Manufacturing sector productivity in South Africa in the 1980s: Error and ideology in a contested terrain

Volume II

(Appendices)

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Charles Meth

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APPENDIX 1-1

The Fosatu Challenge (Meth, 1983)

Federation of South African Trade Unions

A CHALLENGE FROM FOSATU ON PRODUCTIVITY

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A CHALLENGE FROM FOSATU ON PRODUCTIVITY

TO WHOM IT MAY CONCERN

YOUR NUMBERS ARE WRONG

AND SO ARE YOUR CONCLUSIONS

Charles Meth,
Economics Department, University of Natal, Durban

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3rd Floor
House of Hamilton
Banshee Lane
DURBAN
4001

PREFACE

This paper was written by Charles Meth, a lecturer in the Department of Economics at the University of Natal in Durban. He is at present temporary Research Fellow in the Economic Research Unit of the university, under whose sponsorship he is conducting a research project on "productivity" and "capital intensity" from which the results in the paper are drawn.

Inspiration for the research project and this paper in particular came from FOSATU who approached the author to give a paper to a FOSATU national seminar on wages and productivity. FOSATU were highly suspicious of the repeated attacks on productivity that were being bandied about and wanted to arm themselves with a better understanding of the issues involved in productivity. The results of the paper are dedicated to those workers who correctly insisted that relatively fewer of them were producing ever increasing quantities of output.

Earlier drafts of the paper have been circulated amongst colleagues at UNISA, the University of the Witwatersrand, the University of Natal in Pietermaritzburg and also to colleagues at the South African Labour Bulletin. Their critical comments are much appreciated. Naturally any errors in the paper are the sole responsibility of the author. One person deserving special thanks is John Lynch at Central Statistical Services for his help in explaining the data and guiding the author through the perils of the National Accounts.

INTRODUCTION

A recent review article in the Monthly Labor Review, the respected journal of the US Dept. of Labor Bureau of Labor Statistics, by Paul S. Adler called 'THE PRODUCTIVITY PUZZLE: NUMBERS ALONE WON'T SOLVE IT', (1) exposed with clinical precision the myriad difficulties which beset productivity studies - theoretical, conceptual, historical and above all empirical. In South Africa by contrast, fools rush in where angels go warily - thus we have the Minister of Manpower, Fanie Botha asserting confidently that 'South Africa, by achieving a productivity rate of only 15% of that of its competitors, was conceding defeat'.(2)

Such pronouncements have enormous importance in the struggle by workers for a rightful share of the wealth they have produced. It is the intention of this paper to show that the empirical basis upon which the Minister can make such remarks is seriously flawed. At this stage, we are content to attack the 'numbers' only, a future paper will expose the theoretical sterility of productivity studies in South Africa.

There are five parts to the paper. Part I introduces the concept of productivity and some of the problems in estimating it. There is also a brief discussion of the National Accounting system on which productivity estimates are based.

Part II exposes a huge error in the calculation of the value of output in the Mining sector, which implies that South Africa's growth rate over the period 1970 to 1980 was closer to 6% per annum than the 3,6% commonly quoted.

Part III discusses the introduction of a quiet change by the Central Statistical Services of the value of output in Manufacturing, which raised the growth rate from 2,64% p.a. from 1970 to 1979 using the old data, to 4,99% p.a. over the same period using the new - the implications for 'productivity' arguments are clearly staggering.

Part IV shows up the weaknesses of the present method of valuing output in Construction and hence of estimating "productivity". The implication of this is that very few "economic facts" can be regarded as "safe" until they e been subjected to the scrutiny of truly critical academics, trained in art of demystifying social statistics.

t V examines the implications for the workers' struggle of the ormation uncovered by this research. Probably the most important of se are that:

South Africa has, contrary to popular belief, experienced both high economic growth and high productivity from 1970 to 1980 <u>in spite</u> of two recessions <u>and</u> that this good performance has not produced sufficient jobs for the workers <u>nor</u> has it rewarded them sufficiently for their efforts. Far too many workers still earn less than the living wage.

Considerable ignorance about the real performance of capitalist enterprises hampers workers' struggle for their rightful share of output. This "ignorance" stems from the control of information flows by people other than workers.

PART I

uctivity in the economy as a whole may be measured crudely by taking total output of all the goods and services produced in the economy and ding this by the number of people necessary to produce it. Observing way in which this 'output per person' varies over time gives a measure he "physical productivity" of labour.

e important obstacles present themselves when attempting such an cise;

it is very difficult to measure output in "physical" terms, especially when the product that is being made changes, say in quality or design, from year to year. These difficulties are discussed in the review article by Adler, referred to above, which had this to say about the US economy:

> "Measures of output, including those of the Bureau of Labor Statistics, are often approximate, especially in the many industries with no clearly defined products or quality range. In

> an extreme case, that of the computer equipment industry, the difficult task of measuring quality change had led to total capitulation, and the price deflator is conventionally set at 1, as if there had been no qualitative improvement at all since the birth of the computer industry. Some, not implausible, estimates of quality changes in this industry can be shown to boost output measures so much that the productivity lag for manufacturing disappears entirely".(p.17)

A similar 'Capitulation' takes place in South Africa - the rate of growth of manufacturing in 'value' terms is simply equal to the rate of growth of the physical volume of output - a highly suspicious measure!

ii) it is <u>impossible</u> to measure the value of "services" in "physical" terms

Obstacles (i) & (ii) constitute what is known as the "Measurement Problem"

iii) when workers are unemployed and idle their contribution to output is negative, but if they are seeking work they are classified as "economically active". The crudest national productivity figures do not usually take this into account. If the number of unemployed in this country is growing, as some people suggest, their negative contribution to production can help to outweigh growing productivity by other workers.

NOBODY KNOWS WHAT THE REAL UNEMPLOYMENT SITUATION <u>IS</u> IN SOUTH AFRICA, THEREFORE THERE IS CONSIDERABLE ROOM FOR DISAGREEMENT ABOUT CHANGES IN <u>NATIONAL PRODUCTIVITY</u>.

To get around the first of these two obstacles, that is the 'measurement' problem, economists use the 'value' of output instead of the 'physical volume' of output.
One may see immediately that this gives rise to two problems:
<u>Firstly</u>, because of inflation, prices of goods and services produced are changing all the time, so that for example, an item which one bought today may cost 10% more tomorrow. Some method has to be found to eliminate this and sc economists express the "value" of output in what they call "constant" or "real" terms. The method used is similar to this; suppose one's wage was R100 per month in 1975 and R185 in 1980. By dividing the

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)80 wage by the Consumer Price Index, which in 1975 was 100 and in 1980 is 176,7 one discovers that one's "real" wage had risen to R104,70. This ·ocess is called "deflation". The "quality" of this measure of 'real' iges or real output is only as good as the "index" or "deflator" used.

IIS IS VERY IMPORTANT FOR WHAT FOLLOWS. IT WILL BE ARGUED IN THIS PAPER IAT THE INDEX USED TO DEFLATE MINING OUTPUT IS WRONG. IT WILL BE SHOWN IAT THE INDEX USED TO DEFLATE MANUFACTURING OUTPUT PRIOR TO SEPTEMBER 1980 S WRONG AND IT WILL BE DEMONSTRATED THAT THERE IS SOMETHING SERIOUSLY ONG WITH THE INDEX USED TO DEFLATE CONSTRUCTION OUTPUT.

e error in the Mining Statistics means that all of the claims made about bour productivity in the economy as a whole,are wrong. It also means that e economic growth rate, an important economic indicator, has been nsiderably underestimated during the period. Taken together, these ·ors pose serious questions about the nature of development in South ·ica.

:ondly, the measurement of services still gives rise to difficulties - for an example do you measure the "value" of "output" of a policeman? the number of arrests? For practical reasons, economists simply measure s kind of output in terms of the cost of producing it. Therefore if ies go up in real terms and employment remains the same, productivity es. This is clearly problematic, but no alternate measures exist which be used on a national basis.

tacle number (iii), referred to above, namely the problem of the employed" but still "economically active" population, is solved by sidering only those in employment. The national output is divided up o 9 "major economic activities", such as agriculture, mining, ufacturing, construction etc., and the output of each sector in "real" ns is divided by the actual numbers employed in that activity to obtain easure of real outut per worker. As long as this is growing reasonably :er than the real wage per worker, capitalists and the state are happy. it is not, then the trouble starts.

·e is a fourth obstacle which makes productivity measurement difficult, that is the question of trying to work out the contribution to changing uctivity of new or improved machinery and equipment. A whole range of

very complex valuation problems arise which do not really concern us here. However, it is generally claimed that during the 1970's, production in South Africa became more "capital-intensive", but with little or no corresponding rise in productivity. We shall cast a brief and critical eye on this when we discuss manufacturing.

Before beginning the analysis, a word about the way in which the National Accounts are presented. The value of all the output produced in an economy is called the Gross Domestic Product. This is identical in value to all the income received by the producers of that output, which is known as Gross Domestic Income. Conventional economists assert that different "factors of production" are responsible for that output and these "factors" are rewarded in some sort of proportion to their "contribution". There are usually said to be four such "factors", workers, who receive wages, entrepreneurs (owners of businesses, usually 'risking' their own or borrowed capital) who receive profit, money-holders or wealth holders who receive interest or dividends (money is used to buy control over productive resources in whose management they may or may not participate. Money used in this way is called capital by conventional economists). Finally there is land, which when privately-owned, yields rent.

The last three categories of income are together called surplus and go mainly to the wealth-owning class in society.

Official statistics give the Gross Domestic Product (GDP) at factor incomes i.e. the incomes going to the different factors and they give it in three different forms.

1) GDP is given at current prices, that is the actual number of rands paid to those 'factors' in the year in question.

2) They then take this figure, GDP at current prices, and they show how it was divided between wages and surplus.

3) Finally they deflate the GDP to constant or real terms, using a particular year as a base, so that they can make comparisons to see how the economy is performing, or how different sectors are

developing. The current base year is 1975. Because inflation is so high these days, the base year is changed frequently. The previous base year was 1970. When a change of base year is made, output has to be revalued and a whole new set of statistics created. This process, we shall see, has very important consequences for worker struggle.

se official statistics, prepared and presented by Central Statistical vices and by the South African Reserve Bank, which are part of the ional Accounts, are done throughout much of the world according to a ted Nations manual called A System of National Accounts. In the next tion, we will argue that a particular interpretation of this manual has to a massive error in the valuation of output. This "interpretation" is lained in Note 3 at the end of the paper.

PART II.

turn now to a consideration of the MINING SECTOR. In Table 1 below we roduce the official values of output in this sector in "current" and al" terms.

LE 1. VALUES OF MINING OUTPUT IN CURRENT AND CONSTANT (1975) PRICES IN IONS OF RANDS.

?	CURRENT VALUE	CONSTANT 1975VALUE
)	1 207	3 893
?	1 513	3 563
!	3 068	3 287
;	3 182	3 182
;	3 446	3 222
!	5 601	3 372
)	13 400	3 465

ce: South African Statistics 1982, Central Statistical Services, oria, 1982, p21.6 and 21.7.

the right hand column, it appears that the 'real' value of output has en over the whole period, reaching a low-point in 1975. This looks a odd when compared with the left hand column where output in current

terms grew more than eleven times!

What has happened? GOLD IS THE KEY!

Over the period, the gold price fluctuated, but in general it rose, reaching a peak in 1980. The tonnage of gold produced actually fell but the increase in price gave rise to huge revenues. This poses a problem for the statisticians in Pretoria. In the old days, when by international agreement, the price of gold was constant at $35 an ounce, the matter was not of much consequence. But, with the rise in price, this problem suddenly becomes of overwhelming importance.

We will now demonstrate that the method chosen by the Central Statistical Services (CSS), to deflate the value of Mining output is wrong.(3) Common sense alone should tell us that this is so and there is a very simple arithmetical trick, details of which are given in the section on CONSTRUCTION (Part IV of this paper) to prove that the figures in the right-hand column of Table 1 are inconsistent.

Here is the reason; we have already stated that by their own conventions, economists agree that Gross Domestic Product equals Gross Domestic Income. This means that in 1970, the "factors of production" in MINING received R1 207 000 000 in INCOME and in 1980 they received R13 400 000 000! Never mind what the CSS says the "constant value" of that output was - let us rather ask, what happened to that income?

Simple - we know, because the CSS tell us so, that in 1970, R692 000 000 went to surplus (i.e. to the owners of the means of production) and the rest i.e. R514 000 000 went to the workers in the form of wages. In 1980, surplus was R10 497 000 000 and wages were R2 904 000 000.

IN ECONOMIC JARGON ALL OF THAT INCOME REPRESENTS A "COMMAND OVER ECONOMIC RESOURCES" - WHICH WHEN TRANSLATED MEANS YOU CAN BUY THINGS WITH IT!

What did the "factors of production" buy? Wages for unskilled and semi-skilled workers, who happen in South Africa to be black, bought the bare neccesities of life. Wages of white mineworkers and officials, who are nearly all classed as "skilled", went to pay for the obviously higher andard of living which they enjoy and which they have struggled so ·ociously to preserve.

·plus went to the owners of the mines, who used it either to pay for the ·ish life styles they enjoy, or to pay for machinery worn out in ·duction, or to pay for new machinery. The value of fixed capital stock the mining sector in constant 1975 prices rose from R3 268 000 000 in ·0 to R5 860 000 000 in 1980. i.e. by nearly 80%.(4) Some of the money ·t to buy control of other companies, both in South Africa and overseas. · gold mines also paid 21 times more tax to the State in 1980 than they · in 1970. The dividends they paid to shareholders increased more than ·lvefold over the period and company savings rose nearly tenfold.(5)

· did they manage this out of declining real income? The obvious answer that income did not decline! ONLY REASONABLE WAY TO DEFLATE THE CURRENT VALUE OF INCOME EARNED BY "FACTORS OF PRODUCTION" IN MINING IS TO USE SOME COMPOSITE INDEX BASED THE SPENDING PATTERNS DESCRIBED ABOVE. The justification for this cedure can be found on page 53 of the United Nations publication erred to above.(6)

es, capitalist consumption and taxes may quite reasonably be deflated by Consumer Price Index. Machinery prices rose a little faster and it is · difficult to know what to say about the "investments" in other ·panies made by the mining houses i.e. whether or not they paid inflated ·es? Nor is it simple to know what to do about imports.(7)

· compromise it is proposed to use a composite deflator whose derivation explained in a note to Table 2. This Table illustrates the dramatic ·erence made to Mining Output figures when the 'proper' deflator is used current incomes earned in the sector. Incidentally, the use of the ·umer Price Index (CPI) as a deflator (see column 4 of Table 2) does · little indeed to alter our findings.

TABLE 2. VALUE OF MINING OUTPUT IN CURRENT PRICES AND IN CONSTANT 1975 PRICES USING THREE DIFFERENT DEFLATORS

	1	2	3	4
YEAR	CURRENT VALUE	CONSTANT 1975 PRICES: CSS DEFLATOR	CONSTANT 1975 PRICES: COMPOSITE DEFLATOR	CONSTANT 1975 PRICES: CPI DEFLATOR
1970	1 207	3 893	1 924	1 892
1972	1 513	3 563	2 120	2 098
1974	3 068	3 287	3 506	3 482
1975	3 182	3 182	3 182	3 182
1976	3 446	3 222	3 075	3 102
1978	5 601	3 372	4 048	4 082
1980	13 400	3 465	7 525	7 583

SOURCE: As for Table 1.
NOTE: The composite deflator was derived as follows: Capital expenditure on new assets given in South African Statistics 1982 p11.12 was subtracted from current income in mining in each year. Capital expenditure was deflated by the price index of materials used in mechanical engineering (p. 8.11) and the remainder was deflated by the appropriate CPI (p8.20). The sum of these deflated magnitudes is the 'real' value of mining output. Consumer Price Indices used in Column 4 are given on p8.20.

If we take the value of mining output as estimated in Col 3 to be the most reliable, it will be observed that National Output is overstated in 1970 by R 1 969 000 000 and understated in 1980 by R 4 060 000 000. If we "correct" the existing 'real' Gross Domestic Output figures of R 21 216 000 000 and R30 171 000 000 for these years by these amounts we conclude that THE ECONOMIC GROWTH RATE IN SOUTH AFRICA WAS NOT 3,58% per annum BUT 5,93%.(8) TO USE THE FIGURES IN COLUMN 2 TO SUPPRESS THE TRUTH ABOUT THE REAL RATE OF GROWTH IN SOUTH AFRICA'S ECONOMY IS THE SAME AS IF THE OPEC COUNTRIES CLAIMED THAT THE HUGELY INCREASED OIL PRICES HAD NOT PROVIDED ENORMOUS BENEFITS TO THEIR RESPECTIVE ECONOMIES. THIS IS OBVIOUS NONSENSE AND YET

ΙE SAME THING HAS BEEN DONE IN SOUTH AFRICA AND NO-ONE HAS PROTESTED.

shall explore the implications of this for worker struggle in the ncluding section of the paper. It is time now to examine the effects of e "misinformation" created by the errors uncovered above.

we noted at the start, a very important use of the National Accounts is produce estimates of productivity, especially worker productivity. South rican workers' performance in this respect is regularly attacked. However ne people are now twisting the attack on workers in a very subtle way. is claimed that "managers" are "responsible" for productivity - timately what this means is that "managers" must discover ways of eorganising" work so as to extract greater output from the workers! terally hundreds of statements of this nature can be produced. Businessmen l government officials and especially cabinet ministers repeat them llessly. An example is given in the box on page 13.

: primary source of such information is the NATIONAL PRODUCTIVITY ;TITUTE (NPI). A recent publication of theirs called Multiple Input Prod-ivity Indices for Sectors of the South African Economy, which attempted "measure" the productivity of labour and "capital" found that labour ductivity in mining fell by 1,9% (p5) every year from 1970 to 1980 and t the productivity of capital fell by a massive 7% a year over the same iod. (p6)

ever as we have seen above, mining revenue increased more than venfold, while other prices increased about threefold. What is more, ublished data from the Central Statistical Services shows that the rterly tonnage of ore milled per worker (the real measure of work formed by the miners and the machines they used) rose from 43,9 tons in) to 47,5 tons in 1980. This is not a spectacular growth rate, but the : is that more rock was hauled out of the earth at deeper levels and at it danger. That the ore contained less gold is no business of the workers - the rise in gold price more than compensated for this and it "enabled" the mines to pay a little better than the starvation wages have paid since the commencement of gold mining in this country.

Another example, drawn from the coal mining industry, South Africa's second largest mining activity may be used to illustrate the weakness of the official statistics. Table 3 shows how this industry has developed from 1970 to 1980. On the basis of these figures it will be concluded that the "productivity" performance of workers was not good enough because real wages rose faster than output per worker.

This argument is only true if one accepts the "official" valuation of coal mining output. As we have pointed out above, the "real value" of mining output in any particular year in the "official statistics" is based on the physical volume of production". As you may see from the Table, physical output doubled, therefore "value" doubled! BUT THE MONEY VALUE (CURRENT

TABLE 3: PERFORMANCE OF THE SOUTH AFRICAN COAL MINING INDUSTRY 1970 - 1980

	1970	1980
TONS PRODUCED	54 612 000	115 120 000
NUMBER EMPLOYED	74 877	93 049
TONS PRODUCED PER WORKER	729,4	1 237,2
REAL AVERAGE ANNUAL WAGE PER WORKER (CONSTANT 1975 PRICES)	1 020,2	2 082,9
VALUE OF COAL SOLD IN CURRENT PRICES	R 109 914 000	1 495 016 000
VALUE OF COAL SOLD IN CONSTANT 1975 PRICES * (TOTAL REVENUE)	R 172 278 997	846 075 835

RATES OF GROWTH OF THE "INDICATORS" OF PERFORMANCE (% per annum)

OUTPUT	7,74%
EMPLOYMENT	2,20%
OUTPUT PER WORKER	5,43%

	IN CONSTANT 1975 PRICES	IN CURRENT PRICES
AVERAGE WAGE	7,40%	18,92%
TOTAL WAGE BILL	9,76%	21,53%
TOTAL REVENUE	17,25%	29,83%
TOTAL NET PROFIT	-	28,25%
TAXATION	-	27,60%
DIVIDENDS	-	21,67%
COMPANY SAVINGS	-	35,15%

ESTIMATED FROM: South African Statistics 1982, op cit.

