlying theory of the transformations discussed in this section can be found in Technology assumptions in the construction of UK input-output tables[12].

By multiplying matrix A by the commodity output vector q, the commodity by commodity matrix can be shown in value form. Table 4, created using this method, is an aggregated version of the commodity by commodity domestic use matrix for 1990. A commodity by commodity imports use matrix can be calculated in a similar manner, where the starting matrix B is the coefficient form of the imports use matrix.

Table 4 - The 1990 commodity by commodity domestic use matrix

£ million

(Equivalent 123 grps)	Agric (1-3)	Energy (4-9)	Manuf (10-90)	Constrn (91)	Distribn (92-95)	Transport (96-102)	Business (103-114)	Other Ser (115-123)	Tot int
Agriculture	2,853	0	9,059	3	536	32	0	88	12,571
Energy	550	22,203	5,377	598	2,670	2,241	1,824	694	36,157
Manufacturing	3,774	2,896	60,613	14,961	13,372	4,290	8,763	3,410	112,080
Construction	186	-	791	23,022	760	128	1,808	999	27,695
Distribution	873	1,220	12,171	2,891	4,438	2,700	2,472	742	27,507
Transport	266	1,253	7,251	846	12,956	8,091	10,599	1,303	42,564
Business Services	1,010	1,648	21,717	9,008	18,348	7,336	49,008	11,278	119,354
Other services	375	331	3,518	403	1,118	949	3,314	6,059	16,065
Total intermediate	9,888	29,550	120,498	51,732	54,197	25,767	77,789	24,572	393,993
Imports	1,453	8,005	47,084	4,334	3,190	3,019	2,999	1,412	71,495
Sales by final demand	10	52	1,899	136	109	184	1,411	80	3,881
Taxes on exp less subs	-434	3,096	2,690	273	8,427	1,022	5,271	741	21,086
Income from employment	2,966	7,918	69,787	16,703	50,599	22,953	52,776	88,656	312,358
Gross profits etc	5,228	14,255	29,176	16,923	19,175	16,365	23,047	42,359	166,527
Total inputs	19,110	62,875	271,133	90,101	135,697	69,310	163,294	157,821	969,340

Table 4 cont.

	Cons exp	GGFC	GDFCF	Stocks	Exports	Total FD	Total
Agriculture	4,702	146	-	94	1,597	6,539	19,110
Energy	15,464	2,465	-	-194	8,983	26,718	62,875
Manufacturing	41,651	11,697	22,732	-1,313	84,287	159,053	271,133
Construction	5,395	4,802	51,269	881	60	62,407	90,101
Distribution	88,287	1,869	2,376	-	15,657	108,189	135,697
Transport	14,344	2,503	612	-	9,287	26,745	69,310
Business Services	21,288	6,179	8,663	-	7,811	43,940	163,294
Other services	67,774	73,076	-	-	905	141,755	157,821
Total intermediate	258,905	102,737	85,652	-533	128,586	575,348	969,340
Imports	43,968	10,091	21,294	-585	2,022	76,790	148,285
Sales by final demand	5,387	-7,584	-4,360	-	2,676	-3,881	-
Taxes on exp less subs	42,323	4,634	4,190	-	-	51,146	72,232
Income from employment	-	-	-	-	-	-	312,358
Gross profits etc	-	-	-	-	-	-	166,527
Total inputs	350,583	109,878	106,776	-1,118	133,284	699,403	1,668,743

The main focus in this article here has been on commodity by commodity tables rather than industry by industry tables. This is in line with the 1984[3] tables, but unlike previous tables produced for the UK. The main reason for showing industry by industry tables was that it was industry which was of interest to analysts of the United Kingdom economy. However, it can be argued that the commodity by commodity table is more in line with the assumption of homogenous production than the industry by industry table. Since in the latter a single row may contain many products. The significance of homogeneity to input-output work makes the commodity by commodity tables a better starting point.

Industrial analyses can still be carried out using the full tables available associated to this article. A note describing a method for doing so is at Appendix 1 to this article. Further advice on how to use the commodity by commodity tables to do industrial analysis is available from input-output section of the CSO.

The Leontief inverse

The link between commodity output and final demand is given by the Leontief inverse repeated in the equation below:

$$q = (I-A)^{-1}f .$$

Let l_{ij} represent any cell in the inverse matrix. The l_{ij} can be interpreted as the amount of gross output of commodity i needed both directly and indirectly to produce one unit of commodity j for final output. The aggregate form of this matrix (with all entries multiplied by 1,000) is given in Table 5.

Table 5 - The Leontief inverse

(Equivalent 123 grps)	Agric (1-3)	Energy (4-9)	Manuf (10-90)	Constrn (91)	Distribn (92-95)	Transport (96-102)	Business (103-114)	Other Ser (115-123)	Total
Agriculture	1,189.2	4.5	52.8	13.2	11.7	5.7	5.2	2.5	1,284.7
Energy	71.4	1,554.8	52.1	33.5	49.4	67.5	37.0	12.1	1,877.8
Manufacturing	337.2	109.3	1,334.2	324.6	171.3	121.6	125.4	44.0	2,567.7
Construction	20.3	2.3	9.6	1,349.2	13.0	7.1	23.4	11.0	1,435.9
Distribution	78.7	40.0	71.4	67.3	1,053.4	57.5	35.6	10.6	1,414.3
Transport	51.4	49.4	64.1	51.3	139.1	1,159.2	117.7	21.4	1,653.5
Business Services	160.4	87.9	186.0	254.7	250.7	206.7	1,476.6	119.1	2,742.1
Other services	34.1	13.0	24.9	17.8	19.2	23.5	35.3	1,043.6	1,211.2
Total	1,942.6	1,861.2	1,795.1	2,111.5	1,707.7	1,648.8	1,856.1	1,264.2	14,187.2

The data in the Leontief inverse can be interpreted in many ways. The column sum measures the direct and indirect result on the economy of a unit change in the final demand for the commodity at the head of the column. For example, using the above table, if the final demand for agriculture increased by 1,000 units the total effect on the economy would be to increase output by 1,942.6 units. The column sums, when shown in terms of a unit of domestic output, are known as the output multipliers.

Similarly, a row sum shows the total change in an industries' output of a uniform unit increase in the final demand for all commodities. If the final demand for all 8 commodities in the above table increased by 1,000 the output of the transport industry would increase by 1,653.5 units.

The Leontief inverse is especially useful as it shows the amount of one commodity needed directly and indirectly to produce another. This can be seen by examining the power series expansion of the inverse, shown in the equation below (where A is the coefficient form of the commodity by commodity use matrix).

$$(I-A)^{-1} = I + A + A^2 + A^3 + A^4 + A^5 + \ldots\ldots\ldots\ldots(7).$$

In equation (7) A is the direct demand for each commodity. The succeeding terms are the indirect demands resulting from each loop of the economic process. For example, if the demand for commodity i increased there would be a direct increase in the output of commodity i. However, commodities j and k may be needed in the manufacture of commodity i and these may in turn require a certain amount of commodity i to produce them. Hence there will be a further indirect increase in the demand for commodity i, which in turn will generate further indirect demand for j and k and thus i. It can also be shown[10] that after 6 or 7 economic loops the indirect terms become insignificant.

The primary input content of final demand

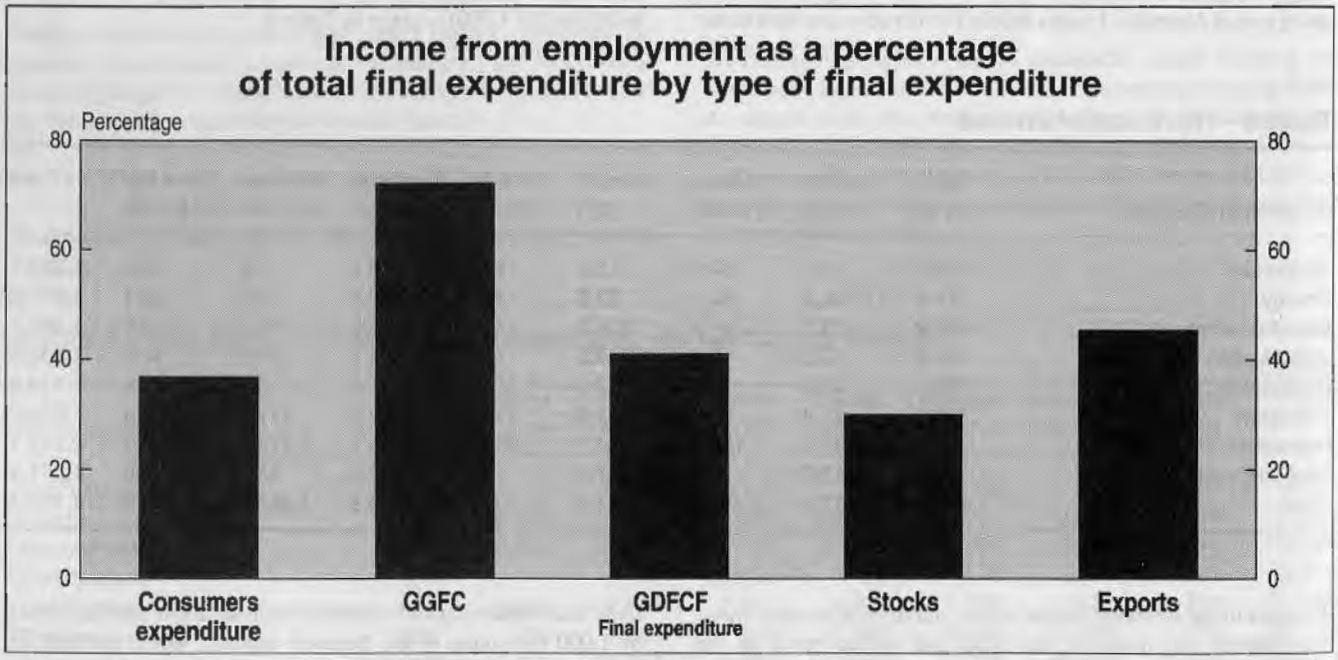
By multiplying each row of the inverse by the appropriate ratio of primary input to gross output for that commodity, it is possible to generate a picture of final demand in terms of the primary inputs needed to generate it, both directly and indirectly. Repeating this analysis for all the primary inputs and summing over all the commodities produces the absolute content of final demand categories in terms of original primary inputs. This is shown in Table 6 below.