*NOTE: We have not derived a 'composite deflator' for the coal mining industry similar to that derived for gold mining because there is no published data on the distribution of output between wages and surplus, nor was the information on 'capital' expenditure readily available. However, as a quick glance at cols. 3 & 4 of Table 2 shows, the CPI is not too inaccurate - it has therefore been used as a deflator. Even massive expenditure on machinery will not affect the results overmuch.
It is very difficult to 'deflate' the profit, tax and dividend indices (see South African Statistics 1982 p21.24)

UE) OF COAL SOLD ROSE NEARLY 14 TIMES. Applying the proper method of uation of output which we used above for gold, to the output of coal, we t conclude that the real value of coal output rose almost 5 times over period. Just look at the bottom of Table 3: REVENUE, NET PROFIT, ATION, AND COMPANY SAVINGS ALL GREW FASTER THAN THE AVERAGE WAGE OR THE AL WAGE BILL. INCIDENTALLY, NEARLY 45% OF THE EXTRA WAGE BILL BETWEEN) and 1980 WENT TO WHITES, WHO CONSTITUTED 9,8% OF THE WORKFORCE IN 1970 13,6% IN 1980.

DID CAPITALISTS MANAGE TO ACHIEVE SUCH HUGE PROFIT RATE GROWTHS AND PAY WAGES AND MORE TAX AND STILL MANAGE TO SAVE AT A FURIOUS RATE, IF THE VALUE OF OUTPUT ONLY DOUBLED? UNTIL THE BOOKS ARE OPENED UP FOR ILED INSPECTION BY WORKERS, WE WILL NEVER KNOW. IN THE MEANWHILE WE OT AVOID DRAWING THE OBVIOUS CONCLUSION AND THAT IS THAT FROM THE SSAL PROFITS WHICH ACCRUED TO CAPITAL, THE BULK OF THE WORKERS HAVE THROWN A FEW CRUMBS.

NPI's Visser ... measuring productivity

SA's managers are spoiled. The country's relative abundance of minerals, labour and cheap energy has tempted them to expand production by employing more people and not by extracting more production per worker.

This formula is no longer working. The economy is not providing enough jobs to soak up unemployment, let alone to accommodate the new work seekers coming on to the labour market each year.

The only way to generate a fast growth rate in the economy is to improve productivity. This does not refer only to labour productivity. Business has four units of production: labour, capital, raw materials and machinery. Productivity improvement is concerned with the optimal utilisation of all of these.

In the advanced economies of north-western Europe some two-thirds of economic growth flows from productivity increases. In SA the proportion is around 30%.

Figures from the National Productivity Institute (NPI) show that between 1970 and 1980 the real gross domestic product per economically active person in SA grew by a low 4,6% — an average of 0,1% a year. Since 1974, productivity has actually declined (see figure).

Countries like Sweden, Japan and Taiwan have shown a consistent high rate of growth in per capital gdp. Sa's poor performance is disturbing, particularly since its slow average rate of growth means it is tending to fall even further behind the more industrialised countries.

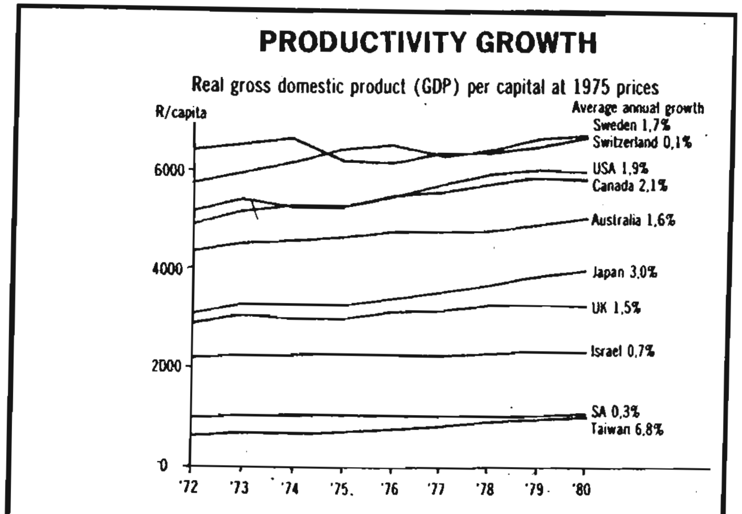
An analysis of the manufacturing sector from 1972-1981 (see figure) shows that at the end of the 10-year period, employees were being paid 20% more for producing only 4% more. As NPI executive director Dr Jan Visser comments: "This discrepancy between wage increases and productivity performance is too big for comfort." It is also one of the reasons for this country's soaring inflation.

South African workers ... a dismal productivity record

THESE ILL-FOUNDED CLAIMS ARE TYPICAL OF THE PRODUCTIVITY MYTHS WE ARE ATTACKING IN THIS PAPER

Source: Manpower Survey. Supplement to Financial Mail. August 27, 1982

THE SILLY RESULTS OBTAINED BY THE NPI RESULT FROM THE USE OF INCORRECT DATA AND MISLEADING PRESENTATION. HERE IS ANOTHER EXAMPLE WHICH ILLUSTRATES THE COMBINED EFFECT OF TWO OF THE DIFFICULTIES DISCUSSED EARLIER. FROM THE SAME SOURCE AS THE EXAMPLE IN THE BOX ABOVE, NAMELY THAT UNCRITICAL MANAGEMENT MOUTHPIECE FINANCIAL MAIL, WE REPRODUCE A SET OF GRAPHS PURPORTING TO SHOW SOUTH AFRICA's 'PRODUCTIVITY' PERFORMANCE RELATIVE TO ITS "COMPETITORS"



Source: Manpower Survey. Supplement to Financial Mail. August 27, 1982

ıere are two major errors in this graph:

GDP has been undervalued, because of the error in MINING discussed above. This means that the "per capita GDP" figures used are naturally incorrect.

) South Africa has a huge and growing population in the bantustans which has very little direct connection with the so-called 'modern' sector. To compare South Africa with the advanced capitalist countries in the graph above, which do not share this characteristic, is not merely MISLEADING, IT IS STUPID!

PART III

We have argued above that income and wealth in South Africa have grown much faster than is commonly believed because of errors of valuation of mining output - here is one further piece of evidence to suggest that this is so. If the argument offered above is correct, then the huge increase in "factor incomes" must be at least partly reflected in increased demand, both for locally manufactured and for imported goods. As far as locally produced goods are concerned it is very easy to show that extra demand was translated into vastly increased production.

Because of persistent inflation, the Central Statistical Services, as we noted above, periodically change the base year used for comparing "real" values of output. If we look at South African Statistics 1980 we see that output in MANUFACTURING in constant 1970 prices was valued at R2 796 000 000 in 1970 and R 3 535 000 000 in 1979. This gives a disappointing growth rate of 2,64% per annum. In November 1982 a revised and updated set of output figures appeared in South African Statistics 1982 (9) where it is estimated that in constant 1975 prices the value of manufacturing output was R 4 490 000 000 in 1970 and R 6 958 000 000 in 1979. THIS GIVES A GROWTH RATE OF 4,99% per annum - ALMOST DOUBLE THE PREVIOUS ESTIMATED GROWTH. SUCH A REVALUATION OF OUTPUT NOT ONLY MAKES AN ENORMOUS DIFFERENCE TO PRODUCTIVITY CALCULATIONS, IT ALSO SHOWS THAT THE OUTPUT OF THE MANUFACTURING SECTOR WAS VERY MUCH HIGHER THAN WAS PREVIOUSLY THOUGHT TO BE THE CASE - PRECISELY WHAT ONE WOULD EXPECT IF THE HUGE INCOMES FROM MINING WERE TRANSLATED INTO EXTRA DEMAND. These apparently small percentage changes may not appear to be so significant, but look at it this way: if you invest R100 for 9 years at 2,64% compound interest, it will grow to R126,43 - if you invest it at 4,99%, it will grow to R155,00 - a very substantial difference.

In the meantime what happened to real wages and output per worker in Manufacturing? Real average wages (all workers) grew from R 2 172,70 p.a. to R2 603,40 (in constant 1975 terms) i.e. a growth rate of 2,03% p.a. whilst output per worker, also in constant 1975 terms, grew from R4 200,50 p.a. to R5 145,70 from 1970 to 1979 i.e. a growth rate of 2,28% p.a. Thus, despite the economy experiencing two recessions during the decade, the

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second of which was the longest and the deepest since the Great Depression of the 1930's, output per worker grew faster than the average wage! This is a STAGGERING ACHIEVEMENT!

OK,OK, so management will claim, we would expect rising productivity over the period because of the tremendous investments in plant and machinery. The truth of the matter is that that claim is open to very serious doubts. For most of the recession of 1976 - 1978 it is unlikely that investment took place in the bulk of the factories which go to make up the nanufacturing sector, and for the period 1970 to 1976 it is easy to demonstrate that most of the investment in new plant, machinery and equipment went into the basic metals and chemical industries. In 1970, these two industries accounted for 12,2% of total employment in nanufacturing and they used 33,3% of all plant,machinery and equipment - by 976 these figures had changes to 14,5% and 47,9% respectively.(10)

he point is that the investment activities of giant industries such as SCOR and SASOL in a relatively small economy such as South Africa can istort very seriously the apparent "capital intensity" of manufacturing. ven the National Productivity Institute recognises the need for ub-sectoral" analysis of South African manufacturing.(11)

TIL SUCH DETAILED STUDIES BECOME AVAILABLE AND WITH RELIABLE STATISTICAL SES, WORKERS MUST TREAT EVERY PRONOUNCEMENT ABOUT PRODUCTIVITY WITH THE MOST SUSPICION.

come now to the question of how it is that the colossal differences in oductivity referred to above managed to escape CRITICAL ATTENTION? The ent of the difference between the two output series has been public wledge since at least September 1980 when the first set of data in stant 1975 prices appeared.

following wonderfully bland statement by the Reserve Bank introduced a ies of substantial alterations:

> "As a result of structural changes in the economy between 1970 and 1975, the use of new weights in the recalculation of composite index and constant-price figures resulted in changes in some series, in particular national account series. Formerly observed rates of change in these series may, therefore, not correspond entirely (emphasis added) with those in the newly calculated series".(12)

The reason for the relative ease with which the re-estimated values of the output of the different sectors of the South African economy were accepted, was that there were a series of self-cancelling errors which resulted in the growth rate as estimated using constant 1970 data not being vastly different from the overall growth rate as estimated using the constant 1975 data, therefore there was no need to make a huge fuss.

Table 4 below shows how different sectors are alleged to have grown using the two different base years. LOGICALLY, THERE IS NO REASON WHY GROWTH RATES SHOULD CHANGE SIMPLY BECAUSE THE BASE YEAR CHANGES. HOWEVER, THE VALUATION PROBLEMS DISCUSSED EARLIER TROUBLE THE STATISTICIANS. ESPECIALLY THOSE WHERE PHYSICAL VOLUME INDEXES ARE USED eg. MINING AND MANUFACTURING! YOU WILL NOTICE THAT "SERVICES" ARE LESS AFFECTED, MAINLY BECAUSE "OUTPUT" IS EITHER THE "REVENUE" FROM GOODS "SOLD" OR THE "COST" OF PRODUCING "SERVICES" (MAINLY WAGES AND SALARIES). DISSATISFACTION WITH THE "GOODS" INDICES LED TO THEIR BEING RE-ESTIMATED, WITH THE STARTLING CONSEQUENCES FOR MANUFACTURING WHICH WE HAVE ALREADY NOTED! AGRICULTURAL GROWTH RATES DECLINE AND MINING (WHICH IS WRONG ANYWAY!) GOES FROM POSITIVE TO NEGATIVE GROWTH!

DATA FOR 1980 IN CONSTANT 1970 PRICES IS NOT AVAILABLE THEREFORE WE CAN ONLY COMPARE CHANGES IN GROWTH RATES AS A RESULT OF CHANGES IN THE BASE YEAR, FOR THE PERIOD 1970 TO 1979. NONETHELESS WHEN WE USE THE CORRECTED MINING OUTPUT GROWTH FIGURES FOR THESE YEARS, THE EFFECT ON THE TOTAL GROWTH RATE IS DRAMATIC. EVEN EXCLUDING THE BOOM YEAR OF 1980, SOUTH AFRICA'S GROWTH RATE WAS CLOSE TO 5% INSTEAD OF 3,2% - AN ENORMOUS DIFFERENCE!

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TABLE 4 CHANGES IN THE GROWTH RATES OF DIFFERENT SECTORS OF THE SOUTH AFRICAN ECONOMY 1970 - 1979, CAUSED BY CHANGING THE BASE YEAR FROM 1970 TO 1975 (VALUES IN THE TABLE ARE % COMPOUND GROWTH RATES PER ANNUM)

	GROWTH RATE ON BASE YEAR 1970 DATA	GROWTH RATE ON BASE YEAR 1975 DATA	DIFFERENCE
TOTAL ECONOMY	3,36	3,18	-0,18
AGRICULTURE	4,08	2,97	-1,11
MINING	1,09	-1,20	-2,29
MANUFACTURING	2,64	4,99	+2,35
CONSTRUCTION	1,87	1,96	+0,09
RANSPORT	6,16	5,48	-0,68
OMMERCE	3,00	2,77	-0,23
INANCE	2,90	3,34	+0,44
ENERAL GOVERNMENT	4,32	4,02	-0,30
EVISED ESTIMATES BASED ON THE REVALUED MINING OUTPUT GIVEN IN PART II OF HIS PAPER COMPARED WITH CONSTANT 1975 DATA ABOVE.			
)TAL ECONOMY	3,18	4,99	+1,81
NING	-1,20	11,73	+12,93

urces: South African Statistics 1980 and 1982 op. cit., & Part II of this per.

SHOULD BEAR IN MIND THAT THE MANUFACTURING VALUE OUTPUT SERIES RESTS ON INDEX OF PHYSICAL VOLUME OF OUTPUT SERIES, A CONCEPT WHOSE WEAKNESSES RE HIGHLIGHTED IN STARTLING FASHION BY THE REFERENCE TO THE AMERICAN MPUTER INDUSTRY AT THE BEGINNING OF THE PAPER, AND WHOSE UNRELIABILITY IS MADE STARTLINGLY CLEAR TO US. WHAT WILL HAPPEN TO MANUFACTURING OUTPUT NEXT TIME THE CSS CHANGES BASE YEARS?

ore anyone is tempted to say, ah! careful selection of end points duces these results it must be pointed out that

the years 1970 - 1980 were also selected by the National Productivity titute for discussion in the publications referred to, and

the comparison between the years 1970 and 1979 is dictated by the ilability of data.

Also it is recognised quite clearly that capitalism has suffered setbacks during the decade, nobody has ever denied the unevenness of capitalist development. Nonetheless, taking the long view, which is precisely what monopoly capital can afford to do, things have gone remarkably well for them, in spite of their protestations to the contrary.

The valuation errors discussed above mean that the National Accounts have to be recalculated for the period before 1970 as well. A quick estimate of the effect of incorrect valuation on the data between 1960 - 1970 suggests that the growth rate over the period was not 5,9% but 5,5% This has two important implications:

1. The economy performed "better" by the rough indicator of "economic growth rates" between 1970 and 1980 than it did in the previous decade. THIS IS COMPLETELY CONTRARY TO THE ACCEPTED WISDOM ON THE SOUTH AFRICAN ECONOMY.

2. Even though the growth rate for the period 1960 - 1970 must be revised downwards slightly, the fact remains that South Africa has enjoyed A TWENTY YEAR PERIOD WITH AVERAGE GROWTH RATES IN EXCESS OF 5,5% - AN ACHIEVEMENT SELDOM EQUALLED IN THE WORLD - YET UNEMPLOYMENT AND POVERTY REMAIN AT CRISIS PROPORTIONS.

PART IV

Finally a note on yet another anomaly in the statistics for an industry which is plagued by serious problems, namely the CONSTRUCTION industry. In any reasonably organised economic system, where housing of workers is a chronic problem, one would expect the construction industry to boom. Not so in South Africa! This is not the place to present a full-scale analysis of the woes of that sector, all we wish to achieve here is to point out the weakness of the statistical basis on which some of the pronouncements about poor productivity performance of the workers in that industry are made. Once again the problems are caused by the difficulties of valuation and they can be revealed by a simple trick which any economist can perform.

It goes like this: we have already noted that the national income (or output, since they should be the same) is divided between the wages which go to workers and surplus which goes to capitalists. We can use this information to check up on the quality of the National Accounting data. Let us consider the period 1970 to 1976. First of all we present figures for the performance of the industry.

TABLE 5 ANNUAL RATES OF GROWTH OF EMPLOYMENT, WAGES, AND OUTPUT (REAL TERMS) IN CONSTRUCTION 1970 - 1976

Employment	6,60%
Total Wage Bill	7,97%
Average Total wage	1,28%
Average wage whites	0,37%
Average wage blacks	4,89%
Output	5,15%
Output per worker	-1,36%

(Estimated from South African Statistics 1980 and 1982, op. cit)

-rom this we may see readily that the industry was in trouble - employment vas growing faster than output and average wage was growing faster than)utput per worker so surplus must have been falling. But, when we turn to :he series referred to above which shows the division of output between /ages and surplus we discover the following:-

otal value of output in Construction in 1970 in current prices was R507m, urplus was R74m or 14,6% of the total.
otal value of output in Construction in 1976 in current prices was R1 16m, surplus was R349m or 24,6% of the total.(13)

)W CAN WE RECONCILE THIS WITH THE CONCLUSION DRAWN ABOVE THAT SURPLUS IST BE FALLING OVER THE PERIOD? THE ANSWER IS THAT WE CANNOT AND THE ASON WHY WE CANNOT IS BECAUSE THERE IS SOMETHING WRONG WITH THE WAY IN ICH THE OUTPUT OF THE CONSTRUCTION INDUSTRY IS VALUED. CENTRAL ATISTICAL SERVICES ARE AWARE OF THIS BUT EVEN NOW USE THE SAME VALUATION THOD AND DO NOT KNOW HOW TO SOLVE THE PROBLEM - IN THE MEANWHILE CAPITAL D THE STATE CASTIGATE THE WORKERS AND RUSH AROUND PRETENDING TO EACH HER THAT EDUCATION IS THE ANSWER - RUBBISH!! THE WORKMEN WHO BUILT THE RAMIDS, OR ZIMBABWE RUINS OR WESTMINISTER ABBEY DID NOT EVEN PASS

STANDARD I - THEY PROBABLY COULD NOT EVEN WRITE THEIR OWN NAMES!

Here is the proof of the error in the output series for Construction.

Let the value of output in the Construction Sector = 100 in 1970.

Then 14,6 goes to surplus and 85,4 goes to wages.

Now let output grow at the annual rate shown in Table 5 i.e. 5,15% p.a.
Therefore value of output in 1976 = 135,16

And let the wage bill grow at the annual rate shown in Table 5 i.e. 7,97%
Therefore value of the wage bill in 1976 = 135,29

WAGES THEREFORE EXHAUST THE TOTAL VALUE OF OUTPUT - THERE IS NOTHING LEFT FOR THE POOR CAPITALIST! BUT WAIT, WE HAVE JUST SHOWN ABOVE BY THE OTHER METHOD THAT THE PROPORTION OF SURPLUS WAS RISING! BOTH CALCULATIONS CANNOT POSSIBLY BE CORRECT.

However until the statistics people sort themselves out, workers (and even on occasion, management) will continue to be blamed for falling productivity, rising inflation and every other economic ailment suffered by South Africa.

The simple arithmetical procedure described above may be used to show that the mining output figures are rubbish and that the old manufacturing figures published in South African Statistics 1980 are also rubbish and hence that every productivity study based on these numbers is wrong.

PART V.

WHAT LESSONS ARE WE TO DRAW FROM ALL THIS?

LESSON NO 1.

This paper has concentrated on current struggles over PRODUCTIVITY, BUT WE MUST NEVER LOSE SIGHT OF THE FACT THAT THESE STRUGGLES HAVE CHARACTERISED CAPITALISM RIGHT FROM THE VERY START. IF NECESSARY WE CAN SUBSTANTIATE THIS WITH COUNTLESS EXAMPLES DRAWN FROM WORKER HISTORY BOTH HERE AND ELSEWHERE.

WHAT THIS MEANS IS THAT NO MATTER HOW "PRODUCTIVE" THE WORKERS BECOME, THIS STRUGGLE WILL NOT CEASE, BECAUSE OF THE INHERENT CONFLICT BETWEEN LABOUR AND CAPITAL.

This conflict has had important implications for the way in which "economics" as a social science has developed, and for the way in which "economic research" is conducted. To illustrate this, here are a few points from a paper written by HORWOOD twenty one years ago. (14)

The statements which follow have been selected deliberately because (a) they still represent accurately the school of economic thought which is dominant today and (b) because HORWOOD, as chief architect of economic policy shows no signs of deviating from the principles embodied in the kind of economic theory he espoused.

The first point illustrates the connection between some of the intellectual trivia taught at our universities under the guise of "economics" and the way in which this is used by capitalists and the state to justify denying workers the fruits of their labour.

HORWOOD said:

> "However powerful the mines, agriculture and secondary industry may be as buyers of African labour, no reliable evidence has been made available to show that they are "exploiting" their workers in the sense of paying them less than their marginal revenue product".

ven if the concept "marginal revenue product" (which translated means the amount" the last worker to be hired "adds" to total revenue and which ıder "competitive" conditions allegedly helps to determine "wages"), had ıy theoretical validity, which it does not(15), it could not, in and of :self, be used as a justification for the payment of starvation wages to ırkers. Horwood admits as much when he says:

> "The need to raise the wages of many African workers on grounds of sheer humanity is not disputed......" (emphasis in original)

Yet the statement above contains the implicit prescription that workers should be paid their "marginal revenue products" i.e. is that workers should submit themselves to the insane logic of so-called "private enterprise".

That logic operates as follows - wages must be linked closely to 'productivity' . This according to "conventional" economcs, operates with the force of a natural law.
HORWOOD said as much when he noted in his paper that:

> "low wages appear more likely to be associated with low productivity, however little that may be the fault of the worker".

Competition between capitalists on a local, national and/or international scale keeps the prices of certain commodities low, this means that workers' so-called "marginal revenue products" are also low, therefore they are paid starvation wages. The clothing industry is a good example:

WHEN THE WORKERS IN THE CLOTHING INDUSTRY ARE SUFFICIENTLY WELL-ORGANISED TO PRESS FOR A LIVING WAGE, THE FORCES OF COMPETITION WILL ENCOURAGE CAPITAL TO RELOCATE FACTORIES TO THE BANTUSTANS WHERE THEY WILL NOT BE PLAGUED BY UNIONS. THIS WILL THEN BE HAILED BY THE STATE AS 'DEVELOPMENT'.

Raise the question of why mineworkers' wages were so low for so long and you will be told that "their marginal revenue products" were low. This was because the gold price was low. HOWEVER, THE GOLD PRICE WAS FIXED BY PEOPLE! BY FINANCIERS AND POLITICIANS! NOT BY SOME LAW OF NATURE. This has been amply demonstrated when the gold price was 'unfixed' And so too with most other commodities, whose 'prices' are the complex outcome of struggles between capitalists - struggles which are both the cause and effect of uneven development. At one level, this uneveness of capitalist development suits capital very well because it divides workers - thus as we noted above, some workers are said to be in "low productivity industries" with low wages of course and others, who get higher wages, do so because of their 'higher' productivity.

But, as may readily be demonstrated, this nonsense stems from the way production is organised, nationally and internationally, NOT from unchangeable natural laws". It is quite clear that a worker may work very hard and be 'skilled' and still receive a low wage because of the peculiar workings of the capitalist market.

THUS, NOT ONLY IS THE THEORY INCORRECT, BUT THE STATISTICS USED TO SUPPORT THE ATTACK ON WORKERS IS DEMONSTRABLY WRONG!

LESSON NO.2.

The second point of interest in HORWOOD's paper is relevant to the set of solutions currently being offered for the salvation of workers in South Africa. HORWOOD said:

> "Without doubt, government's persistent refusal to sanction African trade unions appears, on economic grounds, to be a great weakness in our system". HE CONTINUED, "And there is equally no doubt of the grave disabilities confronting non-white (and particularly African) workers in the shape of a plethora of restrictions upon individual freedoms".

Two points are relevant here:

i) As a result of successful worker struggles, independent, democratic, non-racial unions now exist, although the degree of unionisation of still remains relatively low.

THE STRUGGLE, EVEN FOR SUCH A MODEST GOAL AS A LIVING WAGE, HAS PRODUCED THE REPEATED CHARGE THAT WORKERS' 'UNREALISTIC' WAGE CLAIMS ARE RESPONSIBLE FOR RISING UNEMLOYMENT! THE COROLLARY TO THIS IS OF COURSE ALWAYS THAT "WAGE CLAIMS" MUST "MATCH" PRODUCTIVITY.

Seeking to blame workers for the economic ills resulting from the internal contradictions of the economc system in South Africa simply clouds the issue.

IT IS NOT UP TO SMALL GROUPS OF WORKERS TO SACRIFICE THEIR HARD-WON RIGHTS, TO EASE A PROBLEM WHICH THEY DID NOT CAUSE AND WHICH, UNDER THE EXISTING SET OF ECONOMC ARRANGEMENTS, THEY CANNOT RESOLVE.

ii) We hope that HORWOOD has recanted on the second part of the statement because his party's policies will maintain most of the restrictions. It is however, popular amongst members of the loyal opposition and amongst certain fractions of capital to press for the removal of "restrictions" on all blacks. Suppose for a moment that the state had to agree to this (it is clear of course that they have no such intention), overnight we would have a dozen new "Crossroads". What would become of these people? Small businessmen? Nonsense, they will simply constitute a more visible part of a huge army of the unemployed - available to capital to use to force down the real wage.

Freedom of movement under the present set of economic arrangements will constitute freedom to starve in a different area. For the State's part it is not about to relax its control over the "Orderly Movement of Persons," because it wishes to maintain strict control over the location of the unemployed, whilst maintaining an adequate supply of labour to industry.

Consider this for a moment - between 1970 and 1980, approximately 101 000 new jobs were created each year in the so-called "modern sector" of the economy. Agricultural employment is either static or declining. It is estimated that somewhere between 200 000 and 270 000 new job seekers come onto the "market" every year. Capital and the State (and some sell-out trade unionists) have claimed repeatedly that if only "productivity" and "growth" were to rise, especially under a joyous regime of "private enterprise" so too would the rate of "job creation".

WE HAVE DEMONSTRATED IN THIS PAPER THAT BOTH CONDITIONS i.e. HIGH GROWTH AND HIGH PRODUCTIVITY, HAVE BEEN MET. WHERE ARE THE JOBS?

The economic basis for this gross socio-economic failure is not the legitimate activities of trade unions - it is the domination of the economy by giant monopoly corporations which impose a particular stamp upon patterns of growth in the South African economy.

No amount of lip-service to "freedom of individuals" will alter this truth.

LESSON NO. 3.

THIS INFORMATION MUST BE USED BY WORKERS TO STRIKE A DECISIVE BLOW IN THE BATTLE OVER THE SHARE OF THE BENEFITS OF RISING PRODUCTIVITY. IT IS CRUCIAL TO NOTE THAT SO FAR, NO REAL CHALLENGE HAS BEEN MOUNTED AGAINST THE BENEFITS ACCRUING TO CAPITAL. ALL THAT HAS BEEN SAID IS THAT WORKERS HAVE PAID IN BLOOD AND SWEAT FOR THEIR SALARY INCREASES.
FOR BLACK WORKERS THIS HAS OFTEN BEEN AT THE EXPENSE OF WHITE WORKERS. SO WHILST THE HISTORICAL GAP BETWEEN WHITE AND BLACK WAGES REMAINS UNACCEPTABLE, CURRENT TRENDS SHOULD SEND A VERY CLEAR MESSAGE TO THE WHITE WORKERS THAT NO AMOUNT OF RACIAL RHETORIC AND RACIST UNIONISM IS GOING TO PROTECT THEIR STANDARDS OF LIVING IN THE LONG RUN. ONLY A UNITED NON-RACIAL LABOUR MOVEMENT WILL EFFECTIVELY GIVE ALL WORKERS A REAL SHARE OF THE GREAT POTENTIAL WEALTH OF SOUTH AFRICA.

LESSON NO. 4

IN NUMEROUS STRUGGLES OVER THE LAST TEN YEARS, WORKERS HAVE BEEN HAMPERED BY A LACK OF ACCESS TO INFORMATION WHICH WOULD HAVE ENABLED THEM TO ARGUE THEIR CASE MORE FORCEFULLY. WE HAVE DEMONSTRATED THAT AT THE LEVEL OF NATIONAL ACCOUNTING STATISTICS, WHICH BECOMES OF SUPREME IMPORTANCE IN THE FORMATION OF ECONOMIC, SOCIAL AND POLITICAL POLICY, THE STATE'S OFFICIAL STATISTCIANS HAVE BEEN SO GROSSLY WRONG THAT VERY SERIOUS QUESTIONS ARE RAISED ABOUT THE WHOLE PROCESS OF DEVELOPMENT IN SOUTH AFRICA. THE CHALLENGE TO THE TRADE UNIONS IS TO DEVELOP A SYSTEMATIC UNDERSTANDING OF THESE PROBLEMS AND TO FORMULATE ALTERNATE ECONOMIC PROGRAMMES.

LESSON NO. 5.

FINALLY, THIS PAPER RAISES IMPORTANT POINTS ABOUT THE ROLE AND DIRECTION OF ECONOMIC RESEARCH AND FOR THAT MATTER, ALL SOCIAL SCIENCE RESEARCH IN SOUTH AFRICA. IT IS LITTLE WONDER THAT FOR THE ORDINARY WORKER OR MAN IN THE STREET, CONVENTIONAL ECONOMICS HAS SUCH A POOR REPUTATION. IT IS ALWAYS CONFUSING AND BY LARGE SEEMS TOTALLY IRRELEVANT. BUT FAR WORSE, IT IS ALL TOO OFTEN WRONG AND WITH DETRIMENTAL CONSEQUENCES FOR WORKERS, THE GROSS ERRORS IN NATIONAL ACCOUNTING UNCOVERED HERE BEING A CASE IN POINT.
IF WE AS INTELLECTUALS ARE TO GAIN THE RESPECT AND CONFIDENCE OF THE GROWING WORKER MOVEMENT IN SOUTH AFRICA WE WILL HAVE TO GET DOWN TO A HARD CRITICAL ASSESSMENT OF THE NUMEROUS FALLACIES USED DAY-IN AND DAY-OUT TO ATTACK WORKERS AND THEIR LEGITIMATE ASPIRATIONS.

Notes and References:

1. October 1982.
2. see The Citizen, August 6 1982. (quoted in South African Digest, Week ended August 27 1982).
3. The method used by Central Statistical Services (CSS) to value Mining Output, operates as follows:
the different sections of the mining industry are assigned a "weight" according to their contribution to output (value added) in the base year (presently 1975). The Index of Physical Volume of Production (in the case of most minerals, based on tons produced) is then applied to that "base weighted" contribution to obtain the "real" contribution of the particular mining section, say "coal" for example, in any year.
USING THIS SYSTEM, PRICE CHANGES IN THE DIFFERENT MINERALS DO NOT CHANGE THE SYSTEM OF WEIGHTING, NOR THE REAL VALUE OF OUTPUT.

For example, the contribution of 'goldmining' to National Output in 1975 was R2 150 000 000 and the output index stood at 100. In 1980, the production index had fallen to 94,4, therefore the real value of gold output, according to the CSS was R2 029 600 000 (Source: unpublished data from Central Statistical Services).
4. see "A statistical presentation of South Africa's national accounts for the period 1946 to 1980", supplement to South African Reserve Bank Quarterly Bulletin, (SARB QB) September 1981, Table 22.
5. Estimated from South African Statistics 1982, op.cit., p21.24.
Note that this data applies only to "listed companies". What happens to the rest is anybody's guess.
6. see A System of National Accounts, op.cit., Ch.IV., para 4.8.
7. Obviously some of the income went to pay for imports and the terms of trade should therefore be taken into account. These terms for "merchandise only", moved against South Africa from 96 in 1970 to 76 in 1980. In other words, R100 of South African exports would have bought R96 of imports in 1970 but only R76 of imports in 1980. The use of the CPI as a deflator therefore overstates economic growth, but unless a very substantial proportion of the mining income "leaked" into imports, this overstatement may not be all that significant. It is assumed here that the "composite" deflator used in

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Column 3 of Table 2 takes account of 'imports' because of the overwhelming importance of 'machinery' in the import bill. Payments to "factors of production" overseas, i.e. investors in South African mining obviously have to be taken into account as well. In 1970, Investment Income paid to overseas investors amounted to R388m (excluding taxes). By 1980, this amount had risen to R1 824m. (SARB QB March 1980 and March 1982). Total Foreign Liabilities of South Africa in 1980 were R25 485m of which R3 377m was invested in Mining, or roughly 13% of the total. (Third Census of Foreign Transactions, Liabilities and Assets, 31 December 1980, supplement to SARB QB December 1982 A-6 & 7).

Even if the rate of return on investment were so unequal that say 1/3 of total foreign earnings went to investors in Mining, it would still only mean that R600m or so out of a total surplus of R10 497m went overseas. Excluding the import bill and the money sent by South Africans on the purchase of foreign assets, the balance must have remained in South Africa.

Not unsuprisingly, Real Gross National Product (GNP) provides a much better indicator of the rate of growth in South Africa than does the present method of measuring growth using Real Gross Domestic Product, precisely because the former takes into account movements in the gold price. (see for example SARB QB December 1980 p7). South Africa's GNP grew from R19 911m to R32 027m between 1970 and 1980 (constant 1975 terms) i.e. a growth rate of 4,87% (see supplement on national accounts to SARB QB September 1981). If GNP is identical to GDP plus net factor earnings, and total payments for services and transfers exceeded receipts by R2 747 in current prices in 1980, how can GDP have been less than GNP? For that is what the Reserve Bank would have us believe. Unfortunately, in an open economy like South Africa it is virtually impossible to do productivity studies on the basis of GNP data. GDP is almost always used.

These figures made their first appearance in the September 1980 edition of the South African Reserve Bank Quarterly Bulletin.

see Census of Manufacturing 1970, Report No.10-21-26, and Census of Manufacturing 1976, Report No.10-21-32, Dept. of Statistics, Pretoria.

see Multiple Input Productivity Indices for Sectors of the South African Economy, op.cit., p1.

12. see South African Reserve Bank Quarterly Bulletin, September 1980, p16.

13. The years before the start and end points selected here were checked to ensure that the results are not produced by 'unusual' values in the base year (1970) and the end year (1976). THEY ARE NOT. There is an as yet unexplained rise in the proportion of output going to SURPLUS in the early seventies - this requires investigation.

14. see HORWOOD OPF, "Is Minimum Wage Legislation the Answer for South Africa?" South African Journal of Economics, Volume 30 Number 2, June 1962, pp123-129.

15. For a complete account of the destruction of the marginal productivity doctrine see Harcourt GC, Some Cambridge controversies in the theory of capital, Cambridge, at the University Press, 1972.

> "If, then, a small (but, I like to think, significant) section of the trade is convinced that the distribution of income and factor prices cannot be explained either within the system of production alone or, relevantly, as the outcome of a general equilibrium system even when (because) we use marginal productivity notions and modern programming methods, factors and forces elsewhere in the economic system - and other than these - must be introduced." (p175)

For a similar hatchet-job on marginal productivity as an empirical tool see Lester C Thurow, "A Do-It-Yourself Guide to Marginal Productivity", in Readings in Labour Economics, ed.King JE, Oxford University Press, 1980.

NOTE:

Would be critics are advised not to attempt to dismiss the claim in this paper that changing base years from 1970 to 1975 produced a change in the growth rate from 2,6% to 5%, on the basis of the figures given on page 12.60 of South African Statistics 1982. A quick glance at this index of Physical Volume of Production Series gives the 1979 value as 114,9 and the 1970 value as 82,8, (1975 = 100) which implies a growth rate of 3,7%. On closer inspection it turns out that for some inexplicable reason Central Statistical Services give the bottom half of the table, covering the years 1973 - 1967 the base year of 1973!

APPENDIX 1-2

Appendix 1-2 Unpublished response to Fosatu Challenge by Swanepoel and van Dyk (1983)

KOMMENTAAR OP MNR METH VAN DIE UNIVERSITEIT VAN NATAL SE SIENING OOR DIE KORREKTHEID VAN NASIONALE REKENINGE-GEGEWENS EN PRODUKTIWITEIT

1. Inleiding

Mnr Meth beweer dat die amptelike nasionale rekeninge-syfers waarop die groeikoers vir Suid-Afrika gebaseer word, verkeerd is. Na sy mening word verkeerde deflators gebruik om die reekse teen heersende pryse na konstante pryse om te skakel. In die besonder is sy kritiek gemik teen die berekening van die reële bruto binnelandse produk van die mynbousektor, fabriekswese en konstruksie. Omdat nasionale produktiwiteit op basis van hierdie reële produksie gemeet word, volg dit dat na sy mening produktiwiteitsyfers ook verkeerd is. Blykbaar is die relatief swak produktiwiteitsprestasie van die arbeider in Suid-Afrika vir hom onaanvaarbaar, en poog hy gevolglik om die amptelike produksiesyfers in diskrediet te bring. Hy maak verder sy eie reële berekenings van veral die reële toegevoegde waarde van die mynbousektor en maak daarop aanspraak dat sy metode van deflering meer korrek is as dié wat deur die amptelike instansies gedoen word.

Aangesien mnr Meth se kritiek hoofsaaklik teen die berekening van die reële toegevoegde waarde van die goudmynbousektor gemik is, sal die amptelike metode om reële goudproduksie te bereken kortliks toegelig word. Tweedens sal mnr Meth se alternatiewe metode kortliks geskets word. In die derde plek sal aangetoon word waarom mnr Meth se metodiek nie alleen onwetenskaplik is nie, maar ook heeltemal onprakties. Daarna word die rol van goud in die Suid-Afrikaanse ekonomie geskets en die geskiktheid van nasionale rekeninge-syfers vir produktiwiteitsanalises aangestip. Ongegronde kritiek teen die hersiening van reële fabrieksproduksie as gevolg van nuwe gewigte word weerlê en 'n paar opmerkings oor die reële toegevoegde waarde van die konstruksiesektor gemaak.

2. Die reële toegevoegde waarde van die goudmynbousektor.

(a) Die metode deur amptelike instansies gevolg

Die toegevoegde waarde van die goudmynbousektor is die verskil tussen bruto opbrengs en intermediêre insette. Dit volg logies hieruit dat die reële toegevoegde waarde (of reële produksie) dus die verskil is tussen reële opbrengs en reële intermediêre insette. Dit beteken niks anders nie as dit die verskil verteenwoordig tussen die waarde van die opbrengs (of die waarde van goudverkope) gedefleer met die goudprysindeks en intermidiêre insette gedefleer met 'n samegestelde indeks van insetpryse. Hierdie metode staan bekend as die dubbele-defleringsmetode en word allerweë deur internasionale deskundiges aanbeveel. 'n Ander metode om die reële toegevoegde waarde van die goudmynbousektor te bereken, is bloot om die waarde in die basisjaar (sê 1975) met die volume goud geproduseer te ekstrapoleer. Die dubbele-defleringsmetode vereis uitgebreide gegewens oor intermediêre insette en toepaslike pryse. Gevolglik word hierdie metode slegs periodiek gebruik om die toegevoegde waarde wat op die volume goud geproduseer gebaseer is, te kontroleer. 'n Vergelyking van die twee metodes deur die Sentrale Statistiekdiens het aan die lig gebring dat die resultate weinig verskil.

(b) Mnr Meth se metode

Mnr Meth vind dit onversoenbaar dat die reële goudproduksie volgens die amptelike berekenings 'n daling tussen 1975 en 1980 toon, terwyl die toegevoegde waarde teen heersende pryse (weens die styging in die goudprys) fenomenaal toegeneem het. Tereg verwys hy na die groot styging in faktorvergoedings (salarisse en lone en winste vóór dividende), (wat volgens definisie gelyk is aan die toegevoegde waarde) wat deur die goudmyne gedurende hierdie tydperk geskep is. Hy beroep hom dan op 'n ander aanbevole en aanvaarde metode, die sogenaamde uitgawemetode, om te bewys dat die reële toegevoegde waarde volgens hierdie metode bereken, inderdaad gestyg het. Hy defleer naamlik die vergoeding van werknemers met die verbruikers-prysindeks. Die oorblywende gedeelte van die faktorinkomes, die sogenaamde bedryfsurplus, verdeel hy tussen investering (wat per definisie gelyk is aan besparing) en ander. Die investering defleer hy met 'n afgeleide investeringsdeflator en die ander met die verbruikersprysindeks. Die som van die gedefleerde faktorinkomes verteenwoordig volgens hom dan 'n noukeuriger raming van die reële toegevoegde waarde van die goudmynbousektor, wat wesenlik hoër is as die amptelike syfers.

(c) Kommentaar op mnr Meth se metode

Mnr Meth dwaal grootliks in sy toepassing van die uitgawemetode. Hierdie metode, wat makro-ekonomies deur die bekende Keynesiaanse funksie

$$Y = C + I + G + X - M$$

aangedui word, word hoofsaaklik vir die ekonomie in sy geheel, en nie vir individuele sektore nie, gebruik. Dit verteenwoordig die besteding aan die bruto binnelandse produk, bestaande uit private en owerheidsverbruiks-besteding, vaste en voorraadinvestering, en uitvoer minus invoer, wat per definisie gelyk is aan die bruto binnelandse produk. Indien mnr Meth die reële produk vir die goudmynbousektor volgens die uitgawemetode wil bereken, moet hy die finale besteding met behulp van 'n interindustrie-vloeitabel (inset-uitsetgegewens) bepaal, en hierdie finale bestedingskomponente met toepaslike deflators defleer. Om die totale reële bruto binnelandse produk op hierdie wyse te bereken, moet dit vir al die sektore só gedoen word, ten einde dubbeltelling te vermy.