Table 6 - Primary input content of final expenditure in 1990

£ million

	Cons exp	GGFC	GDFCF	Stocks	Exports	Total
Imports of goods and services	70,513	14,779	33,943	-827	29,876	148,285
Sales by final demand	6,569	-7,326	-3,506	-29	4,292	-
Taxes on expend less subs	54,341	5,967	6,791	-15	5,147	72,232
Income from employment	129,035	79,305	43,811	-335	60,543	312,358
Gross profits etc	90,124	17,152	25,737	88	33,426	166,527
Total inputs	350,583	109,878	106,776	-1,118	133,284	699,403

Examining the above table in percentage terms shows that the composition of expenditure groups varies substantially. For example, nearly 32% of investment (GDFCF) is made up of imports compared to just 13% of general government expenditure (GGFC). A similar comparison for income from employment, in the graph below, shows income from employment comprising three quarters of government final expenditure compared to less than two fifths for consumers' expenditure.



Derived tables - general notes

The simple Leontief model based upon input-output tables contains two major assumptions:

- Industry output can be represented as a linear combination of its inputs.
- The input-output industry and commodity groups are homogeneous.

Any significant departure from these two assumptions may affect the quality of analysis carried out.

The number of input-output groups was expanded for the 1990 balances and the table presented here to 123. The expansion was concentrated in the service sector where business services and other services have been divided up. There has also been some re-organisation of energy groups and a split in forestry and fishing. The definition of the groups in terms of the SIC(80)[11] for 1990 and 1984 can be found in references 1 and 3 respectively.

In the 1990 balance tables[1] a new treatment of general government final consumption was introduced. This entailed splitting general government purchases between the service industries of government eg education and health and including these transactions in the relevant industry columns in the use matrix. Government was then shown as purchasing all of its own output in the final demand column. For consistency with previous input-output tables the old treatment has been adopted here. This means that government is shown purchasing individual commodities in the final expenditure column.

The adjustment for financial services in the income measure of GDP as shown in the national accounts represents the net receipt of interest by financial institutions. This is, by convention, not included in the measure of output of the banking industry, which results in a negative profit for this industry. To overcome this presentational problem in the input-output tables, the adjustment for financial services has been added to the measure of profits for the banking industry and subtracted from total value added by an element in the profits row under the adjustments column. To prevent an imbalance between supply and demand, a figure for demand for this adjustment has also been placed in the adjustments column, and the measure of gross output of the banking industry in the make matrix reflects the addition of the financial services adjustment. Similar measures are taken for the financial services adjustment in insurance.

The adjustment column is economically meaningless for the input-output analyses. Therefore, before the use matrix could be transformed to a commodity by commodity version the adjustment for financial services was distributed through the banking (insurance) product row increasing intermediate consumption. A counterbalancing amount was then subtracted from the profits of each industry leaving gross output unchanged. This reallocation is not strictly accurate as the adjustment for financial services includes payments by consumers, but to adjust final demand components would require a change to the measure of GDP and this has been avoided. The method used for 1990 is equivalent to the one used for 1984 except that for 1990 the allocation of the financial services adjustment to industries was done on the basis of bank deposits and not gross output.

General sources and methods

A full explanation of the data sources used to construct these tables including final demand is given in the 1990 balance article[1].

For a fuller description of the methods used to compile the 1990 input-output tables see Armstrong[10] or Bulmer-Thomas[13]. Previous versions of input-output tables for the UK, referenced below, may also prove useful.

Computer readable data

Data are available for the full 123 by 123 matrix in computer readable form and as hard-copy. The computer readable tables are available as either ASCII files or Lotus 1-2-3™ spreadsheets on 3 1/2 or 5 1/4 inch floppy disks. They can be accessed from an IBM-PC™ compatible computer running DOS 3.0 or higher. A handling charge of £50 will be made for the set of tables. The previous 1990 balances published in October 1993 are also available in the same computer readable form for a handling charge of £30.

Contact points

Enquiries on data availability should be addressed to:

Maxine Richards
Input-Output Section
Room 131A/2
Central Statistical Office
Great George Street
London SW1P 3AQ

Tel : 071-270 6045

All other enquiries should be made to Mr Duncan Millard at the same address, or by phone on 071-270 6062.

Acknowledgement

I would like to thank Ian Gouldson, Sanjiv Mahajan and Neil O'Driscoll for their help in producing these tables.

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UK 1989 Energy Input-Output tables

The Department of Trade and Industry (in conjunction with Keele University and the Statistical Office of the European Community) have produced a set of Energy Input-Output tables for 1989.

The tables provide a disaggregated picture of the energy flows in the UK economy. They provide a detailed analysis of the pattern of energy supply and demand, with ten of the 59 sectors used in the tables being energy specific. A distinctive feature of the tables is that they are expressed in energy units as well as value terms.

Further information on the tables can be obtained from Mr Mike Cornish at the DTI on 071-238-3590. Copies of the tables in computer readable Lotus 1-2-3™ format and hard copy are available for a handling charge of £25 from Dr J L R Proops, Department of Economics, Keele University, Keele, Staffordshire, ST5 5BG.

Appendix 1

Note on using commodity by commodity tables to carry out industrial analysis

The Leontief equation, $q = (I - A)^{-1}f$, gives the change in commodity output associated with a change in final demand. It is possible to use the largely diagonal structure of the make matrix and the Market Share Mix (MSM) hypothesis to translate the change in commodity output into a change in industry output.

The diagonal nature of the make matrix demonstrates a strong (although not one - one) relationship between commodities and industries. So a change in one will be closely mirrored by a change in the other.

The MSM hypothesis is used in the derivation of the analytical input-output tables. It is represented by the equation:

$$D = M\hat{q}^{-1}$$

where $\hat{q}$ is the diagonal matrix form of the commodity output vector. Each d_{ij} is defined as the proportion of commodity j output produced by industry i per unit level of commodity j output, ie all the industries that produce commodity j do so in fixed ratios. This means that if industry i produces a tenth of the total output of commodity j it will also produce a tenth of any extra commodity j required to meet an increase in final demand. Matrix D is the coefficient form of the make matrix under the MSM hypothesis.

Let ▲ (the delta symbol) represent a change in. Then we have:

$$\blacktriangle q = (I-A)^{-1}\blacktriangle f.$$

So ▲q is the change in the commodity output resulting from the change in final demand. Then multiplying the change in commodity output by the matrix D generates the change in industry output, given by:

$$\blacktriangle g = D\blacktriangle q.$$

Once the change in industry output is calculated it can be used to calculate the change in any of the primary inputs (eg. income from employment, value added etc) for each industry. For example the change in income from employment, Ie, would be:

$$\blacktriangle Ie = Ie\,(\blacktriangle g/g),$$

or in matrix notation:

$$\blacktriangle Ie = Ie\,\widehat{[\blacktriangle g\hat{g}^{-1}]}.$$

Notation:

- q = the commodity output vector
- A = the coefficient form of the commodity by commodity use matrix
- f = the final demand vector
- g = the industry output vector.

Using the method described above will produce results of comparable (if not greater) accuracy to those produced using the Leontief inverse based on the industry by industry use matrix. The calculation of the industry by industry table requires the final demand components to be transformed from a commodity to an industry basis. Apart from introducing a further transformation, this can introduce errors of classification and interpretation because final demand is clearly defined in terms of commodities not industries. It is questionable whether the question 'what is the change in output of industry A resulting from an increase of x in the final demand for industry's B output?' actually makes economic sense. It is better to formulate the question in terms of identifiable commodities and then use the above methodology to work out the associated change in industrial output.

TESTING FOR BIAS IN INITIAL ESTIMATES OF THE COMPONENTS OF GDP

U M Rizki, Central Statistical Office

Introduction

This article continues the series of articles analyzing the revisions data to test for bias in the initial estimates of main economic indicators. The last article published in May 1994 indicated that initial quarterly estimates of annual growth rates of gross domestic product (GDP) showed some evidence of bias. The present article analyses the revisions to growth rates of the components of GDP, when examined in terms of income, expenditure, and output in order to identify which of the individual components contributed to the bias in the aggregated measure of GDP. It updates the results published in the February 1994 issue of Economic Trends.

The growth rates examined in this article relate to 40 quarters over a ten year period from Q4 1980 to Q3 1990 inclusive. These initial estimates were those published in April 1981 to January 1991 respectively. These have been compared with the corresponding "final" estimates published three years later in April 1984 to January 1994 respectively. The growth rates for each quarter are the percentage changes since the corresponding quarter a year earlier.