Tweedens fouteer mnr Meth grootliks om die bedryfsurplus, uitgesonderd investering (in die mate wat dit wel deur eie fondse gefinansier is) met die verbruikersprysindeks te defleer. Wat mnr Meth daardeur te kenne gee, is dat die totale reële bruto binnelandse produk netsowel bereken kan word deur die binnelandse produk teen heersende pryse met die verbruikersprysindeks te defleer; 'n metode wat internasionaal slegs in die mees uitsonderlike gevalle (in die besonder by gebrek aan toepaslike prysindekse) wel toegelaat word. Indien mnr Meth nog die bedryfsurplus met die goudprysindeks defleer het, sou dit verskoonbaar gewees het.

Derdens begryp mnr Meth klaarblyklik nie die verskil tussen inkome en produksie nie. In die nasionale rekeninge-konteks verteenwoordig produksie die toegevoegde waarde, dit wil sê die waarde van die opbrengs (verkope) minus die waarde van intermediêre insette. Per definisie is produksie wel gelyk aan die vergoeding wat betaal word aan die produksiefaktore wat by die produksieproses betrokke is. Indien reële waardes egter vanaf die inkomstekant bereken wil word, moet deflators wat die produksieproses weerspieël, en nie die besteding van die inkome nie, toegepas word. Die stimulerende effek van verhoogde faktorinkomes uit goudmynbou weens die styging in die goudprys word aan die PRODUKSIEKANT wel gemeet aan toenames in die produksie van motors, meubels, klere, kapitaaltoerusting, ens., en aan die UITGAWEKANT aan verhoogde private verbruiksbesteding en vaste investering. Die verhoogde inkome wat deur die goudmyne geskep is, het egter nie die reële produksie (goud) van die goudmyne verhoog nie, maar wel die sekondêre effek gehad dat die produksie van ander nywerhede toegeneem het, wat in die nasionale rekeninge-syfers in 'n toename in die reële toegevoegde waarde van hierdie sektore weerspieël is. Verder het die styging in die goudprys 'n aansienlike verbetering in Suid-Afrika se ruilvoetverhouding aangedui, wat in die nasionale rekeninge-syfers in 'n toename in die reële nasionale produk verteenwoordig word. Sodanige toenames beteken 'n aansienlike styging in die lewenstandaard van Suid-Afrikaners, aangesien 'n groter volume invoergoedere en -dienste met 'n gegewe volume uitvoergoedere en dienste verkry word.

3. Die rol van goud in die Suid-Afrikaanse ekonomie

Die rol van goud in die Suid-Afrikaanse ekonomie kan nie alleen aan die bydrae van die goudmynbou tot die binnelandse produk gemeet word nie. Op die gebied van werkverskaffing, verhoogde staatsinkomste, befondsing van investering, produksie van kapitaal- en intermediêre goedere en die verdiening van buitelandse valuta speel die goudmynbousektor 'n baie belangrike rol, wat wel op een of ander regstreekse of onregstreekse wyse in die nasionale rekeninge-statistieke weerspieël word.

4. Produktiwiteit in die goudmynbousektor

Mnr Meth vind dit onverklaarbaar en onverstaanbaar dat produksie per werker in die goudmynbousektor volgens amptelike statistieke kan daal, terwyl die tonnemaat erts gemaal per werker tog gestyg het. Sy afleiding is summier dat die amptelike syfers verkeerd is. In hierdie opsig verwar mnr Meth produktiwiteit met bedrywigheid. Die enigste bruikbare of verkoopbare produk wat die goudmyne lewer is goud (plus natuurlik 'n klein hoeveelheid ander metale wat, uitgesonderd uraan, vir alle praktiese doeleindes geïgnoreer kan word). Ongeag die hoeveelheid erts wat vergruis word en arbeiders en kapitaaltoerusting wat aangewend word, kan reële produksie eenvoudig nie styg indien die hoeveelheid goud wat geproduseer word daal nie. (Die aanplanting van 'n groter oppervlakte mielies, maar droogtetoestande wat die opbrengs laat daal, gee tog nie aanleiding tot verhoogde mielieproduksie nie!) Indien indiensneming dus styg en produksie neem stadiger toe, bly dieselfde of daal, sal die gemiddelde produksie per werknemer daal, wat vertolk kan word as 'n daling in die arbeidsproduktiwiteit. Eerder as om hierdie daling summier as onsinnig te verwerp, behoort mnr Meth sy ekonomiese kennis aan te wend en die REDES vir die daling in perspektief te stel. Indien dit aan doelbewuste bestuursbesluite gewyt kan word (die ontginning van laergraadse erts, dieper skagte, langer vervoerafstande, ens) moet dit as die verklaring vir dalende arbeidsproduktiwiteit aangebied word, terwyl arbeidsbedrywigheid (soos gemeet aan die tonnemaat erts per werker vergruis) wel kon gestyg het. Dalende arbeidsproduktiwiteit in die goudmynbousektor kan dus met stygende arbeidsbedrywigheid gekwalifiseer word, sonder om die amptelike syfers as verdag te bestempel.

5. Hersiening van die reële produksie van fabriekswese

Mnr Meth beweer dat die reële toegevoegde waarde van fabriekswese "stilweg" verander is van 'n gemiddelde jaarlikse groeikoers van 2,64 persent op die basis van 1970-pryse, tot 4,99 persent in terme van 1975-pryse. Om dit as "stilweg" te bestempel, terwyl dit inderdaad wyd bekendgemaak is, is nie alleen onbillik nie, maar bevat ook kwaadwillige insinuasies. Weens oppervlakkige ondersoek besef mnr Meth nie dat die 1970-syfers in der waarheid 1963-gewigte weerspieël het nie, en dat die eerste hersiening van gewigte eers in 1975 gedoen is. Hy kan oënskynlik nie verstaan dat struktuurveranderings gedurende die twaalfjaartydperk tot 'n aansienlike verandering in die relatiewe belangrikheid van hoofgroepe gelei het nie, sodat die berekening van nuwe gewigte 'n merkbare groter styging in totale reële produksie kon veroorsaak het nie.

6. Die reële toegevoegde waarde van die konstruksiesektor

Die amptelike instansies bereken die reële toegevoegde waarde van die konstruksiesektor deur ekstrapolasie van die basisjaarwaarde met 'n toepaslike volume-indeks van reële investering in geboue en konstruksiewerke. Mnr Meth wil dit bepaal deur deflering van die faktorvergoedings teen heersende pryse met die verbruikersprysindeks, maar trap in dieselfde slaggat as by die goudmynbousektor. Hy kan ook geen verklaring vind waarom die bedryfsurplus in sommige jare vinniger as arbeidsvergoeding kan toeneem nie!

7. Opsomming

(a) Dit wil voorkom of mnr Meth se kennis van die nasionale rekeninge gebrekkig is en hoegenaamd nie die ingewikkelde proses van die samestelling van toepaslike deflators vir die berekening van reekse teen konstante pryse begryp nie.

(b) Omdat hy basies in die arbeider se lot belangstel, is deflering met die verbruikersprysindeks vir hom van oorheersende belang, met rampspoedige gevolge.

(c) Hy begryp klaarblyklik nie die verskil tussen reële produksie en reële inkome nie, en verwag dat hoër reële inkome in die goudmynsektor geskep tot groter reële goudproduksie moet lei.

(d) Arbeidsproduktiwiteit en arbeidsbedrywigheid is vir hom sinoniem.

(e) Hy ontken dat struktuurveranderings in die fabriekswesesektor tussen 1963 en 1975 plaasgevind het.

(f) Dit moet beklemtoon word dat die resultaat van vergelykings oor tyd sterk beïnvloed word deur die keuse van die begin- en eindtydperk. In hierdie verband is mnr Meth nie konsekwent met sy keuse van begin- en eindjare nie.

(g) Dit wil voorkom of hy nog baie leiding in die konsepte, werking, betekenis en interpretasie van die nasionale rekeninge nodig het, nieteenstaande die feit dat iemand hom alreeds gehelp het "...in explaining the data and guiding the author through the perils of the National Accounts". Sy versuim om deskundige advies in te win is onverskoonbaar.

J SWANEPOEL & J VAN DYK
A RESERWEBANK
ETORIA
Mei 1983
)51N)

APPENDIX 1-3

Appendix 1-3 NPI response to Fosatu Challenge (NPI, 1983)

Produktiwiteit SA

December 1983

Productivity SA

NPI rejects claims regarding 'inaccurate' productivity statistics

Mr Charles Meth a lecturer at the University of Natal recently launched an attack on national statistics published by the South African Reserve Bank (SARB), the Central Statistical Services (CSS) and the National Productivity Institute (NPI) in an occasional publication of the Federation of South African Trade Unions (FOSATU). He claims there are "huge errors" in calculations of output in the mining, construction and manufacturing sectors published by the SARB and the CSS. According to him, all productivity indices based on these statistics are therefore also wrong and underestimate labour productivity growth. By attempting to bring the official production figures into disrepute, he tries to direct the attention away from the relatively weak productivity performance of the South African worker.

The article is interspersed with calculations which do not conform to national accounting procedures and the NPI decided initially to disregard its content. The NPI has however received various enquiries regarding the article and it has therefore been decided to publish comment on some of them.

Both the SARB and CSS, the main sources for all productivity statistics published by the NPI, have disregarded the contents of Mr Meth's articles.

Real value added

Mr Meth's major objection is against the way in which real value added, also known as real production or contribution to real Gross Domestic Product, (GDP) in the gold mining sector is determined. He uses a different set of deflators to convert current values to constant (base year) values, and comes up with results that yield much higher real value added figures. These, he claims, reflect the factual position more accurately, because, according to him, his deflators take the benefits of the increase in the price of gold into account. He deflates the remuneration of employees and a part of profits with the Consumer Price Index (CPI) while the other part of profits is deflated with a composite price index reflecting the price of capital inputs. This method, according to him, is superior to the official procedure by which the real value added of the gold mining industry is compiled by extrapolating the value at current prices in 1975 (prevailing base year) on the basis of the trend in the quantity of gold produced. This official procedure was confirmed in 1981 by OECD experts and statisticians of the Statistical Office of the United Nations as correct and in line with methods employed internationally.

The flaws in Meth's approach are briefly the following:

- He does not differentiate between **income** and **production**. In a national accounts context **production** represents the value added, i.e. the value of output minus the value of intermediate consumption. Income represents the income generated (mainly salaries, wages, interest and profits) in the **production process**. If real contribution to GDP is to be calculated from the income side, deflators that reflect the **production process**, and not the expenditure of the income, must be used. For example, remuneration of the various factors of production should **not** be deflated by the CPI, as this index reflects final expenditure patterns and is **not** directly related to price changes of production or of intermediate expenditures.
- The economic gains of increased income generated by the gold mines (via gold price increases) are not shown in increased quantities of gold produced (as Mr Meth would seem to argue). An increase in gold sales has the secondary effect of stimulating production in other industries, such as motor vehicles, clothing, capital equipment, etc.
- The immediate effect of an increase in the real national accounted for by an improvement in South Africa's terms of trade. In the national accounts this favourable development is reflected in an increase in the real national product, which in turn represents a higher standard of living.
- The quantity of gold ore milled per worker can be used as a measure of labour productivity at a micro level, but for national accounts purposes only the gold recovered, representing a saleable product, is a valid measure of output in the gold mining industry. At the macro level, ore milled per worker will be measured as labour activity, and not as labour productivity.

Output figures

Mr Meth stated that the official output figures for manufacturing for the period 1970 to 1979 were changed from an average annual growth rate of 2.64 per cent based on 1970 prices to 4.99 per cent in terms of 1975 prices. This means that labour productivity has increased at a much faster rate than is usually stated. The CSS published the reasons for the changes and the revised figures in an official Newsletter, p. 12.1, of 4 June 1982. The reason for the changes are:

- According to United Nations' recommendations base year changes, (i.e. 1970 to 1975) have to be made regularly (usually every five years) to keep pace with any structural changes which might occur.
- The results of the 1976 Census of Manufacturing showed that the growth rate based on a sample of manufacturing establishments was underestimated.
- The output figures were also changed because the sample of manufacturing establishments used by the CSS for the short term statistical series was revised on the basis of the results of the 1976 Census of Manufacturers.

It must be stressed that the NPI uses official publications (mainly from the CSS and SARB) in calculating productivity statisitics. Although we cannot guarantee the accuracy of these figures, we do place very great store on the authority of these two institutions and we have never had any reason to challenge their figures. In any case labour productivity in manufacturing, based on 1970 as base year, showed an average annual increase of 1.13 per cent between 1970 and 1979, compared to 2.31 per cent with 1975 as base year — still not a growth rate to be proud of and which would certainly not have changed any of the conclusions drawn previously.

Mr Meth suggests that real value added in construction should be obtained by deflating the value added at current prices with the Consumer Price Index rather than the technically correct method of extrapolation used by the CSS. According to this logic, it will be equally acceptable to deflate the value of motor vehicle sales at current prices by the Consumer Price Index for footwear to obtain real motor vehicle sales. The CSS calculates the real value added of the construction industry by extrapolating the base year value added with the relevant volume index of real capital formation in buildings and other construction works.

Mr Meth also criticised international comparisons in GDP per capita between different countries and described them as stupid. We know (and we always qualify) that such comparisons are subject to various assumptions and errors, such as using the exchange rates to convert foreign currencies to SA Rand. Such comparisons are also published by institutions like the UNO, OECD, the American Productivity Center and the Israel Institute of Productivity.

Solomon Fabricant wrote in his well known book A Primer on Productivity, that differences in per capita output could best be explained by differences in labour productivity among nations. Therefore, the comparison of labour productivity among nations is not only useful in delineating the sources of growth, but also in analysing how labour as an important input can affect a country's economic development. All the inputs, of course, cannot be isolated from one another. In considering labour productivity, one should also take into account the effect of other inputs upon labour, such as capital investment per worker and the optimum combination of all resources. The quality of labour, no doubt, also affects its productivity.

Many people make the mistake of deflating with the wrong indices and therefore drawing the wrong conclusions and this is regularly encountered by national accountants. Errors like these are, of course, excusable.

Should Mr Meth feel that the NPI's reaction to his article is unfair or unjust, we could arrange for a meeting between all parties involved in this matter, to discuss it in detail.

APPENDIX 1-4

Content analysis of media reports on productivity - raw results

Survey of clippings at Natal Newspapers, 7 Dec 1994

Date / Characteristics 1-22

Day	Mon	Yr	N	R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
22	12	89	NM	B	1			1	1																	
22	12	89	WI	B	1			1	1																	
25	10	89	DN	B	1													1								
8	10	89	DN	A												1	1									
1	10	89	DN	B																				1		
26	8	89	ST	C																1						
8	8	89	NM	C															1							
5	8	89	ST	C								1														
28	5	89	ST	C																			1	1		
7	5	89	DN	B					1						1											
27	4	89	DN	A	1		1				1			1												
25	4	89	NM	A										1												
15	3	89	DN	D	1							1												1		
14	3	89	DN	D	1																					
8	1	89	DN	A		1	1							1												
23	11	88	DN	D			1															1				
21	11	88	TR	A		1	1					1														
30	8	88	DN	A	1	1																				
29	6	88	DN	B											1		1							1		
20	6	88	DN	D					1								1									
3	5	88	DN	B	1																					
2	5	88	DN	B																				1		
17	4	88	TR	A	1																					
18	2	88	DN	A	1	1																				
1	2	88	DN	C															1					1		
17	1	88	DN	B	1		1															1	1	1		
15	9	87	DN	B					1																	
1	9	87	TR	D	1																			1		
12	9	86	DN	D		1						1														
10	9	86	NM	A		1																1		1		
5	9	86	DN	A		1																	1			
2	9	86	DN	D					1																	
2	9	86	WI	D					1																	
27	7	86	DN	C	1				1																	
22	9	85	ST	B											1											
17	9	85	NM	A												1										
15	9	85	ST	A							1					1										
9	9	85	NM	B					1													1				
18	8	85	DN	B																					1	
24	7	85	WI	B	1		1																			
14	7	85	DN	A	1		1																	1		
23	6	85	DN	B	1																					
20	6	85	NM	A					1																	
5	6	85	DN	B	1				1																	
14	4	85	DN	C																						1
24	3	85	TR	B					1								1									
12	3	85	NM	B								1														
2	3	85	NM	B																	1					
19	2	85	WI	D	1																					
19	11	84	DN	B	1																					

Survey of clippings at Natal Newspapers, 7 Dec 1994

Date					Characteristics 1-22																					
Day	Mon	Yr	N	R	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
7	8	84	DN	A																		1				
2	8	84	WI	D	1				1														1	1		
1	8	84	DN	D	1																			1		
10	7	84	WI	B	1	1																				
10	7	84	WI	D	1																	1				
8	7	84	TR	B	1																					
18	6	84	DN	A		1	1				1															
23	5	84	NM	D	1	1			1			1														
15	4	84	DN	B	1	1	1															1				
26	3	84	DN	B	1	1						1														
26	3	84	WI	B	1	1				1												1				
16	1	84	NM	A	1		1					1														
13	1	84	DN	A	1																					
4	8	83	DN	C											1											
4	8	83	DN	D			1			1																
7	6	83	DN	B																		1				
29	5	83	ST	B	1	1	1																			
28	11	82	ST	B	1	1																				
26	11	82	WI	D	1				1																	
16	9	82	DN	B	1																					
16	9	82	WI	B	1																					
19	8	82	WI	B					1																	
6	8	82	NM	D	1				1																	
20	10	81	DN	A		1	1					1										1				
2	10	81	DN	A					1														1			
28	9	81	DN	A	1																					
30	8	81	DN	B	1				1																	
22	5	81	NM	B	1																					
22	5	81	DN	B	1																					
21	12	80	DN	B	1	1			1													1	1			
30	10	80	NM	A	1																					
11	4	80	DN	B	1		1																			
16	12	79	DN	A	1																					
25	10	79	DN	B	1									1												
3	6	79	ST	A	1																					
22	3	79	CI	D	1	1	1																			
14	2	79	NM	A	1	1	1															1				
4	2	79	TR	B	1																	1				
13	3	78	DN	A		1																				
9	9	76	WI	A		1	1																			
25	7	76	WI	B		1	1																			
22	1	76	NM	D	1																					
21	1	76	DN	D	1																					
28	12	75	TR	A					1																	
26	11	75	NM	A	1																	1				
16	5	75	NM	A					1																	
1	4	75	DN	A	1																					
4	8	73	TR	D	1		1															1				
20	5	73	TR	B	1																					
20	4	72	DN	D	1																					

Survey of clippings at Natal Newspapers, 7 Dec 1994

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Date          Characteristics 1-22
DayMonYr  N   R  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22
-----------------------------------------------------------------------------------
19  1 72  DN  D  1
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Source - Newspaper (N)

WI	Natal Witness	13 articles
TR	Sunday Tribune	9
ST	Sunday Times	8
NM	Natal Mercury	18
DN	Daily News	53
CI	Citizen	1
	Total	102

Source - Respondent (R)

A NPI spokesperson
B Business spokesperson (either high-level manager or consultant)
C Other - academic or overseas commentator
D Political figure - mainly cabinet ministers

Characteristics:
1 Poor productivity performance
2 Wage growth exceeds productivity growth
3 Wage growth and inflation linked
4 Unreasonable wage demands
5 Management responsible for poor performance
6 Increased mechanisation
7 Poor capital productivity
8 Declining international competitiveness
9 Negative union role
10 Declining GDP/C linked to poor productivity growth
11 Desirability of incentives to improve productivity
12 Reference to a productivity improvement
13 Specifically generous to labour
14 Under-utilisation of capacity
15 Productivity and education linked
16 Critique of productivity measures
17 Improvement in quality
18 Training recommended
19 Skill shortage and/or excess sup of unskilled workers
20 Poor attitude and/or ignorance about productivity
21 Managers positive, supervisors not
22 Poor living conditions of workers

Frequency:

1989	15
1988	11
1987	2
1986	6
1985	15
1984	15
1983	4
1982	6
1981	6
1980	3
1979	6
1978	1
1976	4
1975	4
1973	2
1972	2
Total	102

APPENDIX 2-1

Gold and the Perverse Deflator Effect: An unresolved problem in national accounting

Introduction

One of the major concerns of economics is the measurement of changes in the levels of economic welfare[1] of different groups in society. Assessing changes in the level of welfare presupposes that the notions of 'output', 'value', 'income' and the like - the most basic conceptual tools of economics - have been filled with content by theory. Unfortunately, this is seldom easy to do. Changes in welfare may come about in several ways - the particular concern here is with the relationship between the output produced (approximated in key sectors in the national accounts by physical volumes) and the income generated by the sale of that product. The former is conventionally referred to as Gross Domestic Product (GDP) at constant prices, and the income to which that production gives rise, as real Gross Domestic Income (GDI).[2] The latter measures the "...purchasing power of the total incomes generated by domestic production" (UN, 1993, p404). Real incomes, for all their weaknesses, are the most common measures of changes in the level of economic welfare. Real incomes are affected, amongst other things, by trade. When the relative prices of goods which are transported across international boundaries change, ie, when prices of exports (P_x) change relative to those of imports (P_m), so-called terms of trade effects result. Changes in the terms of trade give rise to a trading gain (loss), which, if large enough, can cause "...a significant divergence between the movements of GDP at constant prices and real GDI" (UN, 1993, p404). The terms of trade effect has been estimated on occasion to be as large as five percent of GNP in Japan, six percent of GNP in Italy and between one-half and the whole of GNP in the extreme case of Saudi Arabia, depending on the method used to estimate this effect (Gutmann, 1981, p433).

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1 Welfare, in the narrowest sense in which economists use the concept, consists in the flow of goods and services available for consumption in any particular period. Improvements in welfare can be had either by redistribution or by increasing the size of that flow, or by different combinations of the two. National accounts set out to capture some of the data required to assess welfare changes. Significantly, distributional changes are ignored in conventional national accounting, because of the extreme difficulties of valuation involved. The popularity of SAMs (Social Accounting Matrices) is evidence of growing concern over this weakness. (See Pyatt, 1991). It is doubtful whether the latest revisions to the SNA (UN, 1993) meet the concerns expressed by Pyatt (and others) - the chapter on SAMs (Ch XX) does not appear to offer much by way of any detail.
These deficiencies persist despite the fact that the national accounts include a large number of different economic measures - Copeman, for example, notes that 64 variants of the basic national or domestic product estimates are conceivable, not to mention a similarly large range of income measures, all of which "...are possibly useful in the right context" (1981, p3-1).

2 Recall here the distinction drawn attention to in Chapter 1-1 between magnitudes valued in constant prices (volumes) and those valued in real terms (eg, incomes).

The simplest terms of trade measure is known as the barter terms of trade - P_x / P_m. Other things being equal,[3] one would expect an improvement (deterioration) in the barter terms of trade (a rise (fall) in P_x relative to P_m) to lead to an unambiguous welfare gain (loss). Other things generally do not remain equal, however, and it is therefore not easy to gauge the welfare effects of a change in the terms of trade accurately. Rather obviously, one would expect volumes to be influenced by price changes, but unless elasticities and/or changes in the relevant volumes of goods and services traded are known, the terms of trade effects are difficult to unravel. Paradoxically, for some commodities, even when price and volume changes are known with great precision, as is the case with gold, the terms of trade effects are still difficult to estimate. The reasons for this are explained in this appendix. For much of the time, the conventions adopted in lieu of a proper theoretical resolution of the problem of valuing the trading gain (loss) appear to perform satisfactorily. Under certain conditions, however, the practical efforts of the compilers of the national accounts are hindered in what will be shown to be quite significant ways. In short, measuring the effects of changes in the terms of trade presents a problem of valuation for which no 'correct' solution has yet been found, notwithstanding the attention lavished on it.

Such changes also have another effect - one of which economists have long been aware, and yet one on which the literature is curiously silent. When an improvement in the terms of trade occurs, ie, when P_x rises relative to P_m, the 'real' value of x relative to m falls. This is because the use of the now larger deflator on current price estimates of the value of exports makes the constant price values of exports smaller than they would have been had the terms of trade not improved. If volumes traded moved downwards in the correct proportion in response to such price changes, real welfare levels would decline and the use of the now larger deflator would be appropriate. But for goods for which demand is inelastic this need not happen. This will give rise to a windfall gain which may be of long or short duration. While it lasted, which was not very long, the gold price bonanza in South Africa had a substantial impact on wages and investment. By contrast, before the collapse of OPEC, oil price hikes raised living standards for a lengthy period of time and fuelled investment booms in several of the major oil-producing countries.

When price change episodes of this type occur, it is a simple matter to show that a Perverse Deflator Effect (PDE)[4] as I have called it, will operate on the national accounts and cause them

3 Chief among the things held equal are volumes of trade. Except for commodities like gold, demand is unlikely not to respond to changes in price, certainly not in the medium-term. Volumes traded will then depend on levels of international competition.

4 This concept and the empirical analysis on which it is based was first presented to a meeting of the Natal branch of the South African Economic Society in May 1986. An unpublished paper (Meth, 1991b) contains much of the material covered below.

to understate real GDI quite significantly. The workings of the PDE can overwhelm the adjustment made to national accounting estimates to accommodate changes in the terms of trade. If the measures used to estimate the terms of trade effect were adequate, they should be able to compensate for the PDE. It is, however, possible to show that for changes in the terms of trade of a certain magnitude, the terms of trade adjustment is more than neutralised by the PDE.

In South Africa it is possible to demonstrate that in certain years, even after the necessary adjustments for terms of trade effects have been made, the PDE has affected the accuracy of the estimates of the contribution of the mining sector to the total income measure. Effectively, the PDE makes real gross national income (formerly, and misleadingly termed 'real gross national product' in this country) smaller than what it would otherwise have been.

Inconsistencies in the South African national accounts that result from the operation of the PDE arise because of fluctuations in the price of gold, still the major export of the country. The South African case, however, must surely be only one example, albeit an excellent one, of what is a more general phenomenon. The investigation concentrates on the period when gold price fluctuations were at their most extreme. As price volatility decreases, so the magnitude of the PDE diminishes. Although some commentators predict a relatively stable price for gold in the medium term, the level of global uncertainty is such that hard and fast statements about its likely price in the future are not easy to make. The same probably applies to petroleum, a non-renewable resource tied to a political powder-keg.[5]

Apart from the intrinsic interest of the topic, therefore, a thorough examination of the problem is of considerable importance in the field of national accounting. When a period of price instability does occur, the unresolvable problems to which it gives rise can render the accounts unfit for the uses to which economists and others habitually put them. By implication, the national accounts of all economies which depend to a high degree on exports (and possibly, imports) of one or two commodities will, on occasion, exhibit similar errors, ranging in seriousness from gross instability to minor distortion.[6]

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5 For an analysis of the relationship between oil and gold in the South African context, including a brief discussion of the terms of trade impact, see van der Merwe and Meijer (1990).

6 The latest SNA makes reference to the possibility of large trading gains or losses being experienced by economies whose exports consist of "...primary products such as cocoa, sugar or oil, while its imports consist mainly of manufactured products." (UN, 1993, p404)

The terms of trade debate

Perhaps the most comprehensive analysis of the terms of trade effect in a national accounting context is that which appears in Gutmann (1981). That article examined the development of the techniques for the estimation of the effect in their historical setting. It looks in some detail at attempts by economists over a 25-year period to grapple with the problems caused by terms of trade effects. Consensus on the precise method by which these effects should be measured and incorporated had not been reached - a non-trivial matter in certain cases.

The central problem to be discussed in this study, ie, the difficulties involved in the choice of appropriate deflators for imports and exports, was more than merely hinted at in the Gutmann paper, but the complications which these difficulties cause for the terms of trade/real income debate were not addressed. Indeed, although the problem of the terms of trade effect has generated a substantial literature, the phenomenon to be examined here appears so far to have escaped attention, even though it must have been encountered many times in the past. It is not possible to wave a wand and solve the deflators problem - it is, however, possible at least to become aware of the PDE and the circumstances in which it is likely to operate. That is the limited aim of this appendix.[7]

It is not necessary, for the purposes of this appendix, to conduct an exhaustive review of the inconclusive debate over the problems raised by changes in the terms of trade - the Gutmann piece is a more than adequate review. Brief reference will be made instead to a few curiosities that turned up during the course of a literature. These illustrate various aspects of the debate - amongst them the extreme difficulty of settling disputes about the nature of the impact on an economy of changes in the terms of trade. Bhagwati and Johnson (1960), for example, appear to have had the final word in a debate that commenced with an argument advanced by Edgeworth in 1894 that welfare in an exporting country could decrease as a result of an improvement in productivity in that country and a consequent fall in P_x.

With the growing interest in national accounting in the period from World War II onwards, the terms of trade question appears at regular intervals in the literature. An article by Dorrance (1948/49) was one of the first to distinguish income from (net) barter terms of trade and to show how these can differ. Dorrance's treatment is interesting - he makes much of the disequilibrium conditions of the time, arguing that concepts (and their corresponding statistical

7 Price indices are often identified by the letter *P*, followed by a subscript, eg, P_x. Gutmann makes little use of this convention - he employs, say, *px* (price index of exports) or *pm* (price index of imports). For the sake of uniformity, Gutmann's nomenclature will be altered so that it conforms with that used throughout the study.

measures) developed in other, less interventionist times become inapplicable and that new measures are called for. Noting that persistent trade imbalances called for new statistical measures, he suggested the following procedure:

> "What should be done is to calculate an index of the value (quantity multiplied by price) of exports and the price of imports for any country whose foreign accounts are to be analysed. Then the export value index should be divided by the import price index. The result would be an index which would reflect, for the country concerned, changes in the volume of imports obtainable from its export income (i.e. changes in its "real" export income, measured in import terms)." (1948/49, p52)

The expression for the terms of trade effect would thus take the form:

$$T = (P_{x1} \cdot Q_{x1}) \,/\, (P_{xo} \cdot Q_{xo}) \,/\, (P_{m1}/P_{mo})$$

This apparently sensible suggestion was rejected by Stone in 1956, for reasons given below. In 1969, with the development debate beginning to warm up, especially that part of it concerned with relative changes in the terms of trade of developing as opposed to developed economies, Wilson, Sinha and Castree extended the arguments presented by Dorrance, and performed an extensive empirical investigation into the results of a large sample of both types of economy. Drawing attention to the difference between barter terms of trade ($B = P_x/P_m$) and income terms of trade ($J = P_x/P_m \cdot Q_x$), they show that B can deteriorate while J[8] improves. Income terms of trade differ from barter terms in that, in principle, the former may rise for all countries, whereas the latter clearly cannot. Table 1 (p819) in their article suggests that over the period 1950-53 to 1962-65, the South African economy experienced a steady decline in the barter terms of trade from 100 to 83,4 while the income terms of trade rose from 100 to 184,3. Since the income terms of trade measure the purchasing power of a country's exports in terms of imports, this appears, at first sight, to represents a substantial welfare gain. To make the welfare comparisons between countries more plausible, Wilson *et al* develop a third measure - per capita income terms of trade. This they obtain by subtracting the population growth rate from the percentage annual rate of change of the terms of trade. South Africa was lumped in with the developed countries, and against Japan's figure of 14,7 per cent for the period, the local result was a paltry 0,9 per cent - similar to Jamaica in the developing country list.

The deflators problem, of course had raised its head right from the start - it has long been known that no solutions exist to several of the problems encountered in the field. A paper by

8 Problems with nomenclature arise due to the absence of general agreement on the symbols to be used to represent the different magnitudes. In the original article referred to here, B is referred to as N, and J as I. The changes are made because N is used below to represent the balance of trade $X - M$, and I is commonly, though not universally used to represent investment.

Stuvel on the valuation of non-commodity flows (correcting for changes in the purchasing power of money) notes that:

> "As with so many problems in national accounting, this one can only be solved by introducing a convention, for in the last resort the choice is an arbitrary one." (1959, p283)

Unlike Stone, however, this particular paper of Stuvel's shows no particular awareness of a problem in the selection of deflators for *X* and *M* - he appears to move unproblematically from current price (p275) to constant price magnitudes (p282). The true magnitude of what Stuvel seems blithely to be ignoring will become clearer when we look at the Gutmann piece below.

Finally, a couple of references to work published after the Gutmann piece will be made - the first of these is a paper by Bean (1985) which illustrates just how far theory is from coping with the effects of a change in the terms of trade. In national accounting practice it is conventional to consider only the income effect of changes in the terms of trade at an aggregate level. As Bean points out, however, a change in the terms of trade:

> "...alters the relation between the product wage, which is relevant to the firm's labour demand decision, and the consumption wage, which is relevant to the worker's labour supply decision. It will also induce a wealth effect on labour supply." (p38).

Bean takes up the issues of changes in the terms of trade on both on employment and on the trade balance. Noting that terms of trade effects can have an impact on output levels even when labour markets clear, he remarks on the absence of any:

> "...intertemporal model in which the distinction between temporary and permanent, and current and future, terms of trade changes can be properly investigated." (p39)

Having made some attempt to fill the gap, he concludes that the integration of the dynamics of changes in the labour supply and in capital formation "...could lead to extremely complicated behaviour in the current account, especially when both the terms of trade and the discount rate, as will in general be the case." (p45)

Finally, the problem of adjusting productivity and output indices in the face of changes in the terms of trade is addressed by Diewert and Morrison (1986). They criticise the work of a string of authors who have considered the terms of trade adjustment issue using models that look at single consumers or by using community utility functions (p659). Their approach, by contrast, starts in production, building on the authoritative work done by Diewert and his co-workers Caves and Christensen (1982a; 1982b).[9] Their approach is complex, and they do not

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9 There is a partial review of debate on one aspect of the index number problem by Samuelson (1984) which traces the development in his own thinking under criticism from Keren and Weinblatt (1984) and Swamy (1984). In this interchange, Samuelson's graciousness in changing his views, as well as his generous evaluation of the importance of Diewert's work on [illegible]

present any results, although they have done some empirical work on Japan and the US (Morrison and Diewert, 1985). If an enterprise such as they have undertaken were to be considered for South Africa, it would seem that a great deal of work has yet to be done - estimating production functions on the basis of the existing dataset is unlikely to yield particularly trustworthy results at present.

With that, we return to the Gutmann paper, where it will be seen that the debate over terms of trade effects is divided into three stages or approaches in each of which an attempt is made to see how changes in the terms of trade affect the "... amount of resources which an economy has at its disposal to satisfy its needs" (1981, p433). The first of these, in the period immediately after World War II, attempted to attribute "...part of the changes in the balance of trade specifically to the change in the relative prices of imports and exports" (1981, p433). In practice, this entailed relating current values of any commodity flow to base values, a multiplicative process which ran into extreme complications when attempts were made to show estimate the share of each component of change in observed totals (1981, pp434-435). The second phase of the debate was characterised by an attempt to "defin[e] a measure of "real national income" (real GDP measured in terms of purchasing power), in a different way from the normal measure of real GDP, and attribut[e] the difference to the "terms of trade effect" " (p433).

Before proceeding with the summary of the debate, a digression on the nature of the precise relationship between real income and constant price GDP will be made. This relationship is spelled out in the latest SNA - the relevant section is reproduced below partly because reference will be made later to some (terminological?) confusion on the part of the SARB, and partly because it is useful to be clear on exactly what the content is of the various magnitudes under discussion. Past discussions have been marked by an absence of uniformity in the names of the different magnitudes concerned. The latest SNA is a model of clarity on the matter, and everything pertaining to the substance of the problem discussed here, except, of course, its solution (and any reference to the PDE)!, may be found in the space of two pages (UN, 1993, pp404-405). Assuming for a moment that a satisfactory method of valuing the trading gain (loss) exists, then:

(*a*) *Gross domestic product at constant prices*: i.e., GDP in the current year valued at the prices, or price level, of the base year obtained by extrapolating (i.e., multiplying) the value of GDP in the base year by the volume index for GDP, whether a fixed weight or a chain index;

plus the trading gain resulting from changes in the terms of trade:

(*b*)	equals: *real gross domestic income*;
plus	real primary incomes receivable from abroad
minus	real primary incomes payable abroad;
(*c*)	equals: *real gross national income*;
plus	real current transfers receivable from abroad
minus	real current transfers payable abroad
(*d*)	equals: *real gross national disposable income*;
minus	consumption of fixed capital at constant prices;
(*e*)	equals: *real net national disposable income*. (UN, 1993, p405)

One difficulty is to find a satisfactory way of measuring the trading gain. Another is to find a suitable deflator for the income flows and transfers listed above. Commenting many years ago on one aspect of this problem, the valuation of factor earnings on assets owned abroad, the authors of a guide to the British national accounts state that:

> "It is impossible to make direct estimates of income from abroad at constant prices consistent with other items of national expenditure, without knowing how that income was spent." (Maurice *et al*, 1968, p468).

On the convention of revaluing net property or factor income from abroad by means of the implicit import deflator, Maurice *et al* note that no attempt is made to revalue separately, property income paid abroad, as opposed to property income received from abroad. In South Africa, net factor payments have hithertofore always been a negative item in the national accounts, ie, we pay more abroad than is paid to us. This seems unlikely to change in the foreseeable future. The problem in valuing or deflating these payments would thus be to guess what the income would have been spent on had it not been necessary to send it abroad to foreigners, clearly a difficult task.[10] Since the nominal value of net factor payments abroad in South Africa in 1992 was R9 145 million when GDP was R295 614 million (SARB *Quarterly Bulletin*, June 1993, pS-89) slightly over three per cent, an error in the choice of deflator may not be trivial.[11] The way in which the latest SNA deals with this problem is to suggest that:

> "...the purchasing power of these flows [primary incomes and current transfers received from abroad and paid to abroad (*sic*)] be expressed in terms of a broadly based numeraire, namely the set of goods and services that make up gross domestic final expenditure. In other words, primary incomes and current transfers should both be deflated by a price index for gross domestic final expenditure." (UN, 1993, p405)

10 On this, see Stadler (1973, p263).

11 The corresponding figures in 1984 were R4 079 million and R104 765 million, ie, just under four percent. SARB *Quarterly Bulletin*, Sept 1985, pS-77.

So much for income flows and transfers. The far more intractable problem is that of measuring the trading gain (loss) - a matter to which we return by rejoining Gutmann at the point where we left off above. The attempt to distinguish real income from constant price GDP was part of the broader debate on the problems raised by the question of the proper way to deflate national accounting aggregates - a debate in which two sides vied for supremacy, and which led ultimately to the adoption of the so-called Geary method. This approach, still used today, derives constant price total GDP by deflating each component by its own price index. The purchasing power concept promoted by the losing side in the debate survives in the form of a measure of real national income "...embodying a purchasing power concept" (p436).

Calling the difference between real national income and constant price GDP the "...effects of terms of trade on real national income", the first widely-accepted measure of this took the form:

$$T = (X - M) / P_m - (X / P_x - M / P_m) \quad \text{.......} \quad (1)$$

where:

X = exports at current prices
M = imports at current prices
P_x = the price index for exports
P_m = the price index for imports

After cancelling out the common components, C, I and G, the left hand term represents real national income and the right hand, GDP in constant prices. This is referred to by Gutmann as the Stuvel or OEEC measure (1981, p436 and 445).

With the exception of the deflator for the term $(X - M)$, this expression is identical to that appearing in the latest SNA (UN, 1993, p404). Here the effects of the terms of trade, or trading gain as it is now referred to is given by:

$$T = (X - M) / P - (X / P_x - M / P_m) \quad \text{.......} \quad (2)$$

where:

P = a price index based on some selected numeraire (UN, 1993, p404)

With a little manipulation, this is transformed into:

$$T = x(P_x / P - 1) + m(1 - P_m / P)^{12} \quad \ldots\ldots (3)$$

where:
x = export proceeds divided by their own price deflator (P_x)
m = import proceeds divided by their own price deflator (P_m)
P = some other general deflator

This is the standard expression underlying all of the measures of the trading gain reviewed by Gutmann. The differences between the five formulae he considers (some with several variants) may all be shown to reduce to differences in the way in which the deflator P is estimated.

The third stage of the debate constituted an attempt to:

> "integrat[e] these measures (real national income, real GDP, effects of terms of trade) into a consistent system of national accounts in real terms." (p433)

This saw a proliferation of measures, each justified by appeal to its ability to represent the reality of the transactions involved (Gutmann, 1981, pp438-443). The details are of no concern here - suffice it to note that one of these enterprises yielded the compromise deflator proposed by the latest SNA. This was suggested by Geary in 1961, to overcome an objection to an earlier approach put forward by Geary and Burge (Gutmann, 1981, p443). As will be demonstrated below, neither the Geary and Burge approach, nor any of the others presented in the Gutmann paper, can cope with PDE.

To show how expression (3) is derived, Gutmann's presentation of one of the more common approaches to the problem, that of Geary and Burge, is summarised below. These authors begin with a "...highly consolidated system of five accounts" - all in current price terms:

Production account:

$$Y = O = C + K + X - M$$

Income and outlay accounts:

$$S = Y - C = K + X - M$$

Accumulation account:

$$S = K + N$$

12 The nomenclature used by Gutmann has been altered slightly to make it consistent with that adopted for use in this study.