Since 1993, the estimates of the expenditure, income and output components of GDP have been published in a new CSO publication called "UK Economic Accounts - A Quarterly Supplement to Economic Trends". Before this they were published in a quarterly article in Economic Trends. The data analyzed 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 covered relate to estimates of growth rates into 1990. The analysis in this article, therefore, 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 the CSO. The results of these changes would only be seen in shorter term revisions, which are not covered in this article.

Methods of Testing for Bias

The methods used for the present analysis are the same as described in the article published in the May '94 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.

A standard t-test is not usually appropriate for testing the significance of mean revisions when the successive values in a revision series are frequently correlated. The t-test requires the conditions of normality and the independence of successive values. While the revision 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 formulae 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 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 for serial correlation, 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 were 10 years from 1984 to 1993 and 5 years from 1989 to 1993 inclusive. The dating here refers to publication of the revised data. For example with the long term revision to the total expenditure component, the revision taken is three years after the first publication, the final value included relates to Q3 1990, the thirteenth published estimate of which appeared in the Quarterly Supplement to Economic Trends in January 1994.

It was, however, felt that to test the effects of the economic cycles properly, the overestimation or underestimation of the growth rates, a longer series of data were needed. Twelve years of data were thus used for each indicator for this purpose. Out of 48 values in these twelve years, covering the initial estimates from 1979 to 1990, 28 values were associated with the expansion and 20 with the contraction phases.

Main Results

- Out of the 23 GDP components tested only 4 showed significant evidence of bias. These were the total expenditure component at constant prices, the total income component, "other" income and manufacturing output.

- In the phase analysis over the whole 12 years, 10 out of the 23 components showed significant bias during the expansion phases of the economy. None of the components showed evidence of bias in 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, eg. the total GDP expenditure component, and then the individual components are examined separately. Also included in the annex are separate graphs for each indicator, showing the magnitude of the individual revisions over the latest 10 year period.

Technical Notes:

In the Previous articles we used the Cochrane-Orcutt procedure to allow for serial correlation when fitting a regression model

$$Y_t = \mu + \beta X_t + \varepsilon_t$$

where the errors $\{\varepsilon_t\}$ are thought to be serially correlated and follow an autoregressive model of order one (AR1) namely

$$\varepsilon_t = \alpha \varepsilon_{t-1} + u_t$$

where the $\{u_t\}$ are independent and the constant α is such that $|\alpha| < 1$ for stationarity.

In this article we use a simpler procedure. For an (AR1) process it can be shown (Priestley, *Spectral Analysis and Time Series*, 1981, p.320) that the variance of the sample mean is given (approximately) by $\sigma^2(1 + \alpha)/n(1 - \alpha)$; σ^2 denotes variance of the usual process. When α is zero (no serial correlation) this formula reduces to the usual formula, namely σ^2/n. The equivalent number of independent observations will be
$n(1 - \alpha) / (1 + \alpha)$.

The variance is estimated (Box and Jenkins, *Time Series Analysis, Forecasting and Control*, 1976, p.195) by

$$s^2_{\bar{x}} = s^2 (1 + r) / n(1 - r)$$

where s^2 denotes the usual estimate of variance and r equals first order serial correlation of revisions.

A corrected t-statistic, therefore, would be calculated directly (wihout needing to use the CO procedure) by

$$t = \text{mean revision}/s_{\bar{x}}$$

with $n^* = n(1 - r^2) / (1+r^2)$ degrees of freedom. This n^* represents the equivalent number of independent observations for estimating variance (Priestley, 1981, p.327).

Components of Total Expenditure

Estimates of the total expenditure component of GDP, at current and constant prices are published in table A27 in the Quarterly Supplement to Economic Trends. The individual expenditure components are published in table A2 in the same publication.

The mean revision to the growth rates of **total expenditure** at current prices was 0.71 percent over the 10 year period ending December 1993. Over the latter 5 year period it was 1.10 percent.

The corresponding figures in constant prices were 0.66 for the 10 year period and a higher figure of 0.90 for the 5 year period (1988-1992). The total expenditure at constant prices over the 10 year period showed a t-value significant at the 5% level, indicating a bias in the initial estimates. These figures are lower than those published in the February article.

The components which contributed most to the revisions to the total expenditure were **consumers' expenditure** and **gross domestic fixed capital formation (GDFCF)**. These two items together account for more than 60% of the total GDP expenditure component of GDP.

The mean revisions for consumers' expenditure and GDFCF, at both current and constant prices, were reduced over the ten and five year periods since the previous analysis. The t-values for consumers' expenditure and GDFCF at both current and constant prices were not significant.

General government final consumption (GGFC) represents the total of local authority and central government current expenditure on goods and services.

The average revision to the annual growth rate of GGFC was higher in the latest 5 year period than in the 10 year period studied. All the t-values, over both spans and at both price measures however, were non-significant.

Exports are added to the total domestic expenditure to get total final expenditure, while **imports** are subtracted from the final expenditure to arrive at the total expenditure component of GDP.

The t-values for the average revision to the growth rates of both exports and imports were non significant for the current and constant price measures for both time spans.

The phase analysis over the 12 years showed that none of the expenditure components at either price measure showed evidence of bias during the contraction phases of the economy. There was evidence of bias during the expansion phases; revisions to total expenditure being significant at the 5% level at current prices, and at the 1% level at constant prices. GDFCF was significant at the 1% level at both current and constant prices. None of the other expenditure components showed evidence of significant bias.

The other total GDP expenditure components are **value of increase in work and stocks in progress, subsidies and taxes on**

expenditure, which is a negative item. These components have not been included in this study.

Components of Total Incomes

The total income component of GDP is published in table A27 in the Quarterly Supplement to Economic Trends. 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 income** was higher in the 5 year period than in the 10 year period covered. The t-value, after allowing for serial correlation was non-significant for the 10 year period, but highly significant (at the 1% level) in the latter 5 year period. Out of the 20 revision values in the latest 5 years, there were 17 positive and only 3 negative values.

The components which contributed most to the overall mean revision were **"other" income (sum of income from self employment and rent)** and **gross trading profits of companies (GTPC)**. Only the t-value for "other" income over the latest 5 year period showed some evidence of bias. The mean revision for "other" income over the latest 5 year period was 2.46, but the 10 year mean revision to "other" income was much lower at 1.38. The non-significant t-value for GTPC was due to a high standard deviation which was in turn the result of a very wide range of revisions, mostly made in the latter 5 years of the ten year period. The range of revisions to the growth rates of GTPC in the latest 5 years was from -8.82 to 19.74 (7 negative and 13 positive).

The mean revisions to **income from employment** over the 10 and 5 year periods were very low, with corresponding low non-significant t-values.

None of the income components showed evidence of bias in the contraction phases of the economy. During the expansion phases of the business cycle, both income from employment and "other" income had mean revisions that were significant at the 1% level. The mean revision to total incomes was also significant during the expansion phases, though to a lesser degree.

The other income components of GDP are **gross trading surpluses of public corporations and general government, non trading capital consumption** and **stock appreciation** (which is a negative item). These components have not been included in this study.

Components of Output

The total output component of GDP is published in table A27 in the Quarterly Supplement to Economic Trends. 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 much lower in the latest five years than in the 10 year span to 1993. The t-values for total output for both the 10 and 5 year spans were not significant.

The components of output which contributed most to the overall mean revision were **agriculture, forestry and fishing (AFF), manufacturing** and **"other" services**. Only manufacturing had a significant t-value in the 10 year period. The t-values for manufacturing in the latest 5 years, and for "other" services and AFF for both time spans were not significant.

The other components of output, **construction, distribution hotels and catering, and transport and communication**, all showed non-significant t-values for both 10 and 5 year periods.

When tested for the effects of the economic cycles over the full 12 years, none of the components of GDP output showed any evidence of bias in the contraction phases of the economy. In the expansion phases however, three of the output components showed some phase effect in the initial estimates. The mean revision to the total output was 0.52 in the expansion phases, with a t-value significant at the 1% level. Manufacturing and "other" services also showed some indication of phase effect with significant t-values.

The other output components are **oil and gas extraction** and **other energy and water**. These components have not been included in this study.

TABLE 1: REVISIONS ANALYSIS: EXPENDITURE COMPONENTS AT CURRENT PRICES 1984 - 1993
REVISION: 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 Mean	t-value 1	% of + rev	% of - rev	Range of revision values	
											from	to
Total GDP expenditure component	10	40	1.32	0.71	1.54	0.54 **	0.45	1.59	70	30	-2.86	4.76
	5	20	1.56	1.10	1.70	0.56 **	0.72	1.54	75	25	-2.86	4.76
Consumer expenditure	10	40	0.89	0.54	1.02	0.59 **	0.32	1.69	63	38	-1.39	2.98
	5	20	1.14	0.74	1.26	0.68 **	0.65	1.14	65	35	-1.39	2.98
General govmnt final consumption	10	40	1.19	0.13	1.46	0.24	0.29	0.43	55	45	-3.84	3.01
	5	20	1.22	0.44	1.36	0.22	0.38	1.16	55	45	-1.93	3.01
Gross domestic fixed capital formation	10	40	3.74	2.37	3.77	0.61 **	1.20	1.96	68	33	-4.24	9.73
	5	20	4.33	3.40	3.81	0.63 **	1.79	1.90	75	25	-4.24	9.73
Exports	10	40	0.68	0.00	0.84	0.14	0.15	-0.03	50	50	-1.54	2.28
	5	20	0.70	-0.03	0.86	-0.06	0.19	-0.16	50	50	-1.54	1.51
Imports	10	40	0.79	0.30	1.04	0.22	0.21	1.46	58	43	-2.56	2.91
	5	20	0.60	0.32	0.79	-0.14	0.18	1.77	65	35	-1.02	2.08

NOTE: Ten year period runs from April '84 to Jan '94.
Five year period runs from April '89 to Jan '94.
These dates relate to the publication dates; e.g. the revision published in Jan 94 would relate to the initial estimate for Q3 1990.

1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative

* = significant at the 5% level; ** = significant at the 1% level.

TABLE 2: REVISIONS ANALYSIS: EXPENDITURE COMPONENTS AT CONSTANT PRICES 1984 - 1993
REVISION: 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 Mean	t-value 1	% of + rev	% of - rev	Range of revision values	
											from	to
Total GDP expenditure component	10	40	0.96	0.66	1.15	0.28	0.24	2.71 *	70	30	-1.19	4.39
	5	20	1.18	0.90	1.33	0.39 *	0.45	2.01	70	30	-0.85	4.39
Consumer expenditure	10	40	0.75	0.24	0.97	0.53 **	0.28	0.88	63	38	-1.63	2.85
	5	20	0.96	0.25	1.21	0.65 **	0.59	0.43	60	40	-1.63	2.85
General govmnt final consumption	10	40	0.91	-0.18	1.15	0.14	0.21	-0.87	35	65	-2.06	2.56
	5	20	1.01	0.25	1.29	0.13	0.33	0.76	50	50	-2.05	2.56
Gross domestic fixed capital formation	10	40	3.61	2.15	3.79	0.61 **	1.21	1.77	70	30	-5.09	8.88
	5	20	3.80	3.28	3.47	0.60 **	1.54	2.12	80	20	-2.29	8.88
Exports	10	40	0.85	0.06	1.12	0.27	0.23	0.26	48	53	-2.29	3.17
	5	20	0.96	0.16	1.27	0.26	0.37	0.44	50	50	-2.29	3.17
Imports	10	40	1.22	-0.34	1.55	0.51 **	0.43	-0.80	40	60	-4.12	2.46
	5	20	0.96	-0.05	1.23	0.26	0.36	-0.14	40	60	-2.16	2.46

NOTE: Ten year period runs from April '84 to Jan '94.
Five year period runs from April '89 to Jan '94.
These dates relate to the publication dates; e.g. the revision published in Jan 94 would relate to the initial estimate for Q3 1990.

1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative

* = significant at the 5% level; ** = significant at the 1% level.

TABLE 3: REVISIONS ANALYSIS: INCOME COMPONENTS AT CURRENT PRICES 1984 - 1993
REVISION: 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 Mean	t-value 1	% of + rev	% of - rev	Range of revision values from	to
Total GDP income component	10	40	0.92	0.44	1.19	0.38 *	0.28	1.56	65	35	-2.40	3.98
	5	20	0.82	0.78	0.82	0.19	0.22	3.48 **	85	15	-0.27	2.45
Income from employment	10	40	0.82	0.04	1.03	0.71 **	0.40	0.11	48	53	-2.52	1.95
	5	20	0.93	0.08	1.20	0.72 **	0.67	0.12	45	55	-2.52	1.95
Gross trading profits of companies	10	40	6.00	2.01	7.34	0.27	1.53	1.32	55	45	-12.34	22.82
	5	20	6.63	3.03	7.35	0.29	2.22	1.36	65	35	-8.82	19.47
Other income	10	40	2.10	1.38	2.26	0.60 **	0.72	1.92	70	30	-3.26	6.89
	5	20	2.72	2.46	2.20	0.44 **	0.78	3.14 **	80	20	-1.52	6.89

NOTE: Ten year period runs from April '84 to Jan '94.
Five year period runs from April '89 to Jan '94.
These dates relate to the publication dates; e.g. the revision published in Jan 94 would relate to the initial estimate for Q3 1990.

1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative

* = significant at the 5% level; ** = significant at the 1% level.

TABLE 4: REVISIONS ANALYSIS: OUTPUT COMPONENTS AT CONSTANT PRICES 1984 - 1993
REVISION: 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 Mean	t-value 1	% of + rev	% of - rev	Range of revision values from	to
Total GDP output component	10	40	0.67	0.41	0.70	0.69 **	0.26	1.60	73	28	-1.24	1.39
	5	20	0.42	-0.08	0.53	0.16	0.14	-0.59	50	50	-1.24	0.81
Agriculture, forestry and fishing	10	40	4.49	1.81	5.60	0.78 **	2.53	0.71	63	38	-8.33	16.96
	5	20	2.75	0.13	3.32	0.87 **	2.76	0.05	55	45	-4.64	6.53
Manufacturing	10	40	0.87	0.52	1.07	0.30	0.23	2.25 *	75	25	-2.35	2.76
	5	20	0.65	-0.03	0.96	0.06	0.23	-0.13	55	45	-2.35	2.07
Construction	10	40	1.45	0.46	1.82	0.42 **	0.45	1.02	60	40	-4.23	3.96
	5	20	1.75	0.40	2.17	0.49 **	0.83	0.48	60	40	-4.23	3.96
Distribution, hotels and catering	10	40	1.18	-0.39	1.63	0.53 **	0.46	-0.83	48	50	-6.05	1.90
	5	20	0.95	-0.25	1.22	0.07	0.29	-0.84	45	50	-2.54	1.77
Transport and communication	10	40	1.62	0.20	1.96	0.10	0.34	0.58	58	40	-3.97	4.24
	5	20	1.99	0.49	2.29	-0.17	0.51	0.93	65	35	-3.97	4.24
Other services	10	40	1.11	0.49	1.35	0.69 **	0.50	0.97	68	33	-2.13	3.86
	5	20	0.75	-0.44	0.89	0.31	0.27	-1.61	40	60	-2.13	0.68

NOTE: Ten year period runs from April '84 to Jan '94. Five year period runs from April '89 to Jan '94. These dates relate to the publication dates; e.g. the revision published in Jan 94 would relate to the initial estimate for Q3 1990.

1: t-value and Std Error are corrected for the effects of correlation except for the cases where the coefficient of correlation is negative

* = significant at the 5% level; ** = significa

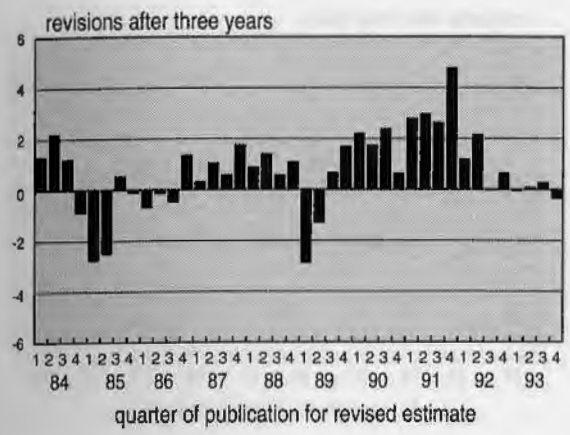
TABLE 5: SUMMARY OF TESTS FOR CYCLICAL VARIATION 1982-1993

Series	Overall Mean	t-value	Expansion Phase		Contraction Phase	
			Mean	t-value	Mean	t-value
Expenditure (Current Prices)						
Total	0.97	1.95	1.32	2.11 *	0.49	1.31
Consumer Expenditure	0.63	1.99	0.86	2.05	0.31	1.35
General Government Final Consumption	0.36	1.25	0.56	1.58	0.09	0.15
Gross Domestic Fixed Capital Formation	2.32	2.06	3.92	4.44 **	0.07	0.05
Exports	0.13	0.74	0.27	1.32	-0.07	-0.40
Imports	0.26	1.42	0.54	1.96	-0.13	-0.59
Expenditure (Constant Prices)						
Total	0.68	2.58 *	1.03	3.04 **	0.20	0.84
Consumer Expenditure	0.26	0.95	0.51	2.01	-0.10	-0.28
General Government Final Consumption	-0.12	-0.67	-0.14	-0.68	-0.09	-0.21
Gross Domestic Fixed Capital Formation	1.97	1.74	3.59	3.88 **	-0.30	-0.20
Exports	0.05	0.25	0.26	1.30	-0.23	-0.59
Imports	-0.33	-1.03	0.17	0.57	-1.02	-1.87
Income (Current Prices)						
Total	0.30	1.12	0.71	2.72 *	-0.27	-0.79
Income from Employment	0.16	0.48	0.63	2.90 *	-0.49	-1.36
Gross Trading Profits of Companies	0.95	0.64	0.46	0.27	1.64	0.56
Other Income	2.02	2.06	3.09	3.33 **	0.53	0.63
Output (Constant Prices)						
Total	0.41	1.91	0.52	3.00 **	0.27	0.88
Agriculture, Forestry and Fishing	2.01	0.96	2.22	1.49	1.71	0.58
Manufacturing	0.47	2.39 *	0.63	3.40 **	0.25	0.68
Construction	0.44	1.24	0.44	1.12	0.45	1.03
Distribution, Hotels and Catering	-0.68	-0.88	-0.07	-0.23	-1.54	-0.94
Transport and Communications	0.23	0.59	0.74	1.74	-0.48	-0.88
Other Services	0.63	1.38	0.61	2.09 *	0.67	0.90

NOTE: * = significant at the 5% level; ** = significant at the 1% level.