External account:

$X - M = N$

where Y is income, O is output, C consumption, S saving, X and M are respectively exports and imports. Net transfers and factor income from abroad are ignored for simplicity. On the basis of the argument that a constant price series, if conceivable, "...should bear a close formal resemblance to the current price series" - a claim grounded in the fact that in base years, the series are identical, the following constant price system results:

$$p = c + k + x - m$$

$$y = o + T$$

$$x - m + T = n$$

$$c + s = y$$

$$k + n = s$$

Each of the constant price magnitudes represented by a lower case letter is obtained by dividing by the appropriate deflator, eg, $c = C / P_c$, $k = K / P_k$, etc. The constant price account $x - m = n$ is, however, unacceptable because a current price surplus (deficit) can be turned into a constant price deficit (surplus) through differential movements in the export and import price indexes P_x and P_m, ie, P_n could become negative. To resolve this problem, it was argued "...that N should be deflated separately, and that T, the "trading gain" should be introduced as a balancing item in the external account" ie:

$$x - m + T = n$$

$$T = n - x + m = (X - M)/P - (X / P_x + M / P_m)$$

$$= x(P_x / P - 1) + m(1 - P_m / P)$$

The remaining problem is to select the appropriate deflator P. Geary and Burge's approach was to argue that if $N > 0$ (ie, a trading surplus), then N should be treated as part of exports and be deflated by P_x, because it "...represents a fraction of exports not utilized to pay for imports". For $N < 0$, the deflator is P_m because N is part of imports. If those deflators are inserted into the general expression for the terms of trade effect, then, for a surplus:

$$T = m(1 - P_m / P_x)$$

and, for a deficit:

$$T = x(P_x / P_m - 1)$$

Depending on the deflator chosen, the expression obviously undergoes change. Tables 1 and 2 from Gutmann's article have been reproduced below to show the deflators chosen by different workers in this area and the resulting expressions for the terms of trade effect. The tables have been renumbered Tables A2-1.1 and A2-1.2 to keep the numbering consistent. From Table A2-1.2 it may be seen that inserting the seven different deflators into the basic expression generates five different series, each representing T, the terms of trade effect.

Table A2-1.1 Various Deflators Chosen by Different Authors

	Surplus	Deficit
Geary 1, Nicholson, Stuvel (OEEC) and SNA 1	P_m	P_m
Geary and Burge	P_x	P_m
Geary 2	$½(P_x + P_m)$	$½(P_x + P_m)$
Stuvel (at market prices)	$P_s = (C + K + X - M)/(c + k + x - m)$	
SNA 2	$P_n = (C + K)/(c + k)$	
Courbis and Kurabayashi	$P_c = (X + M)/(x + m)$	
Godley and Cripps	$P_g = (C + I + X - M)/(c + k + x - m)$ at factor cost	

Source: Reproduced (with minor modifications) from Gutmann, 1981, Table 2, p445.

Table A2-1.2 Terms of Trade Effects Generated by Various Deflators

$T = x(P_x/P - 1) + m(1 - P_m/P)$

Geary 1, Nicholson, Stuvel(OEEC) and SNA 1	$x(P_x/P_m - 1)$
Geary and Burge	$m(1 - P_m/P_x)$ for a surplus, $x(P_x/P_m - 1)$ for a deficit
Geary 2	$x[(P_x - P_m)/(P_x + P_m)] + m[(P_x - P_m)/(P_x + P_m)]$
Courbis and Kurabayashi	$Mx(P_x/P_m - 1)/(X + M) - Xm(P_m/P_x - 1)/(X + M)$
Stuvel, Godley and Cripps, SNA 2	$x(P_x/P^* - 1) + m(1 - P_m/P^*)$

Source: Reproduced from Gutmann, 1981, Table 2, p445.
Note: In the article from which this table is reproduced, a typographical error has resulted in the terms inside the brackets for a surplus and deficit respectively for the Geary and Burge formulae being transposed. This has obvious and rather unfortunate consequences for attempts to apply the formulae to national accounting data.
The deflator P^* is chosen from Table 1 in Gutmann, 1981

The criteria outlined by Gutmann for choosing between the different measures of the terms of trade effect are given below, as is as an application of six of these methods to the South African data. Before turning to those issues however, it is necessary first to attempt to discover the method used to estimate this effect in South Africa.

Estimating the terms of trade effect

Although matters have changed somewhat with the publication of a 30-page introduction to the latest version of the national accounts (1991) - a big improvement on the seven pages offered in the previous set (National Accounts, 1981), one still has to search to find explanations of some of the fairly simple relationships between the variables in the South African national accounts. In the case below, the search is not successful. The ease with which the necessary information can be obtained from published sources in countries like Britain contrasts strongly with this.

Details of the approach used to estimate the terms of trade effect in Britain appear in an article by Hibbert (1975). The magnitude of the effects is given each year in the Blue Books. In that country, it has been the practice since 1975 to publish a series showing the magnitude of adjustments to be made to constant price GDP to obtain a measure of what their national accounting statisticians term the Real National Disposable Income (RNDI). They may be seen to be the same as those reproduced above from the latest SNA. In short, the RNDI takes into account:

(i) terms of trade effect on domestic product;
(ii) net property income from abroad and
(iii) net current transfers abroad.[13]

There is no comparable official guide to the process of estimating the terms of trade effect in South Africa. The only published details are to be found in Stadler's, unfortunately, dated work (1973). Here the terms of trade effect R (ruilvoetaansuiwering) for a surplus is given as:

$$R = M(1 - P_m/P_x)$$

and for a deficit:

$$R = X(1 - P_m/P_x)$$

Stadler uses uppercase symbols but these apparently have the same meaning as Gutmann's lower case symbols. Until the publication of the 1991 National Accounts, neither the 1971, nor the 1976, nor the 1981 presentations of the South African national accounts gave any clue as to the manner of incorporation of a terms of trade effect into the accounts, nor indeed, does Stadler, although as noted above, he does discuss methods used to value this effect in constant prices (1973, p265). One could, however, infer the method from the following statement extracted from a South African Reserve Bank *Quarterly Bulletin*:

> "Reflecting mainly the sharp increase in the price of gold, the terms of trade improved again in the third quarter of 1980. Consequently the real gross **national** product increased at a notably higher rate than the gross **domestic** product" (Emphasis in original)[14]

There is something distinctly odd about the terminology used here. GNP is defined conventionally as the value of GDP plus net factor earnings from abroad. In the British national accounts this identity is maintained for the data in current and in constant prices[15] - in South Africa it is not. It seems from the quotation above that GNP in constant prices in South Africa is equal to GDP plus net factor earnings from abroad, plus the terms of trade effect.[16]

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13 See for example, Blue Book, 1982, p104.

14 SARB *Quarterly Bulletin*, December 1980, p7. This does not persist for very long - six months later the SARB reports that:
"Mainly as a result of the sharp decline in the price of gold, South Africa's terms of trade deteriorated considerably in the first quarter. This caused the real gross national product to show an actual decline from the level of the fourth quarter of last year." (*Quarterly Bulletin*, June 1981, p6)

15 See for example Blue Book, 1982, Tables 1.1 and 2.1.

16 A minor quibble about the South African accounts is the fact that GNP is given in constant prices at market prices only. This has the effect of incorporating changes in indirect taxes and subsidies into the GNP series. During a period when these alter substantially, this can produce misleading results. In Britain for example, between 1960-80, real GNP at market prices grew at about 2,3 percent *per annum*, whereas the corresponding figure for GNP at factor cost was about 2,0 percent. See Blue Book, 1982, Table 2.1

Paragraph 4.8 of the 1968 SNA makes it quite clear that the identity of composition between the current and constant price values of GNP was meant to be maintained. The deflation process recommended there makes no mention whatsoever of terms of trade effects - the components deflated are the standard items of final expenditure (UN, 1968, p53). It does not seem unreasonable to insist that current price and constant price magnitudes should be built up from the same elements.

Assuming that net transfers abroad were also included in the South African constant price GNP series, it would then appear that what the British national accountants call Real National Disposable Income (RNDI) was called Real Gross National Product (RGNP) in South Africa. This is more than just a mere terminological quibble - this confusion between product and income (which can be traced back to the absence of an agreed value theory in economics) goes to the heart of the dispute between myself and the authorities over the value of output and income. The bones of that dispute may be chewed over at the end of this appendix, and examined as well in their full polemical splendour in Appendices 1-1, 1-2 and 1-3 - the Fosatu Challenge and the responses to it by the SARB and the NPI.

Most interestingly, the confusion appears to persist to this day. In the 1991 National Accounts, 'Gross National Product' is defined thus:

> "The gross national product is a measure of income accruing as factor income to *residents* and is estimated at current and constant prices.
>
> The gross national product at current prices is calculated as the gross domestic product at market prices *less* net distributed factor incomes to the rest of the world, in the form of net remuneration of employees and net other factor payments.
>
> The real gross product is calculated by: (a) *subtracting* from the real gross domestic product the net factor payments (i.e. remuneration of employees and receipts on capital investments) to the rest of the world, at constant prices; and (b) *adding* trading "gains or losses" which occur when there is a change in the so-called *terms of trade.*" (1991, p13) (Emphasis in original)[17]

As will be recalled from the discussion above, the latest SNA calls this magnitude 'real gross national income' - all in all, to talk of national income seems more sensible than the South African practice because it does not violate the commonsense principle that in making the awkward crossover from a measure of product to a measure of income, the label of the concept concerned should specifically admit of the possibility of changes through variations in relative price levels. The terminology used in the SNA and in the British national accounts, by virtue of the reference to real income rather than to 'real' product, meets this condition.

17 Similar terminology to that discussed here is employed in recent SARB *Quarterly Bulletins* - see June 1993, pS-89.

Using published data and a method similar to that spelled out in Stadler (1973, pp264-266), an attempt has been made to estimate the values of the terms of trade effect and the value of net payments to foreign factors in constant prices. This was done to check the inferred method of obtaining Real 'GNP' from constant price GDP and the other relevant data. The results are presented in Table A2-1.3.

Table A2-1.3 The terms of trade effect and the value of net factor payments to the rest of the world, 1960-80

Year	NFP+ToT1	NFP+ToT2	NFP	ToT
1960	1 348	1 231	685	545
1961	1 383	1 270	776	494
1962	1 419	1 280	708	572
1963	1 572*	1 394	687	707
1964	1 770	1 616	788	827
1965	2 033*	2 432	683	1748
1966	2 184*	1 905	909	996
1967	2 157	2 010	941	1068
1968	2 045	1 867	1 044	843
1969	2 188	2 136	1 173	963
1970	2 556*	2 953	1 031	1 922
1971	2 442*	2 805	988	1 816
1972	2 153	2 045	1 168	876
1973	926	893	1 084	+192
1974	252	346	1 115	+768
1975	1 220	1 220	1 220	0
1976	1 585*	2 076	1 162	914
1977	1 897	1 802	1 309	493
1978	1 645	1 622	1 260	362
1979	1 239	1 233	1 095	137
1980	398	342	1 022	+680
	1	2	3	4

Key: Column 1 NFP+ToT1 = GDP - GNP
Column 2 NFP+ToT2 = Column 3 + Column 4
Column 3 NFP = Net factor payments in current prices. Table 1 National Accounts (1981), deflated as per Stadler's method (Stadler, 1973, p263)
Column 4 ToT = Terms of trade effect estimated by the Geary and Burge method (Gutmann, 1981, p445)

Notes: GDP (at market prices) is taken from Table 7, National Accounts (1981), and GNP (at market prices) is from Table 1 National Accounts (1981).
All estimates are R millions in constant 1975 prices, and all the values appearing in this table, with the exception of the zero in 1975, the two positive results directly above it in Column 4, and the 680 for 1980, are NEGATIVE (as one would expect).

The actual excess of GDP over GNP as estimated in the National Accounts is given in Column 1 (labelled NFP+ToT1) and the excess estimated by the inferred method in Column 2 (labelled NFP+ToT2). The two components of NFP+ToT1, namely estimated real payments to factors abroad - NFP, and the estimated terms of trade effect - ToT, are given in Columns 3 and 4 respectively. The formula applied to the South African data in Table A2-1.3 to generate the series ToT is that developed by Geary and Burge (given in Table A2-1.2 above). Deviations of NFP+ToT1 from NFP+ToT2 in absolute terms are small for all except six observations (these are marked with an asterisk in the table).

The inferred method of estimating 'Real Gross National Product' (Real Gross National Income) appears to be correct, these deviations notwithstanding. For the meanwhile, no attempt will be made to explain them - for the purposes of the exercise to follow, the values of ToT, the terms of trade effect, need not be too accurate. The reasons for this will become clear as the analysis proceeds.

Choosing between formulae

Addressing the question of choice of the proper method of estimating the terms of trade effect Gutmann spells out the practical criteria for choosing a 'suitable' measure for measuring the terms of trade effect. The criteria are as follows:

(a) the effects should be nil when export and import prices are equal;
(b) the effects should be symmetrical in the two-country case: if one considers two countries trading exclusively with each other, the effects from changes in terms of country one *vis-a-vis* country two should be the opposite of the effects from changes in terms of trade of country two *vis-a-vis* country one;
(c) the measure should be capable of meaningful economic interpretation;
(d) the measure should be based on statistics which are presently available in a standardized form for most countries. (1981, p446)

The various measures have been classified in this table according to the above criteria. These are reproduced below in Table A2-1.4. Using these criteria, one can evaluate formulae presented in Table A2-1.1 above.

Table A2-1.4 Assessement of formulae on different criteria

	(a)	(b)	(c)	(d)
Geary 1, Nicholson	**		*	**
Geary and Burge	**	*	*	**
Stuvel			*	**
Godley and Cripps			*	**
Geary 2	**	*	*	**
Courbis, Kurabayashi	**	*	*	*
SNA 2	**		*	**

Key: ** Verified criteria.
* Approximately verified criteria.

Source: Reproduced from Gutmann, 1981, Table 3, p446.

From this table it will be observed that only three of the expressions meet all four criteria, namely Geary and Burge, Geary 2, and Courbis and Kurabayashi. Gutmann observes after examining the methods available for estimating this effect, that when it comes to making a "Proper Choice":

> "It...is difficult to put an end to the 25-year-old debate on this matter. It also seems clear," the author continued, "that both measures of real national income and measures of the effects of terms of trade on real national income can only be conventional." (1981, p446)

There is discussion in Gutmann as well as in Hibbert (1975) on the relative merits of the different measures, but that discussion will not be reviewed here - all that it is necessary to establish is that:

(a) there are several different ways to estimate the terms of trade effect, not one of which may pedantically be called 'correct'; and
(b) the range of values produced by the different methods of estimation is such that most of the observed differences between NFP+ToT1 and NFP+ToT2 in Table A2-1.3 becomes inconsequential.

Applying these different methods to the data for the OECD countries, Gutmann concluded that the results did not differ significantly from each other (1981, p433). He does note however, that the results of using different methods may be different in countries such as Saudi Arabia "...whose trade and GNP are dominated by the output of a single commodity", ie, a characteristic shared to a less extreme extent by the economy of South Africa. This suspicion was confirmed by the findings of another piece of research which argued that when different methods of estimating the terms of trade effect were applied to the data of a number of developing countries and oil economies, "...substantial differences were observed" (Summers and Heston, 1984, p214n).

In Table A2-1.5 six of the expressions in Table A2-1.1 have been applied to the South African data to gauge the impact of the choice of one or other of these methods of estimating this effect.[18]

Column 7 gives the range or difference between the highest and lowest estimates of the terms of trade in absolute terms and Column 8 expresses this as a percentage of GDP. This range is

18 Moll has also estimated the size of the terms of trade effect using an array of different deflators. With the exception of the Nicholson (P_m), the deflators that he used differ from those estimated here. He notes that the results produced using these deflators differed very little from each other, so he used one set (the Törnquist) to represent the lot. (1990, pp44-46). Although the results presented above in Table A2-1.5 generally have the same sign as Moll's figures, they differ somewhat in magnitude. The range is also much larger than that reported by Moll. For the purposes of the argument presented here, the reasons for these differences are not worthwhile pursuing.

from 0,4 per cent (it must obviously be zero in the base year) to 3,7 per cent, a fairly hefty proportion of total GDP. In Column 9, the absolute values of the differences between NFP+ToT1 and NFP+ToT2 from Table A2-1.3 are presented.

Table A2-1.5 A comparison of six different methods of estimating the size of the terms of trade effect, 1960-80

Year	1	2	3	4	5	6	Range	Range As % GDP	NFP+ToT1 minus NFP+ToT2
1960	813	546	746	731	790	824	279	2.2	117
1961	849	494	737	704	822	890	396	3.0	113
1962	1 034	572	892	846	1 002	1 090	518	3.7	139
1963	1 118	707	1 015	989	1 105	1 172	465	3.1	178
1964	1 141	827	1 092	1 083	1 143	1 178	350	2.1	154
1965	1 348	1 748	1 355	1 356	1 349	1 344	404	2.3	399
1966	1 494	996	1 416	1 398	1 488	1 536	540	3.0	279
1967	1 430	1 068	1 401	1 397	1 437	1 459	391	2.0	147
1968	1 180	843	1 105	1 091	1 240	1 316	473	2.3	158
1969	1 221	963	1 197	1 194	1 241	1 264	301	1.4	52
1970	1 513	1 922	1 611	1 617	1 438	1 353	484	2.2	397
1971	1 456	1 817	1 582	1 585	1 328	1 209	608	2.6	363
1972	1 154	876	1 095	1 086	1 221	1 285	408	1.7	108
1973	+214	+192	+200	+199	+91	+36	178	0.7	33
1974	+858	+768	+870	+869	+872	+874	105	0.4	94
1975	0	0	0	0	0	0	0	0.0	0
1976	818	914	834	835	839	842	80	0.3	491
1977	663	494	602	593	558	539	169	0.6	95
1978	504	362	446	436	309	231	273	0.9	23
1979	197	137	169	164	+159	+374	572	1.9	6
1980	+810	+680	+712	+704	+1 137	+1 451	771	2.4	56
	1	2	3	4	5	6	7	8	9

Note: All estimates of the terms of trade effect are R millions in constant 1975 prices, and all values of the terms of trade effects in Columns 1 to 6 are NEGATIVE with the exception of the 1975 values (zero) and those marked with a positive sign.
These terms of trade effects are estimated using the formulae given in Gutmann (1981, p445). (See Tables A2-1.2 above). The methods presented are:
Column 1 Geary 1, Nicholson, Stuvel and SNA 1
Column 2 Geary and Burge
Column 3 Geary 2
Column 4 Courbis/Kurabayashi
Column 5 Stuvel
Column 6 SNA 2 (using market prices)
Range = Highest - Lowest Absolute Values

Source: Estimated from the data in SARB National Accounts (1981).

As may be seen, in almost every case, the absolute size of the range of values produced using the different formulae exceeds these differences on all but two occasions, in most cases quite handsomely. That conclusion holds for the most part, even when the one of the three preferred formulae are used. On these grounds, further investigation of the reasons for the divergences between the two estimates of NFP+ToT is held to be unnecessary.

As to the estimates of the terms of trade effects or trading gains (losses), it will be noted that the Geary and Burge expression (Column 2) produces in general the smallest effect, although there are some years when this is not true eg, 1970 and 1971. The SNA2 formula (Column 6) in general produces the largest absolute values. The South African national accounting statisticians may therefore be underestimating the effect for both deteriorations and improvements in the terms of trade. Economic theory does not provide a basis for selecting the 'correct' method of estimating the terms of trade effect, a fact remarked upon by Hibbert (1975) and by Gutmann (1981). The British National accounting statisticians appear to favour the Nicholson approach (Hibbert, 1975) in which the proceeds of exports and other net income from abroad is revalued in terms of its import equivalent. This is similar to the SNA1 approach used in Column 1 of Table A2-1.5. According to Stadler, who also comments on the absence of unanimity in this matter, the procedure adopted in South Africa is 'conservative'. This is done in order to avoid the inclusion of unrealised gains, which may later be reduced by subsequent changes in the export/import price relation (1973, p266). Quite apart from the array of possible methods available to measure the terms of trade effect and the difficulties involved in making this selection, there exists a series of difficulties generally considered under the rubric of the 'index number problem'. Gutmann discusses some of these difficulties and makes brief reference to the literature. Here are the problems which he refers briefly in the closing paragraph of his article:

(i) Terms of trade effects are calculated with respect to a particular base year. Not only does the level of the effect change when this is changed, the sign may do so as well when another base year is used.
(ii) Gutmann points out that "...different external trade price concepts (Laspeyres, Paasche) as well as different measures (unit value, price) may generate very different price indices".
(iii) He also refers to the finding that "...different categories of price indices for exports and imports (Paasche, Laspeyres, unit value) may produce greater difference on the effects from terms of trade than the alternative general deflators." (Gutmann, 1981, p447)

Having established that estimates of the terms of trade can only comply with convention and can never be 'correct' in any absolute sense, the next step is to examine some of the problems that arise when these 'effects' are incorporated into the national accounts.

On the joys that only improvements in the terms of trade can bring

Widespread recognition of the fact of divergence of constant price GDP from real income has been demonstrated in the previous sections, with the terms of trade effect acting as the bridge as it were, linking one concept to the other. It will now be shown that the conventional choice of deflators for exports and imports reduces the size of the estimates of constant price output when there is an improvement in the terms of trade and has the opposite effect when there is a deterioration.