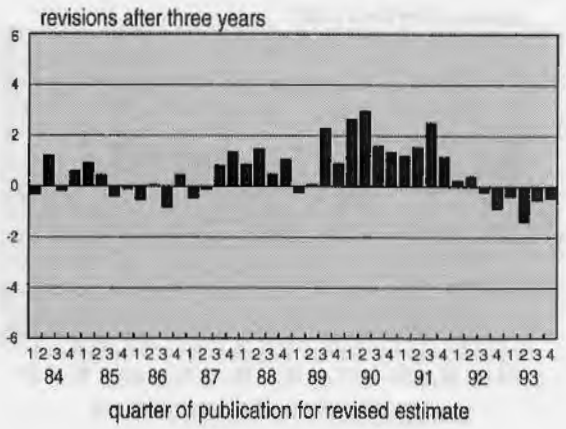
Total GDP expenditure component at current prices

four quarter per cent change



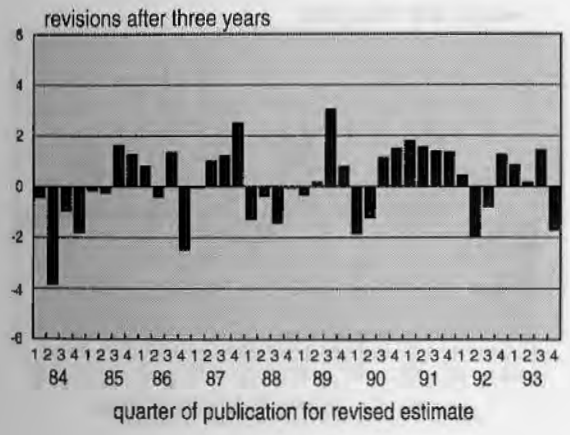
Consumer expenditure at current prices

four quarter per cent change



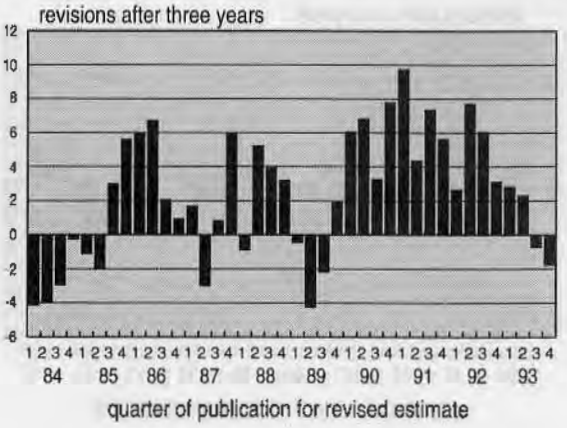
Government final consumption at current prices

four quarter per cent change



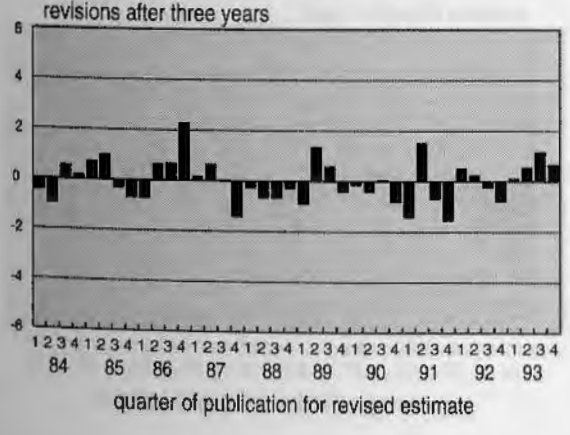
GDFCF at current prices

four quarter per cent change



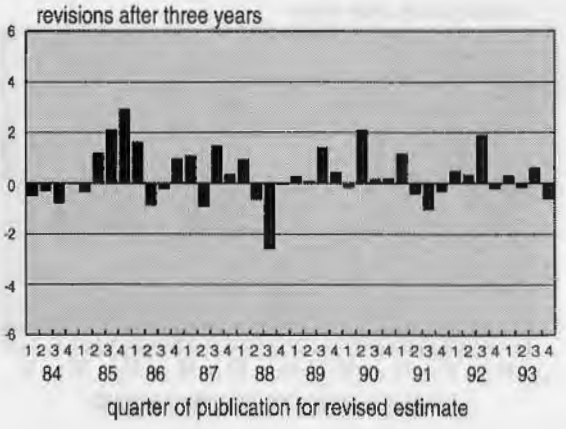
Exports at current prices

four quarter per cent change



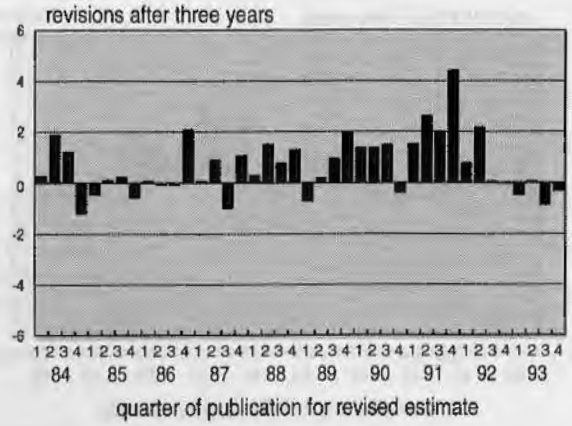
Imports at current prices

four quarter per cent change



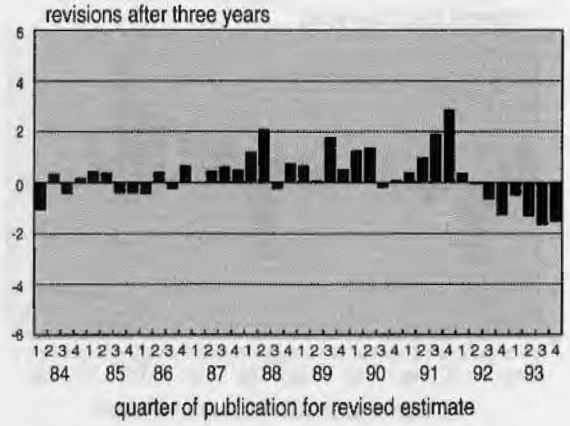
Total GDP expenditure component at constant prices

four quarter per cent change



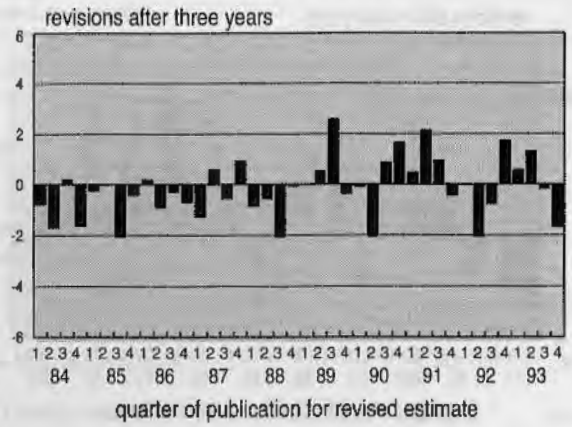
Consumers' expenditure at constant prices

four quarter per cent change



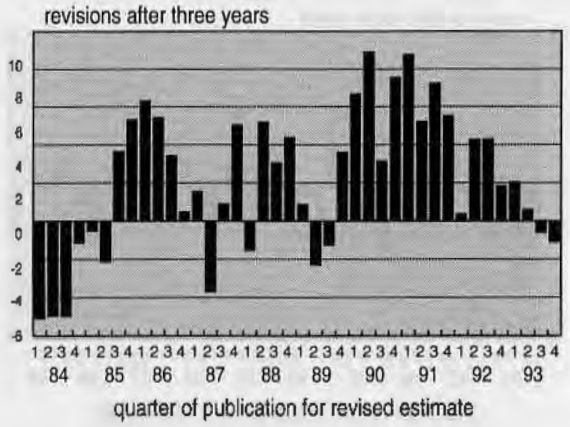
Government final consumption at constant prices

four quarter per cent change



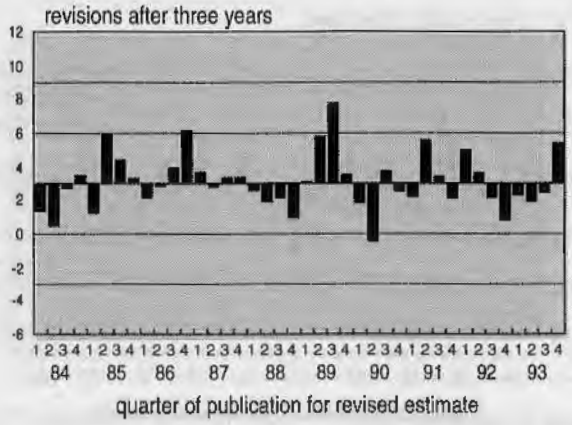
GDFCF at constant prices

four quarter per cent change



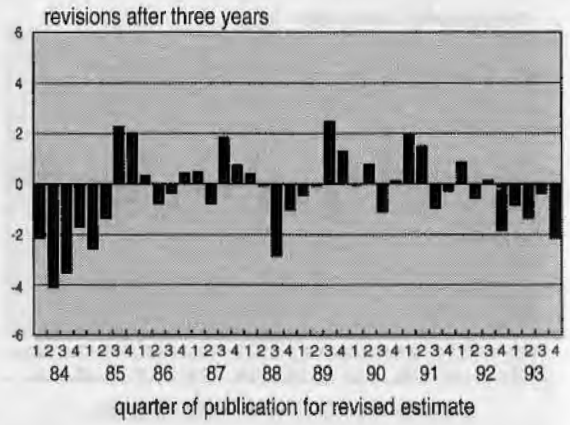
Exports at constant prices

four quarter per cent change



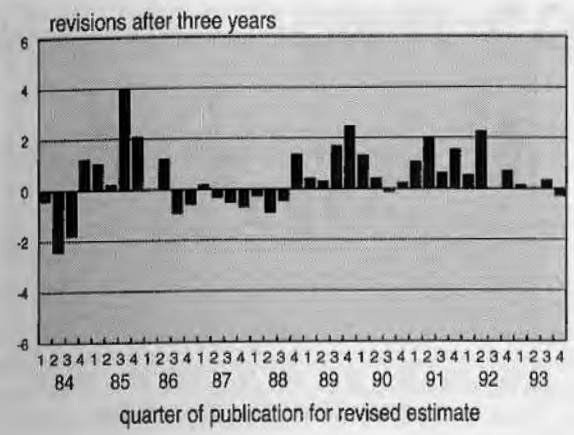
Imports at constant prices

four quarter per cent change



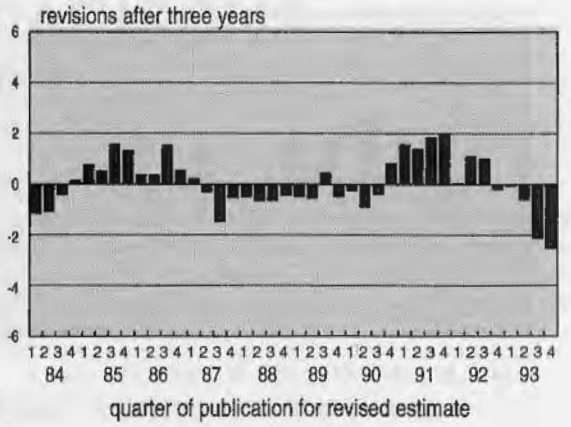
Total GDP income component at current prices

four quarter per cent change



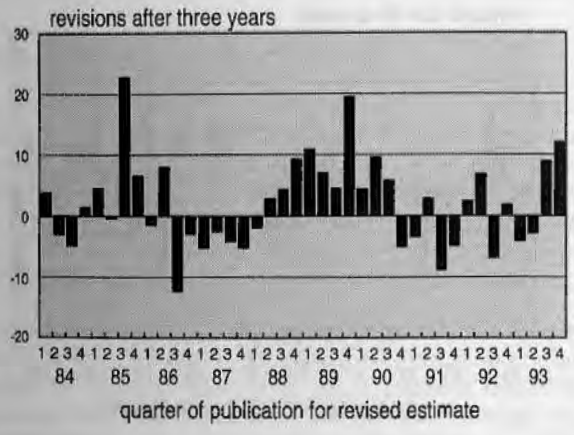
Income from employment

four quarter per cent change



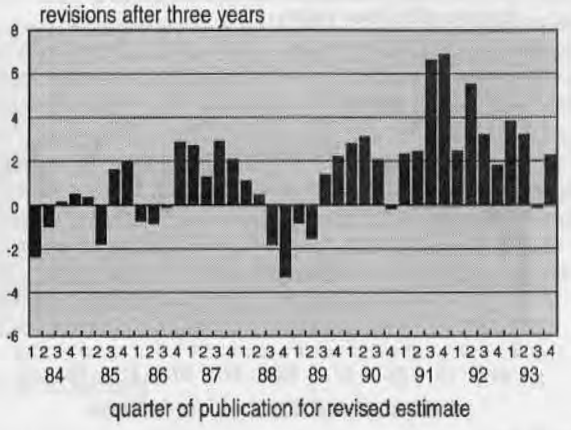
Gross trading profits of companies

four quarter per cent change



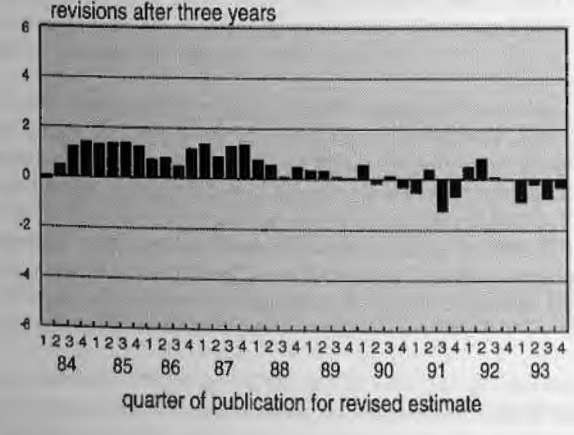
Other income

four quarter per cent change



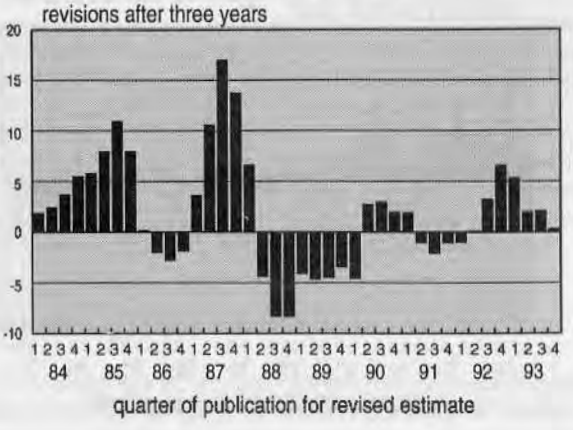
Total GDP output component at constant prices

four quarter per cent change



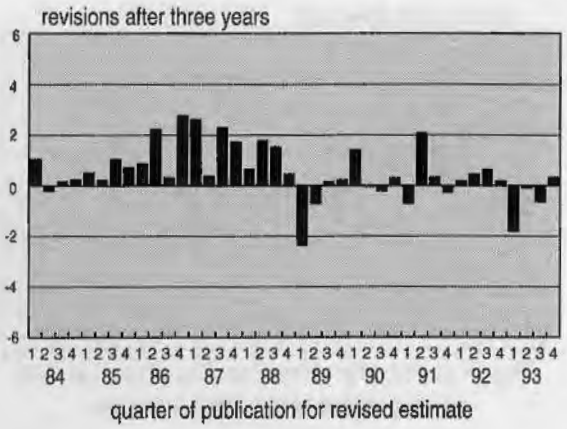
Agriculture, forestry and fishing

four quarter per cent change



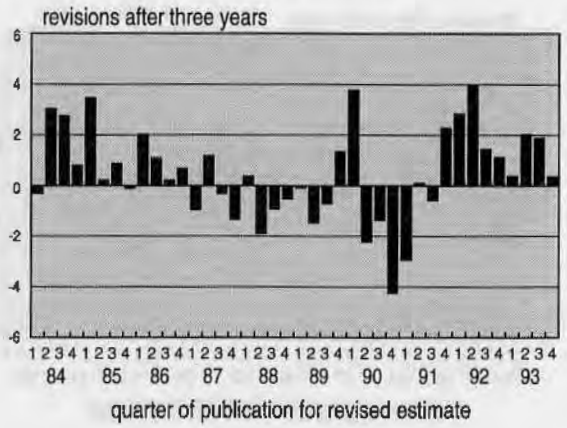
Manufacturing

four quarter per cent change



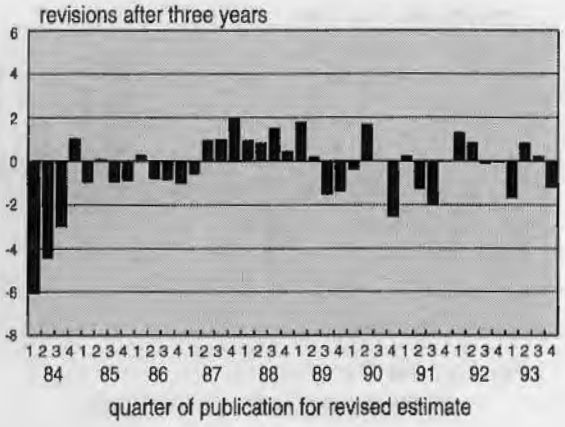
Construction

four quarter per cent change



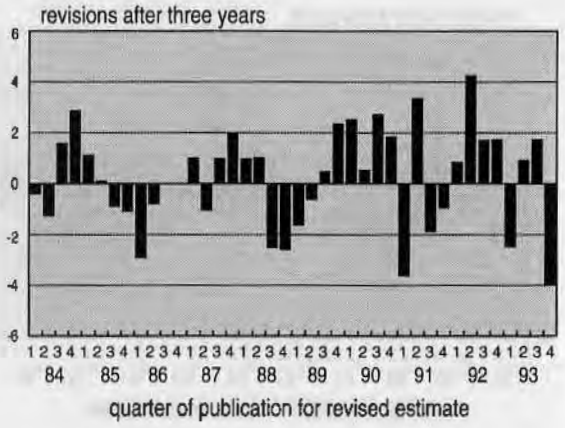
Distribution, hotels and catering

four quarter per cent change



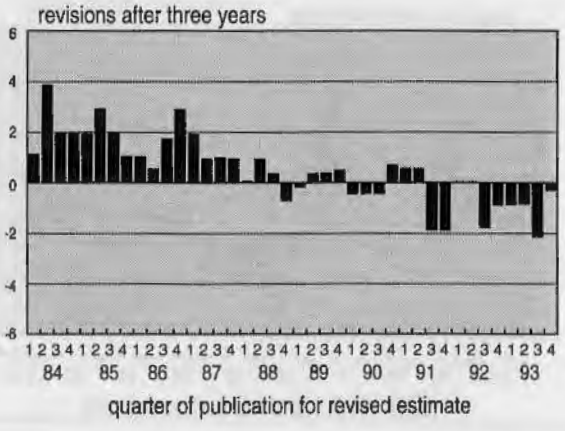
Transport and communication

four quarter per cent change



Other services

four quarter per cent change



RICH OR POOR? PURCHASING POWER PARITIES AND INTERNATIONAL COMPARISONS

Ian Davis, Central Statistical Office

The aim of this article is to provide the reader with an appreciation of some of the difficulties involved in estimating Purchasing Power Parities (PPP) and some of the developments planned in the Statistical Office of the European Communities (EUROSTAT) PPP programme. The article focuses on the use of PPPs in comparing real GDP across countries and so the question of why PPPs are used in this manner is considered first. This is followed by a presentation of the results of the 1992 comparison of real GDP across Europe. Following a brief history of PPPs, the remainder of the article examines how PPPs are calculated in practice (using the EUROSTAT comparison programme as a model), considers some of the problems involved in the calculation of PPPs and some of the latest developments in the EUROSTAT PPP programme. The conclusion drawn is that broad comparisons of real GDP across countries can be made using PPPs, but small differences should be ignored.