This Perverse Deflator Effect (PDE) tends to work in the opposite direction to the terms of trade effect. Depending on the extent of the improvement or deterioration in the terms of trade, and the pre-existing level of the terms of trade, the PDE may outweigh completely the terms of trade effect. In other words, not only does real output fall when the terms of trade improve, real income may also be lower than what it would have been had the terms of trade improvement not occurred.

The approach adopted in this section is to take a period in which the terms of trade improve substantially, viz, 1979-80, and demonstrate that net factor payments to foreigners represented a declining proportion of GDP (and of factor incomes in Mining). On this basis, it is argued that GDP is an appropriate proxy measure for national welfare in the period, ie, payments to foreign factors becomes a smaller proportion of gross product, therefore nationals experience an income improvement. It is shown then that constant price (real) GDP as estimated by the national accountants is lower than it would have been if the terms of trade improvement had not occurred and that the terms of trade effect is completely swamped by the PDE (Perverse Deflator Effect).

After demonstrating that the same perverse effect is present in the British National Accounts, the circumstances under which this occurs are explored by reference to the South Africa experience from 1964-80.

GDP vs GNP as a measure of national economic welfare

In Table A2-1.6 is presented a summary of South Africa's external trade results for the years 1979 and 1980. It will be observed from this table that there is:

(a) relative constancy in the volume of South African goods exports;
(b) a large increase in the volume of imports;
(c) a positive balance of trade which grows in nominal terms over the period despite the increase in imports;
(d) a deterioration in the terms of trade of exports excluding gold;
(e) a large improvement in the terms of trade including gold.

Table A2-1.6 Exports, imports and the terms of trade, South Africa 1979 and 1980

	Exports Excl. Gold Index of		<--------Exports--------> Including Gold Index of			<-------Imports-------> Index of			Terms of Trade		Balance
Year	Vol.	Price	Vol.	Price	Value (Current Rm)	Vol.	Price	Value (Current Rm)	Excl. Gold	Incl. Gold	of Trade
1979	133,2	166,0	121,6	186,1	16 724	76,9	190,3	11 878	87,2	97,8	+4 846
1980	135,0	184,5	120,5	249,5	22 219	91,2	229,0	16 959	80,6	109,0	+5 260

Source: SARB *Quarterly Bulletin*, March 1983, pS-72 and pS-85.

With exception of the slightly increased volume of non-gold exports, coupled with a deterioration in terms of trade for these items, the results presented point to an unambiguous welfare improvement to South Africa. It was argued above that adding the terms of trade effects to GDP in constant prices to obtain real 'GNP' (real income), as recommended by the international authorities in this matter, produces perverse results. Justifying the use of GDP as a measure of welfare may be done by reference to the changes in net factor payments to foreigners (by definition, the difference between GNP and GDP at least at current prices) in 1979 and 1980. In Table A2-1.7 net factor payments to foreigners are expressed first as a proportion of GDP and then of mining output, both in current prices.

Table A2-1.7 Net Factor Payments to Foreigners in Relation to GDP and Mining Output 1979 and 1980

Year	GDP Current Rm	Mining Output Current Rm	Net Factor Paymts Current Rm	Col.3/ Col.1(%)	Col.3/ Col.2(%)
1979	47 656	8 088	2 039	4,3	25,2
1980	61 834	12 805	2 555	4,1	20,0
	1	2	3	4	5

Source: SARB *Quarterly Bulletin*, March 1983, pS-83 and pS-84.
Note: Gross Domestic Product is at market prices and the value of Mining output is at factor cost. Subsidies and indirect taxes are probably of less relevance in Mining than in certain other sectors of the economy.

These payments fell from 4,3 percent to 4,1 percent of GDP and from 25,2 percent to 20,0 percent of mining output. From the proportional declines in the burden which net factor payments represent, in relation to both GDP and the value of mining output, it is clear that the welfare of South African nationals has not deteriorated over the period as a result of changes in the level of net factor payments abroad. It is, therefore, possible to use GDP as an indicator of welfare, safe in the knowledge that an increase in this magnitude over the period will understate the welfare improvement in South Africa.

Before proceeding, a word on the concept, terms of trade. Following standard practice[19] this is obtained by dividing the index of export prices by the index of import prices. Where this is not given in the published SARB material, it may be inferred by dividing constant price estimates of *X* (exports) and *M* (imports) by their current price counterparts in the estimates of expenditure on the GDP. The indices thus produced differ on occasion from those published by the CSS,[20] but these differences are not of any interest to us here. From Table A2-1.8 it may be seen that if South Africa's terms of trade (including gold) had been the same in 1980 as what they were in 1979, then the export price would have been 224 (229,0 x 0,978). This revised deflator has been used to derive 'corrected' values of GDP at market prices at constant prices and these values are shown in Column 3 of Table A2-1.8, ie, values without improvement in the terms of trade.

Table A2-1.8 Corrected GDP with and without improvements in the terms of trade, South Africa, 1980

		National Accounting Magnitude (Rm) In Constant 1975 Prices		
	In current prices (R m)	With Improvement in terms of trade	Without Improvement in terms of trade	Exports deflated by P_m and and Imports deflated by P_x
Exports	22 096	8 837	9 864	9 647
Imports	17 005	7 424	7 424	6 801
GDE	57 126	31 012	31 012	31 012
GDP(I)	62 217	32 425	33 452	33 858
	1	2	3	4

Source: National Accounts (1981), Tables 5 and 7.

Notes: GDP at market prices = GDE + $X - M$

Values of exports and imports 'with improvements' are the values given in the National Accounts (1981), Table 7.

Values 'without improvements' are obtained by deflating imports by their actual price index, ie, 229,05 and exports by the deflator which would have obtained if the terms of trade had remained at 0,978 as in 1979, instead of rising to 1,092. The export deflator therefore equals 224,01.

Exports in Column 4 are deflated by the actual price index of imports P_m, ie, 229,05 and imports by the actual price index of exports P_x, ie, 250,04. Implicit deflators (price indices) were estimated by dividing the current price values of imports and exports by the corresponding constant values. Data from the National Accounts have been used here in preference to that from the SARB *Quarterly Bulletin* used in Tables A2-1.7 and A2-1.6 above, to permit comparability with Table A2-1.3.

The values used in Column 4 will be referred to further below - the immediate concern is with the values in Column 2 and 3. From this table it may be seen that an improvement in the terms

19 See, for example SARB *Quarterly Bulletin*, September 1985, pS-66.

20 See, for example, *South African Statistics 1982*, p16.5.

of trade leads to the GDP, which has been argued above to be an appropriate measure of welfare, becoming smaller than what it would have been had such an improvement not occurred. This is the effect which has been labelled the PDE.

Revealing the results of the improvement in the terms of trade which took place over the period 1979-80 may be done by showing what would have happened had the improvement not taken place. The revised price index or deflator of 224 (1975=100) used in Table A2-1.8 results in an estimate of GDP 3,2 percent higher than the official value of R32 425 million. By subtracting the actual SARB estimate of GDP at market prices (R32 425 million) from the estimate of what GDP would have been had the terms of trade improvement not improved (R33 452 million), it may be seen that the choice of deflators pushes GDP down by R1 027 million.

This amount swamps completely the R680 million (ToT for the year 1980 in Table A2-1.3) added on to the SARB's GDP estimate to give their Real Gross National Product estimate. Only the Stuvel and the SNA2 approaches in Table A2-1.5 produce terms of trade effects greater than the PDE. Since neither of these meet the criteria laid down by Gutmann and summarised in Table A2-1.4, and since the Geary 2 method comes closest to being the recommended approach in the latest SNA (UN, 1993, p405), little relief can be expected from standard international practice in this matter.

The anomaly which causes these results is well known, having been discussed by Stone as early as 1956 (Gutmann, 1981, p437). Stone recognised that real income and constant price (real) product as estimated conventionally would remain equal only in a closed economy. Introducing real world assumptions brought with it the price index problem and in particular the problem of choosing the appropriate deflators for imports and exports. Stone considered the proposition that exports be deflated by the import price index, on the assumption that they are used to finance the purchase of imports, but he concluded that there was no obvious justification for making this assumption since:

> "(a) the export surplus is not in fact used to purchase imports at the time at which it arises; and
> (b) in the future it may be used to purchase home produced goods by means of a reduction in future exports." (Gutmann, 1981, p437)

The rather obvious objection to this latter statement is that it is extremely unlikely that gold will ever be used here for the purchase of home-produced goods. With a major objection falling away, the proposal becomes worthwhile investigating. It suggests, at very least, the separation of gold from South Africa's other exports, and the use on it of the general deflator for imports P_m. Given the limited aim of this appendix (essentially, to demonstrate the existence of the PDE), not much energy is devoted to such a task. Column 4 in Table A2-1.5 shows what a substantial difference the use of P_m as a deflator of X and P_x as a deflator of M makes to the estimates of imports and exports in 'real' terms. Because of this, a perfunctory attempt is made below to look at the problem over a slightly longer period. There does not, however, appear to be any reference in the literature which would suggest that this idea has been taken up anywhere. It seems that the standard deflator for X is P_x whilst that for M is P_m, with the result that the PDE is likely to pop up wherever conditions are right. South African national accounts are thus unlikely to be alone in the predicament caused by the selection of import and export deflators.

A similar effect may be observed in Britain. This is shown below in Table A2-1.9. The differences between the values of GDP obtained with and without improvement in the terms of trade amount to £1 408 million with the assumptions used, ie, some 1,2 per cent of GDP. This has the effect of lowering the 1980 index of constant price GDP from a potential 110,3 if the terms of trade improvement had not occurred, to its estimated value in the Blue Book of 109,0 (1981, Table 1.11).

Table A2-1.9 GDP with and without improvement in the terms of trade, Britain 1980

	In Current Prices (£ m)	Magnitudes in Constant 1975 Prices: With Improvement in Terms of Trade	Magnitudes in Constant 1975 Prices: Without Improvement in Terms of Trade
Exports	63 198	33 316	34 724
Imports	57 832	34 144	33 144
TDE	220 194	114 621	114 621
GDP	225 560	113 793	115 201

Notes: TDE = Total Domestic Expenditure. This corresponds to what is termed Gross Domestic Expenditure (GDE) in South Africa. See Blue Book, 1981, Table 1.1.
GDP is at market prices. Values at current prices are from the Blue Book, Table 1.1. Values at constant 1975 prices are from Table 2.1.

Source: *National Income and Expenditure 1981 Edition*, CSO, HMSO, London, 1981 (Blue Book).

Implied deflators are from the Blue Book, Table 2.6. P_x and P_m for 1979 were 167 and 155 respectively, and P_x and P_m for 1980 were 190 and 169 respectively. The terms of trade therefore improved from 1,077 to 1,124, ie, by 4,7 percent. If there had been no improvement in the terms of trade between 1979 and 1980, then assuming that the price index of imports P_m had been the same, P_x would have been 182. For the year selected here the terms of trade effect, as estimated by Hibbert's method, adds 4,5 points to the GDP index (Blue Book, 1981, p109), thus it vastly overshadows the PDE caused by the improvement in terms of trade.

However, as will be seen, this result is purely fortuitous, depending as it does on the size of the terms of trade and the extent of the improvements.

Conditions in which the PDE swamps the terms of trade effect

In an attempt to understand what it was that would make the PDE overshadow or be overshadowed by the terms of trade effect, ten observations from the South African data during the period 1960-80 when changes in the terms of trade occurred (six improvements and four deteriorations) have been selected for further analysis. The results are presented in two stages. Table A2-1.10 gives estimates of the terms of trade and the effect to which it gives rise from 1964-80. From this, some important aspects of the problem can be revealed.

Table A2-1.10 The terms of trade and its effect, South Africa 1964-80

Year	Implicit Deflators Exports P_x	 Imports P_m	Terms of Trade P_x/P_m	Terms of Trade Effect (Rm)	 % of GDP	Improvement or Deterioration (I or D)
1964	35,26	43,89	0,803			
1965	35,43	45,93	0,771	-1 748	10,1	D
1966	36,53	48,16	0,759			
1967	36,97	47,23	0,783	-1 068	5,5	I
1968	38,31	46,14	0,830	-843	4,2	I
1969	39,38	47,77	0,824			
1970	38,84	49,36	0,787	-1 922	8,6	D
1971	41,19	51,40	0,801			
1972	49,99	58,46	0,855	-876	3,6	I
1973	65,49	63,71	1,028	192	0,8	I
1974	90,46	81,01	1,117	768	2,9	I
1975	100,00	100,00	1,000	-	-	D
1976	108,87	121,70	0,895	-914	3,3	D
1977	124,63	135,30	0,921			
1978	147,51	156,49	0,943			
1979	186,11	190,29	0,978			
1980	250,04	229,05	1,092	-680	2,1	I
	1	2	3	4	5	6

Sources: Implicit Deflators were estimated from the data in the National Accounts (1981), Tables 5 and 7. Estimates of the Terms of Trade effect are from Table A2-1.3 Column 6 (ToT). The estimates are at constant 1975 prices.

First of all a comment on the size of the terms of trade effect. This follows mechanically from the expression used to estimate it. If $P_m > P_x$, ie, $P_x / P_m < 1$, then the terms of trade effect must be negative and *vice versa*. The further P_x / P_m is from unity, the greater the size of the effect. To illustrate this latter point, consider the values of the terms of trade effect in 1965 and in 1974. In the both cases, the terms of trade differ considerably from unity, with the result that the terms of trade effect is large. An improvement in the terms of trade will obviously be associated with a negative terms of trade effect if the terms of trade are negative - a fact which should sound a warning of the dangers of making generalisations about the benevolent effects of such improvements. The size of the effect can become very large indeed, therefore the selection of the appropriate method for estimating this effect becomes an important issue. For example, the method used to estimate this effect in South Africa yielded a value equal to 10,1 percent of GDP in 1965. If any of the other approaches discussed by Gutmann, (1981) had been used,[21] this would have been reduced to about 7,8 percent.

It is time now to bring together the estimates of the terms of trade effect and the PDE caused by the change in the relative prices of imports and exports on the real value of these flows. These changes in P_x and P_m have an element of randomness which makes the prediction of RGNI (or RGNP as it is called in this country) a hazardous affair. In any event, we may now witness the manifest failure of the procedure designed to measure these effects.

In Table A2-1.11 below, the effects of such changes for the ten years selected, are estimated. Two different approaches are utilised for measuring this PDE. In the first, that is in Column 2 of the table, the import price index for any particular year is held constant and the export price index is reduced (increased) to the level which it would have reached if the improvement (deterioration) had not taken place. In the second approach, given in Column 3 of the table, the export price index is held constant and the import price index is increased (reduced) to the level which it would have reached if the improvement (deterioration) had not taken place. There is no reasonable way of saying which approach is appropriate. GDP is then re-estimated on the basis of these new deflators in the same manner as was done for the data in Tables A2-1.8 and A2-1.9. The results of this exercise have been dubbed the 'unofficial' GDP here.

In general, the two unofficial results for each year differ much less from each other than they do from the official figure, a not wholly unpredictable outcome. To facilitate examination of the interaction of the PDE and the terms of trade effect the magnitude of that effect as estimated in Column 4 of Table A2-1.3 (ToT) is repeated in Column 6 of Table A2-1.11. From 1966-67 the terms of trade improved by about 3 percent (see Column 4 of Table A2-1.10), causing GDP to fall about 0,5 percent below what it would have been had the improvement not occurred. Because the terms of trade were less than unity, the terms of trade effect and the PDE were both negative. Between 1967-68 the terms of trade improved by

21 It has been noted above that Summers and Heston (1984, p214n) differ somewhat from Gutmann on the question of the implications of selecting different approaches to estimate this effect.

about six per cent. The PDE, still moving in the same direction as the terms of trade effect, was now nearly half the size of that effect, ie, the larger the percentage change in the terms of trade, the larger the PDE. The change from 1971 was larger still, ie, about 6,7 percent, so too was the PDE, still reinforcing the terms of trade effect. The terms of trade improvement was a substantial 20,2 per cent between 1972 and 1973, but the actual terms of trade stood at a modest 1,028 so the PDE massively outweighs the terms of trade effect. (Recall here that the absolute size of the terms of trade effect is directly related to the absolute size of the deviation of the terms of trade from unity).

Table A2-1.11 Estimates of the PDE and the terms of trade effect

(i) IMPROVEMENTS IN THE TERMS OF TRADE

Year	Official GDP (with improvements)	Unofficial GDP (without improvements)		PDE(i) (1-2)	PDE(ii) (1-3)	Terms of Trade effect
1967	19 419	19 515	19 566	-96	-147	-1068
1968	20 187	20 613	20 473	-426	-286	-843
1972	24 111	24 644	24 491	-533	-380	-876
1973	25 062	26 611	26 216	-1549	-1154	+192
1974	26 850	27 485	27 520	-635	-670	+768
1980	32 425	33 452	33 198	-1027	-773	+680
	1	2	3	4	5	6

(ii) DETERIORATIONS IN THE TERMS OF TRADE

Year	Official GDP (with improvements)	Unofficial GDP (without improvements)		PDE(i) (1-2)	PDE(ii) (1-3)	Terms of Trade effect
1965	17 306	17 071	17 115	+235	+191	-1748
1970	22 467	22 145	22 162	+322	+305	-1922
1975	27 454	26 683	26 508	+771	+946	-
1976	27 857	27 039	27 005	+818	+852	-914
	1	2	3	4	5	6

Sources: Basic data for these estimates is taken from the National Accounts (1981), Tables 5 and 7. Units are R millions in constant 1975 prices.

Notes: PDE(i) is obtained by subtracting the 'unofficial' estimate of GDP in Column 2 from its 'official' counterpart in Column 1. The Column 2 result is estimated by holding the implicit import price index constant and reducing (increasing) the export index to what it would have been if the terms of trade improvements (deterioration) had not taken place.
The Column 3 result used to estimate PDE(ii) holds the export price index constant and performs the corresponding operation on the import price indexes.

The relationship changes again between 1974 and 1975 where the improvement in the terms of trade is 8,7 per cent but the absolute size of the terms of trade index is quite large and the PDE is therefore outweighed by the terms of trade effect. A similar set of movements may be detected for deteriorations. Between 1964 and 1965 the terms of trade fell by a modest 4 percent, but because the absolute level of the index was well below unity, the effect was very large indeed, massively outweighing the small PDE. The change from 1969 to 1970 produced similar results. That from 1974 to 1975, however, did not. Assume for a moment that 1975 was not the base year and that the index stood at 1,001, then the percentage drop from the previous year would have been 10,4 per cent but because the index was near unity, the effect would have been minuscule. The large percentage change in the index produces a very large PDE - one which convincingly outweighs the terms of trade effect, which would have been positive. In the last year considered - 1976 - the two forces just about cancel each other out.

Given the size of the terms of trade index at any point in time, and the amount by which it has changed since the previous period, we can predict systematically the impact on GDP. The only problem is that the impact itself is not regular because of the unpredictability of the set of forces which produce it. Sometimes the movements augment the terms of trade effect, sometimes they counteract or cancel it. In 1980 there was a substantial gain in real income (+680) which was much more than wiped out by the PDE (-1 027). For a system of accounts which hopes to measure the effects from the terms of trade, or as Gutmann terms it, "...the difference between real income and real product" this is intolerable. One has merely to glance at Column 4 of Table A2-1.10 to see how erratically the terms of trade have moved in the past. This presumably results from the combination of unstable international economic and political conditions. But whatever the cause, the effects are undeniable.

The investigation which led to the findings reported above took place because the authorities insisted, against the urgings of common sense, that the value of the output of gold, and hence the value of the GDP had been correctly measured during the gold price rollercoaster of the 1970s and 80s. Moll (1992) has examined this problem quite exhaustively (except for the PDE part of it). There are good grounds for removing gold from GDP altogether if international productivity comparisons are contemplated, at least when its price behaviour is erratic.[22] The existence of the PDE - especially during periods of price instability - suggests strongly that 'real gross national product' is not a reliable welfare measure. Neither the SARB nor the NPI has grounds for defending it as such.

To bring this appendix to a close, two problems raised earlier will be pursued a little further. The first of these is the issue of deflating X by P_m and Y by P_x. The second is concerned with some of the aspects and implications of the terminological confusion evident in the SARB's treatment of the concepts of income and output (product).

22 Given the rapid growth of service industries, GDP measures are becoming increasingly unreliable for this purpose anyway. Harcourt and Kitson (1993, p441).

On using the 'wrong' deflators on exports and imports

It was observed above that the structure of South Africa's exports gives reason to challenge Stone's peremptory rejection of the possibility of valuing exports in terms of the purchasing power over imports that they confer. There may be some virtue in exploring this question thoroughly - the brief analysis below gives an indication of the kinds of difficulties likely to be encountered in doing so.