International comparisons of real GDP

Gross Domestic Product (GDP) is a key measure of economic performance. For any particular country it measures the total economic activity taking place on that country's territory. Changes in GDP at constant prices over time represent changes in the real level, or volume of economic activity. This is equivalent to measuring changes in the value of economic activity after stripping out the effect of price changes.

In a similar way, comparisons of the volume of economic activity can be made across countries. All that has to be done is to strip out the effect of different price levels across countries from their estimates of GDP. This can be attempted in a number of ways. One possible approach is to revalue the GDP of different countries using some reference currency, for example, pounds sterling. However, market exchange rates not only reflect different price levels but they also reflect different interest rates, capital transactions, currency speculation and government policy. In addition market exchange rates are not affected by goods and services which are not tradeable. Re-valuing GDP using market exchange rates not only strips out price level differences but all these other effects as well. To get to a true comparison of the volume of activity across countries a different exchange rate has to be used - the PPP.

For an individual good (or service), the PPP represents the exchange rate necessary to purchase the same quantity of that good or service in another country. To calculate the PPP for a single good we simply take the foreign currency price of the good in the other country and divide it by the price of the good in domestic currency at home. So for example a £40 pair of shoes in the UK selling for DM 80 in Germany would have a PPP of 2. In other words, to obtain the same pair of shoes in Germany the UK citizen would have to obtain DM 2 for each pounds worth of shoe.

To calculate the PPP for total GDP, we take the foreign currency price of a range of goods and services in another country and divide them by the price of an equivalent range of goods and services in domestic currency at home. It is important that the range of goods and services chosen are equally representative of the expenditure patterns of the countries in the comparison (more on this later). The European Community (EC) uses comparisons of real GDP based on PPPs to help in allocating structural funds to the poorer regions of the Community.

Results

EUROSTAT published comparisons of real GDP and the "main uses" (both in absolute values and per capita terms) based on the 1992 PPP exercise in January 1994 in "National Accounts ESA - aggregates". More detailed results covering 55 expenditure headings are expected to be available in the Autumn of 1994. Chart 1 (based on EUROSTAT's published estimates) shows the comparison of real GDP per capita for the twelve member states of the EC for 1992. These results show that the UK was eighth; just about on the EC average for real GDP per capita. Care must be taken when interpreting these figures. Although no precise statements can be made about reliability, there are a number of problems associated with the estimation PPPs which mean that it is difficult to draw firm conclusions from small differences in real GDP (such as those between UK and the Netherlands). Such small differences should be ignored. The rest of this article looks at: how PPPs are calculated in practice; the problems involved with the exercise; and some of the efforts EUROSTAT are making to address the problems. But before this, a brief history of PPPs is provided.

A brief history

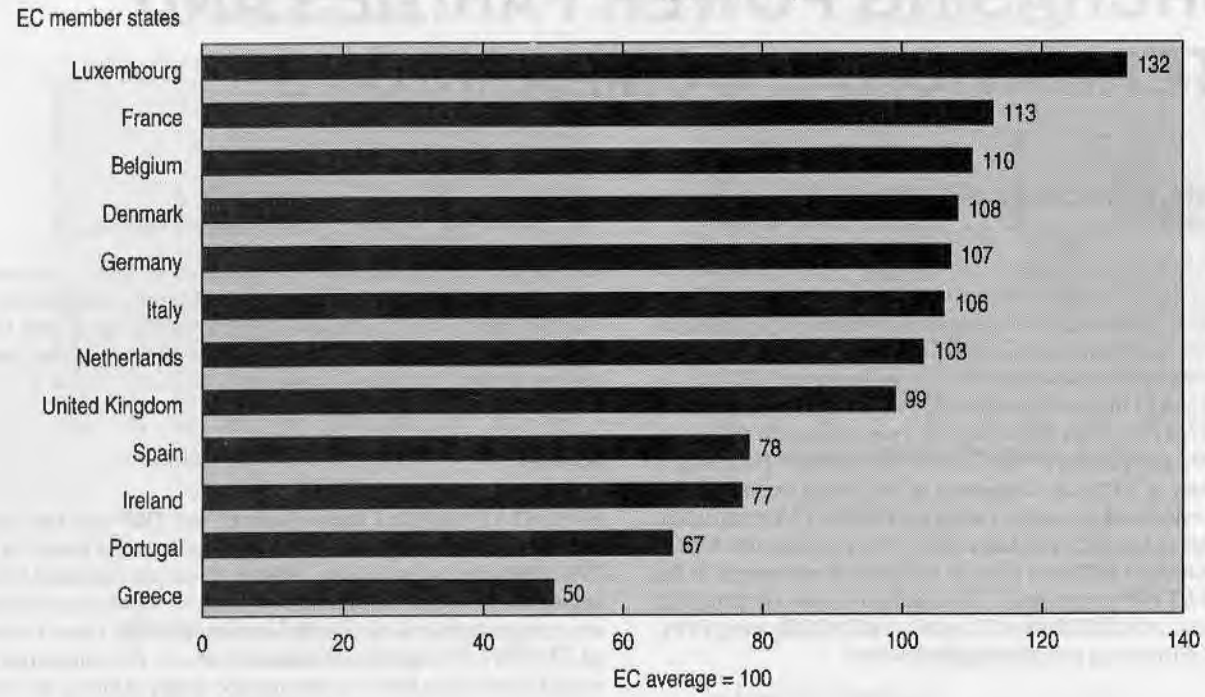
The initial drive for international comparisons of real economic performance came from the United Nations who launched the International Comparison Project (ICP) in 1968. A five yearly programme aimed at comparing real GDP across countries was started with the first price surveys carried out in 1970 for ten countries. In the early 1980s the Statistical Office of the European Communities (EUROSTAT) and the Organisation for Economic Cooperation and Development (OECD) launched their own programme to enable international price and volume comparisons of GDP and its component expenditures to be made for OECD member countries. Benchmark price surveys were carried out in 1980 and 1985 for 18 and 22 OECD countries respectively. The 1990 benchmark involved all 24 OECD countries and results were published in 1992[1]. Since 1990 EUROSTAT has carried out an annual programme, calculating parities and producing comparisons of real GDP for all twelve EC member states. What follows concentrates on the EUROSTAT PPP programme.

Calculating PPPs

In summary, each EC member state provides national average prices for a set of appropriate goods and services and GDP broken down into the expenditure components. The prices are used to calculate PPPs for individual goods and services. The GDP components are

1 "Purchasing Power Parities and Real Expenditures, 1990" OECD, Paris 1992.

Chart 1 **Indices of real GDP per capita 1992**
based on purchasing power parities



Source: "National Accounts ESA - Aggregates 1970-1992" Table B.2

used (as weights) to combine PPPs for individual goods and services into PPPs for each level of aggregation up to GDP. Comparisons of real expenditure are produced by dividing GDP by the PPP of GDP for each country. EUROSTAT use this approach because:

prices are much easier to collect than volumes (or even indicators of volume);

the variability of price ratios is generally much smaller than that of volume ratios.

More detail follows.

The supply of GDP data

As already mentioned, the expenditure components of GDP are used as weights in the calculation of PPPs. These expenditure data are provided to EUROSTAT each year, together with other annual statistical returns by EC member states.

Pricing

The first stage in calculating PPPs is for each EC member state to collect prices for appropriate goods and services. This is achieved through a series of price surveys. Before running any surveys however an appropriate basket of goods and services has to be agreed.

Choosing the appropriate basket

Two main principles underpin the choice of basket

- equivalence
- representativity

Selected goods and services should ideally be identical (ie the same brand, same model, same pack size etc) but it is often the case that brands available in one country are not available in others. Therefore, for valid comparisons, it is necessary that selected goods should at least have **equivalent** characteristics (eg weight, packaging, quality etc). In some cases, such as clothing, goods are rarely identical and equivalences of quality are **difficult** to measure. In other cases, such as the pricing of investment goods, the divergences are so great that a different approach has to be adopted (more on this later).

The basket of goods and services selected must also be **representative** of the expenditure patterns of each participating country. Failure to do so can lead to overestimation of prices (and PPPs) in countries where the basket is not representative. Using these biased PPPs to calculate real GDP can lead to an underestimation of the volume of activity in these countries (on the assumption that there is usually a negative correlation between relative prices and relative volumes).

What happens in practice?

In practice the aim is to specify as many goods and services as possible that can be priced in more than one country. If too few products are specified problems can occur:

- countries may have difficulty pricing those products specified, thus weakening the comparisons;
- countries may be able to price products, but may not be able to price representative ones, usually leading to over estimation of prices and under estimation of their volumes;
- confusion might occur and different countries may price products with different characteristics; effectively pricing different products and so weakening the comparisons.

A few months before each survey each member state scrutinises the list of products that were priced the last time the survey was carried out. They offer additions and modifications to the list. The need for these alterations reflects changing national expenditure patterns over time. Similar goods and services are grouped into "basic headings". A basic heading should contain a homogeneous set of goods or services so that goods can be selected for price collection which are both representative of their type and of the expenditure patterns in participating countries. In practice the definition of basic headings is constrained by the availability of national expenditure data and so they tend to correspond to the lowest level of expenditure category for which explicit expenditure weights can be estimated. Actual basic headings may therefore cover a broader range of goods or services than is desirable.

Countries are encouraged to ensure that they can identify and therefore price at least one product from each basic heading. In this way efforts are made to ensure that potential bias is minimised by making the sample of products equally representative of the expenditure pattern of each country in the exercise.

The product specifications are very detailed and may include information on brand, model, physical dimensions, weight, size etc. In total a list of about 2,600 goods and services is maintained by EUROSTAT.

In practice, it is not possible to identify enough goods that are equivalent and representative for all EC member states but this problem can be overcome (more on this later).

Although EUROSTAT run an annual PPP exercise, price collection does not take place every year for all goods and services in the basket. Instead it takes place in a 3 year rolling programme of surveys, one third of expenditure being covered each year. The remaining two thirds are covered by extrapolating basic heading parities, based on old surveys, using national price indices. For example the 1993 EUROSTAT PPP exercise will be based on the following surveys:

Autumn 1990:	Electric household appliances
Autumn 1991:	Clothing and footwear
Spring 1992:	Food, beverages, tobacco
Autumn 1992:	Services
Spring 1993:	Glassware, tableware, furniture
Autumn 1993:	Personal transport equipment, other goods and services

When collecting price quotations the target price is a national and annual average price. But the surveys are carried out in the capital cities of the EC member states and at different times of the year. Some countries provide regional information that can be used to convert the price in the capital city to the national average price. For other countries (including the United Kingdom) the price in the capital city is assumed to represent the national average. EC member states also provide EUROSTAT with detailed consumer price indices. These indices are used to convert the prices collected in the surveys to an annual average.

Aggregation

Calculation of PPPs from the price quotations collected involves three stages. Firstly, price relatives are calculated for individual goods and services eg UK price quotation divided by Ireland price quotation. It is clear that countries such as the United Kingdom and the Republic of Ireland, who have very similar expenditure patterns will be able to price the same products in many instances. However, identifying specific goods and services available in say both the UK and Greece is difficult. For this reason direct comparisons of the prices of products in the UK and Greece would not often be made. Instead, comparisons are made indirectly by referring to the prices of products of a country whose national expenditure pattern lies somewhere in between that of the UK and Greece. This is known as "graduality" and ensures that meaningful comparisons can be made. Secondly, the price relatives are averaged to obtain a set of unweighted parities at the basic heading level. Finally, the basic heading level parities are combined using the breakdown of national expenditure data (as weights) to arrive at PPPs for each level of aggregation up to GDP. Currently there are two methods employed to derive unweighted parities at the basic heading level. They are the Country-Product-Dummy (CPD) method and the Elteto-Köves-Szulc (EKS) method. Detailed discussion of these methods is beyond the scope of this article and the choice of method does not significantly affect the results[2].

Some difficulties and possible future developments

Determining the product mix

As already mentioned above, deciding on the basket of goods and services to be priced is a difficult process. For instance, consider the pricing of cheese in France and the UK. The most representative cheeses in either country are not representative in the other, and there is not an obvious "compromise" cheese which could be regarded as equally representative of both. The solution is to choose a selection of cheeses which, taken together, can be regarded as equally representative of the countries participating. As already discussed above, problems with representativity can cause bias in the results.

Collective consumption of general government

Collective consumption of general government (police, defence, health and education etc) is a significant component of GDP (approximately 22% in the UK in 1992), but it is not obvious how to price the services it represents.

For the PPP exercises these services are broken down into two broad categories: those that are consumed individually (such as health and education) and those that are consumed collectively (such as defence). The approach to pricing these services for the purposes of the PPP exercise differs depending on whether they are individually or collectively consumed.

For the 'non-market' collectively consumed services, there is no market price. To obtain surrogate prices EUROSTAT use the "input cost" approach. This is based on the assumption that the value of the output of these government services is equal to the cost of the inputs. It is also assumed that the price associated with the services is equal to the "price" of the inputs. EUROSTAT sub-divide the inputs into:

- employment;
- intermediate consumption (i.e goods used up in providing the service - e.g fuel);
- consumption of fixed capital (i.e 'depreciation')

The 'price' of **employment** is taken to be the appropriate wage and salary rates. EUROSTAT maintain a list (drawn from job descriptions taken from the 1968 and 1988 versions of the ILO's International Standard Classification of Occupations) of "standard occupations" employed by central and local government. These are designed to be representative of the type of expenditure made both within and

2 For a more detailed explanation of the methods of aggregation see "Purchasing Power Parities and Real Expenditures. EKS Results Volume 1" OECD 1990.

across countries. Estimates of wage and salary rates for each of the standard occupations are collected by EC member states and the relevant parities are calculated on the basis of this information. This approach has weaknesses, the most serious of which is that it implicitly assumes that productivity is identical in all participating countries. EUROSTAT is looking at methodology to take account of productivity differences in these non-market services.

Individually consumed government services differ from collectively consumed government services in that a market price **may** exist. In cases where market prices do exist (eg NHS and private medicine), EUROSTAT run price surveys and the quotations are used to calculate parities. Where market prices do not exist, the input cost approach is used.

For **intermediate consumption** and the **consumption of fixed capital** no data is collected and the parities for final consumption of households and Gross Fixed Capital Formation are used respectively as parities.

In a further development, EUROSTAT plan to increase the number of separate categories of expenditure identified for health services and defence, in order to increase the detail and accuracy of the PPPs calculated for these services.

Gross Fixed Capital Formation

Gross Fixed Capital Formation is another significant component of GDP (approximately 16% in the UK in 1992) for which pricing is difficult.

For the purposes of the PPP exercise, Gross Fixed Capital Formation is sub-divided into "equipment goods" (e.g lap top computers, electronic telephone switchboards) and "buildings and civil engineering" (e.g houses, sewers). Obtaining representative prices across countries is difficult in both cases, but for different reasons.

Taking **equipment goods** first, the problem relates to the very technical nature of the goods in question. In order to define equipment goods adequately, very detailed descriptions are required of the technical characteristics of each product. For example descriptions of performance (capacity, speed etc.) and descriptions of quality (weight, precision of the work etc.) are required to avoid confusion between different versions of a product, or between different products. In addition it is necessary to define other characteristics such as: accessories to be included with the product; the terms of payment; installation costs; and after sales service etc. all of which affect the quality of the product. EUROSTAT and the EC member states employ the advice of expert consultants in each country to help with the specification and pricing of equipment goods.

The major problem associated with the comparison of prices of **buildings and civil engineering projects** across countries is that most construction projects are unique. To get around this problem EUROSTAT employ the "standard construction projects" method. This involves drawing up a precise description of the work to be carried out and the materials to be used (e.g the number and type of bricks). Essentially this means drawing up detailed bills of quantities required to carry out the "standard" construction project and collecting prices for the individual component quantities. Again the definition of the standard construction project and the collection of the prices is carried out by expert consultants from the EC member states. Due to different national standards, regulations and methods a degree of interpretation has to be allowed in the pricing of the bill of quantities. For this reason a number of different components are included on the bill of quantities to give countries the choice of which to price. Countries are encouraged to price as many components as possible and state which is more representative of their building practices. EUROSTAT take account of this information on representativity in working out the parities for building and civil engineering. Again the scope for bias in the results is quite large if a country cannot obtain representative prices of the bills of quantities.

National prices and annual average prices

As mentioned above, the price collection takes place in a 3 year rolling programme of surveys, one third of expenditure being covered each year. Prices are collected in the capital cities of each country. EUROSTAT have to adjust the results obtained by using consumer price indices and regional price information from each participating country. For accuracy these adjustments need to be consistent from country to country. But some countries have available, and provide, more information than others. For example the Netherlands collect prices in four major cities and present EUROSTAT directly with a national average price. The fact that EC member states, use different methods for calculating their consumer price indices, and provide EUROSTAT with different types of regional price information, reduces the reliability of the PPP results. But EUROSTAT and the EC member states are currently engaged in a programme of work aimed at harmonising consumer price index methodology, which should reduce these problems.

Conclusion

Purchasing power parities represent the exchange rate necessary to purchase the same *quantity* of a good or service in another country. They can be used to produce **broad** comparisons of "real" GDP across countries. The results of the 1992 (Chart 1) EUROSTAT comparison of the 12 EC member states show the UK in eighth place; just about on the EC average for real GDP per capita. Care must be taken when interpreting these figures. Although no precise statements can be made about reliability, the problems associated with the collection of representative prices (as outlined above) mean that it is difficult to draw any firm conclusions from small differences in real GDP per capita (such as those between UK and the Netherlands in 1992). EUROSTAT are trying to overcome these problems by developing the PPP methodology.

References

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