In the last column of Table A2-1.8 it will be observed that a GDP figure of R33 858 million or some 4,4 percent more than the official estimate of GDP results from making $x = X/P_m$ and $m = M/P_x$. This figure is higher still than that obtained by re-estimating GDP without the terms of trade improvement. Given the argument that welfare improvements should not be 'deflated' away by convention, this approach to solving the problem posed by the existence of the PDE appears to hold some promise. To obtain a measure of the welfare of South African nationals, ie, of GDP, net Factor Payments estimated at about R1 022 million would be subtracted from R33 858 million to give a GDP at market prices in constant 1975 prices of R32 836 million. This is 2,5 percent higher than the official estimate of Real Gross National Product in the same terms of R32 027.[23] Unfortunately, as will be shown below, this proposed procedure has other drawbacks.

To understand why this should be so, it is necessary to backtrack a little to the discussion on the different methods for estimating the size of the terms of trade effect and to reproduce Gutmann's summary of the Geary and Burger approach. A basic rule which they adopted in their attempt to produce a set of accounts in real terms or constant prices was one which stipulated that:

> "...if the constant price series is conceivable, it should bear a close formal resemblance to the current price series, if only because in the base year the current and constant price systems must be identical."

When however, they came to consider the external accounts (imports and exports) they were forced to relax this condition because:

> "...it did not make economic sense to generate, say, an external deficit at constant prices starting from an external surplus at current prices (or vice versa) purely through differential import and export price trends." (1981, p439)

It appears to be the case that regardless of the price index chosen to deflate imports and exports, the process is capable of producing the reversal referred to above. This is shown

23 See National Accounts, Table 1.

below in Table A2-1.12. The values in Column 1 (*X-M=N*) are given in current prices. The trade deficit in 1970 is thus R408 million. The corresponding value to this in real terms, if such a concept were admissible could either be that given in Column 2 (*x-m=n*) where $x=X/P_x$ and $m=M/P_m$, ie, a surplus of R686 million in constant 1975 rands. Reversal of deficit into a surplus thus occurs with the standard deflators for the year 1970, and even more strongly with the 1965 result, and again with the 1976 result. If on the other hand one were to take up Stone's rejected proposal and use the values in Column 3 where $x=X/P_m$ and $m=M/P_x$, the deficit in constant 1975 prices would have been R2 564 million, which although it has the correct sign, seems a trifle high. In other years though, Stone's proposed and rejected deflators also produce a reversal of sign. The Column 3 results in Table A2-1.12 convert the deficit into a surplus or *vice-versa* four times, ie, in 1967, 1968, 1972 and 1974.

Table A2-1.12 Estimates of the trade surplus or deficit in current and constant prices

Year	(*X-M=N*)	(*x-m=n*)	(*x-m=n*)	(*x-m+T=n*)
1965	-25	1 294	-1 420	-454
1966				
1967	111	1 665	-1 129	597
1968	374	1 991	-205	1 148
1969				
1970	-408	686	-2 564	-1 236
1971				
1972	447	1 919	-259	1 043
1973	644	797	1 198	989
1974	-179	-1 079	660	-311
1975	-731	-731	-731	-731
1976	-353	528	-1 142	-386
1977				
1978				
1979				
1980	5 091	1 413?	2 846	2 093
	1	2	3	4

Sources: *X, M, m* and *n* are from the National Accounts, Tables 5 and 7. P_x and P_m, used to estimate *x* and *m*, are from Table A2-1.10 above.
T, used to estimate *n* in Column 4 is also taken from Table A2-1.10.

Note: It is because some of the basic data in Table A2-1.10 are used to estimate results here, that the values for only ten years are given. These were the years selected to illustrate the operation of the PDE.

The use, therefore, of constant price estimates of exports and imports in which $x = X / P_m$ and $m = M / P_x$, cannot solve, unaided, the problem of what to do with the terms of trade effect. It was for this reason that in their proposed accounting scheme, Geary and Burge suggested an external account of the form:

$$x - m + T = n$$

The values of n are given in Column 4 of Table A2-1.12, where T, the terms of trade effect is estimated as described above, ie:

$$T = x(P_x / P - 1) + m(1 - P_m / P)$$

Using this approach, and comparing the values in Columns 1 and 4 of Table A2-1.12 it may be seen that the signs of N and n are the same in each case. This is not the case for the Column 3 values however. If the appropriate values are inserted into the Geary and Burge expression for the external account, it may be shown that none of the estimates of the terms of trade effect for, say, the year 1967 in Table A2-1.5 could give a positive sign to n. The search for an acceptable method to deflate imports and exports must therefore proceed on another tack.

Measures of aggregate economic welfare - some aspects of international practice

If the question of developing adequate measures to examine changing welfare and productivity levels is to be taken seriously, then retreats into convention, accompanied by appeals to authority, must cease to be the dominant response of the institutions to criticism. The dispute which lies at the heart of this study started over the question of the validity of productivity analyses of the South African economy undertaken by the NPI. These analyses, based upon data supplied by the SARB and the CSS, looked (then and now) at both aggregate and sectoral performance. A much-used NPI ploy is to conduct international comparisons, based on straightforward exchange rate conversions, usually to US dollars, of GDP estimates. This, it is argued, is not a very sound procedure. The criticisms made in the Fosatu Challenge were but one of a number which suggested that comparisons of this type are not very useful. The discussion that follows makes reference to some of the analytical tools available at the time the dispute arose. To the best of my knowledge, few of them have yet been applied in South Africa.

Upon having their estimates criticised, the SARB claimed that their method of valuing GDP at constant prices was the official method approved by the UN and the OECD. The tone of their remarks made it clear that the aggregate under consideration was GDP(P) or output valued at constant prices (Swanepoel and van Dijk, 1983). This is the aggregate conventionally used as denominator in productivity estimates. It has been shown quite conclusively above, that under certain conditions, regardless of any other valuation problems, the presence of possible Perverse Deflator Effects (PDE) as well as the severe distortions caused by the (almost) arbitrary nomination[24] of base years in the Laspeyres indices usually used to extrapolate constant price output series, occasionally renders conventional estimates of GDP insufficiently accurate for the purposes for which they are used.

Even if no problems in the valuation of industrial output existed, the conceptual difficulties involved in measuring service sector output are so severe[25] (especially in a country like South Africa) that other than praise the national accounting statisticians for their heroic efforts in this regard, one really ought to ignore any estimate of total output measured in constant prices. This is because at best one may hope for an overall grading of 'fair' (accurate to within plus or minus three to ten percent) if data of British quality are produced, and then only for a period of about five years after which the published figures became less and less reliable (Maurice, 1968, p90). The onus of demonstrating that such data are unsuitable for use in productivity measures does not lie with users (and critics), rather it is the producers of such information who should be obliged to show that the results they produce are not seriously misleading. The long and short of it is that occasions can arise when there is little justification for the use of national accounting data in economic analysis, for example, the preparation of productivity estimates at a national level.

Some fundamental questions need to be posed about precisely what information is required to evaluate the performance of the economy, and also as to what variables are suitable for use in international comparisons.[26] As the NPI frequently points out, increases in welfare ultimately must come from increases in productivity. As I have shown elsewhere, the NPI's position on questions relating to the redistribution of income is equivocal, understandably so, because of the intensely political nature of the topic (Meth, 1991d). The fact of the matter is, of course, that the lot of black workers in South Africa has appears to have improved quite significantly in the period from about 1973 onwards as a result of redistribution against whites. Even if *per capita* GDP did not grow at all, it is conceivable for the welfare of the worst-off group in society to improve. Be that as it may, welfare improvements will undoubtedly be much greater under conditions of respectable productivity and output growth.

Different measures are required for the purposes of measuring productivity and aggregate welfare. It is incorrect to use *per capita* GDP as a surrogate measure for aggregate

24 Standard international practice seems to be to change base year every five years. Slavish adherence to this convention in 'exceptional years' like 1980 in South Africa, produces the statistical disasters discussed in this paper. It is not clear what the authorities can do to avoid such pitfalls as long as accounts continue to be constructed as at present.

25 See Kravis *et al*, 1982. Chapter 5 of the ICP deals extensively with some of the problems of the valuation of services, and with the corrections used to resolve them.

26 Much of what Moll (1992) has to say has direct bearing on these questions.

productivity. To the extent that one trusts individual sectoral studies, the relevant variables are obviously those which measure physical output reasonably accurately in those sectors.[27] There is little need even to express these magnitudes in money terms - physical volume indices of production (PVPs) are adequate for most purposes, including wage growth/productivity growth comparisons. Even the performance of certain specialised calculations, such as trade-weighted unit cost comparisons are possible in index form.

So much for the productivity question. Measuring changing levels of economic welfare presents a different set of problems. Once again, the NPI frequently presses *per capita* GDP into service, although according to official reasoning the appropriate indicator should be the incorrectly-named Real Gross National Product *per capita*. Consideration of the results of the United Nations International Comparison Project (ICP), suggests, however, that the conventional approach to estimating the constant price value of GDP could safely be abandoned. The ICP represents the most comprehensive attempt yet to measure 'real gross product', but in fact it actually measures expenditure and income at the aggregate level, not 'product' in the sense in which the NPI and the SARB use it in their respective responses. The product approach, useful though it undoubtedly is in providing the "basis for sector-by-sector and even industry-by-industry productivity comparisons", is but rarely followed. The reasons given by Kravis *et al* in the Phase III report of the ICP are simply that:

> "...the cost of obtaining these interesting and valuable materials is the need to follow a double-deflation procedure. That is, comparisons must be made of input prices as well as output prices for each industry to ensure that the net output of each industry is validly compared. It is also necessary to ensure that the product coverage of each industry be the same and that the degree of integration from raw materials to finished product either be the same or else that suitable adjustments be made for the differences."[28]

What this means in effect is that comparisons of product are not generally made whereas comparisons of expenditure are. Therefore, what the worlds most proficient practitioners of the art of international comparisons were actually doing at the time the disagreement myself and the authorities started was producing a set of welfare comparisons[29] which look at consumption - even a casual glance at the ICP reveals that its central concern was with consumption rather than production. If it is considered desirable that the South African national accounts continue to be discussed as though they constituted a body of usable data,

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27 This, of course, ignores, amongst other things, the problem of changes in quality.

28 Kravis *et al*, 1982, p27. See also the Phase One Report of the same project, p19.

29 Interestingly though, in a discussion of the impact of price changes in petroleum on the real income of an oil producing country, the ICP's compilers state that "...extrapolation of the ICP benchmark year estimates by each country's change in its GDP would yield a measure of relative physical production at constant base year prices for petroleum and all other products" (Kravis *et al*, 1982, p14)
They continue with the statement that "Extrapolations based on production alone are given in Chapter 8." This statement, however, appears to contradict what I understand to be the actual procedures used in that chapter. None of this makes a great deal of difference to the argument so I shall not pursue the matter here.

then an explicit acknowledgement by the authorities of the fact that under certain conditions, the value of total production cannot be estimated accurately, coupled with warnings as to which estimates are particularly suspect, would be of considerable assistance.

Notwithstanding all that has been said above, the national accounts may, with suitable modification, be used as a welfare indicator. An absence of uniformity in the measures used internationally to measure and compare welfare has been referred to above and a few of the measures approximating that concept, eg, RNDI, GDP(I) and GDY have been discussed, some not in any great depth. A brief review of the literature available at the time suggests that the practice of the SARB and the CSS in producing constant price estimates of expenditure, whilst it may well have conformed to UN, OECD and SNA requirements at the time, did not in fact accord with the concepts developed by the then state-of-the-art practitioners and especially those responsible for the production of the ICP. The authors of the various reports produced for this project, it should be emphasised, were working under the auspices of the UN and the World Bank.

The ICP was a complex undertaking which Marris described as one of the "...great contributions to applied economics" (1984, p40). There is a two page summary of the objectives and content of the project (Kravis, 1984, pp24-25), but the aim here is not to come to grips with the full complexity of the project. Rather it is to report one simple fact, ie, that best practice in international comparisons was based on an expenditure comparison approach into which constant price estimates of exports and imports did not enter. Briefly, the procedure adopted in the project was to produce, for each of 34 countries, benchmark year analyses of the three major components of expenditure on the GDP, namely private consumption, government and capital formation. The first two categories were modified to shift expenditure on health and education to consumption, whilst government was reduced to reflect the expenditure on 'pure' social goods such as defence. The net trade balance (exports less imports) required special treatment in drawing up the benchmark year comparisons (Kravis *et al*, 1982, p91).

The main problem in international comparisons is simply that of how to render the output of different countries comparable. Widespread dissatisfaction with the simple conversion by the use of exchange rates, more or less dictated the use of Purchasing Power Parity (PPP) estimates (Marris, 1984, p41). Multilateral comparisons, all with respect to a numeraire country were made in the ICP, using indices specified so that the rankings thus produced were invariant to the choice of base or numeraire country. Estimates of real GDP and GDP per capita for total output (expenditure) as well as its three major components for the 34 countries in the Phase III of the project were made, both in index form with the USA as numeraire country as well in international dollars.[30] Using this approach (and the actual mechanics were many times more complex than this summary suggests) the ICP project team reported as their main finding, significantly higher estimates of GDP for lower and middle income countries when estimated by the PPP method as opposed to the simple exchange rate conversion method. This difference was sometimes of the order of two or three times as high (Kravis *et al*, 1982, p3). The relationship was systematically explored using a measure called the Exchange-rate Deviation index (ERD) (Kravis *et al*, 1982, p11). The tentative explanation put forward for the discovery of these large increases in the estimated levels of output in developing countries is explored in what they term the "productivity differential" model. In this model, it is argued that the gap between real GDP based on conversion by PPP and that based on nominal or exchange rate conversion (*r* and *n* respectively in the nomenclature used by Kravis *et al*, (1982, p333)) will depend on the level of *r* and the extent to which external influences affect domestic prices. Using a simple dichotomy between goods and services they argue that low productivity commodity producers in the developing countries earn low incomes and that these low incomes purchase, at relatively low prices, services in which productivity is not so low (Kravis *et al*, 1982, pp323-331). The reverse is said to occur in high income countries, with goods production dominated by high productivity techniques with attendant high wages, which, it is suggested, spill over into the less productive service sector.

The next stage of the project involved the extension of the comparison to non-benchmark years. The authors pointed out that in order to make comparisons where the relative positions of countries are comparable year to year as well as within years, one has to take note of a fact referred to above, namely that GDP and GDY may differ because of changes in the terms of trade. It is unnecessary to enter this particular debate here, but it is useful to allude to the fact that the extension of the study to non-benchmark years entailed the separate treatment of two components of the GDP namely, Domestic Absorption (DA), which is the sum of the three major components of expenditure (Consumption, Government and Capital Formation) and the Net Foreign Balance (NFB), the difference between exports and imports. The estimates of GDY and GDP which resulted (and there are several methods of deriving these with theory apparently providing but scant guidance as to the selection of the appropriate method) are thus based on a technique of deflation which does not deflate X by P_x and M by P_m, as is usual in national accounting practice.

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30 This currency unit has the same purchasing power over US GDP as a whole, as does a US dollar: "However its purchasing power over the individual categories (which together constitute that output) is different because that is determined by the structure of international prices" (Kravis *et al*, 1982, p7).

Kravis *et al* note that there is no fully satisfactory way to deflate NFB. This applies both to the intertemporal deflation in standard national accounting procedures and *a fortiori* to international comparisons. The technical details of the chosen deflator are not of concern here, suffice it to say that the space created by the acknowledgement above is one in which alternate deflators can and have been proposed. For the rest, the extension of the study to non-benchmark years involved extrapolation of base year estimates of GDP and GDY. Some of the results are referred to below. The important point here is that the two variables occupying centre stage are Domestic Absorption (DA) and Net Foreign Balance and (NFB). The work of Kravis *et al*, was carried forward by two of his co-authors, Summers and Heston. These two authors explicitly set RGDP equal to DA, suitably transformed, plus NFB, also suitably transformed, in a manner which differs from the method used in Kravis *et al* (Summers and Heston, 1984, p212n). Once again, the exact details are not at issue here, what is important is the explicit use of DA and NFB as the major macro-variables for use in international comparisons. The Summers and Heston piece extends the ICP method, with some important modifications such as that noted above,[31] to 115 market economies including South Africa, as well as nine centrally planned economies. By using the expenditure aggregate DA, Summers and Heston sidestep the problems which result from deflating X by P_x and M by P_m, and in particular, they avoid the Perverse Deflator Effect (PDE).

Unpacking official responses

It has been demonstrated that the estimation of real GDI presents serious problems, that the PDE can cause significant errors, and that terminological confusion still reigns at the SARB as far as the separation of production and income concepts is concerned. In addition, it has been shown above that the most of the difficulties in these areas encountered in the South African context were the subject of intense international scrutiny from the early 1980s onwards. Having shown these things, I would like to recall certain aspects of the original debate between myself and the authorities. These are reproduced below, not because ancient history is intrinsically interesting, but because of the light it casts the behaviour of bureaucracies under criticism.

Glimmerings of the existence of problems in the national accounts first became apparent to me when I was writing the Fosatu Challenge (Meth, 1983). The charges levelled in that paper

31 See Summers and Heston, 1984, pp208ff for a discussion of the major differences between their work and the ICP. The Summers and Heston international comparison of real product used a measure of real per capita GDP (RGDP) which took account of changing terms of trade. This they called 'RGDP*' and they argued that it "...may be regarded as a better income variable than RGDP" (1984, p214).

were dismissed out of hand by the authorities, who (a) attempted to show that I did not fully understand national accounting practices (which was certainly true), and who (b) fell back on an appeal authority in the guise of international standard practice (Swanepoel and van Dyk, 1983; NPI, 1983). I have since discovered that pedantic appeals of this sort are a reflex response, and not only to criticism originating on the left.[32]

In the Fosatu Challenge, the phenomenon highlighted was that of the impact on factor incomes of the rapidly gold price rises in the period up to 1980. These, apparently, were 'dissolved' in the process of translation from current price to constant prices. The question of the impact on the real value of those incomes was posed in this way:

> "... by their own conventions, economists agree that Gross Domestic Produce equals Gross Domestic Income [I was referring here to the magnitudes in current prices, C.M.] This means that in 1970 the "factors of production" in MINING received R1 207 000 000 in INCOME and in 1980 they received R13 400 000 000! Never mind what the CSS says the "constant value" of that output was - **let us rather ask, what happened to that income?**"(Meth, 1983, p7) (emphasis in original).

That led to an attempt to derive a composite index with which to deflate factor incomes in mining - a procedure which the NPI (following the SARB), criticised as follows:

> "The immediate effect of an **increase in the price of gold** is accounted for by an improvement in South Africa's terms of trade. In the national accounts this favourable development is reflected in an **increase in the real national product**, which in turn represents a higher standard of living." (Emphasis added). (NPI, 1983)[33]

This statement contains the economic equivalent of a Freudian slip - in the form of an unconscious reference to a peculiar process which converts a change in a price magnitude into one that affects an output measure. This is merely another example of the SARB's mistaken conception of real gross domestic income, and its description of this entity as Real Gross National Product (RGNP). The slip is more than mere terminological inexactitude - the confusion by the authorities of product and income can be traced to the absence of an agreed value theory in economics. Nothing daunted, and probably as unaware as I was at the time of the thicket of difficulties surrounding the topic, the NPI response to the Fosatu Challenge continued with the statement that:

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32 Considerable space has been in Part II of the study to showing that this faith in convention is endemic in statistics-producing institutions, and probably not only in South Africa. The fall-back position of the CSS is an appeal to convention or approved international practice - even when that practice can be shown to yield manifestly silly results.

33 The NPI Response appeared in two forms. The first, an undated mimeo had the wording of the statement quoted as rendered above (without emphasis). In the 'official' version of the response, *Productivity SA*, Vol. 9, No 4, of December 1983, reproduced as Appendix 1-3 above, the statement was garbled, the first sentence coming out as:

> "The immediate effect of an increase in real national accounted for by an improvement in South Africa's terms of trade."

> "[Meth] does not differentiate between *income* and *production*. In a national accounts context *production* represents the value added, i.e., the value of output minus the value of intermediate consumption. Income represents the income generated (mainly salaries, wages, interest and profits) in the production process. If real contribution to GDP is to be calculated from the income side, deflators that reflect the *production process*, and not the expenditure of the income, must be used. For example, remuneration of the various factors of production should *not* be deflated by the CPI, as this index reflects final expenditure patterns and is not directly related to price changes of production or of intermediate expenditures" (NPI, 1983) (Emphasis in original)

Although it is true that at the time I did not differentiate income from production carefully enough, it is also the case that this attempted defence of convention fails because it falls foul of one the mysteries of economics - the nature of 'value'. An inkling of this is found in the attempt by the NPI to effect the differentiation themselves. Production is said to represent "the value added" whereas the income generated consists mainly of "salaries, wages, interest and profits". Unfortunately, economics (and the CSS and SARB) can only define value added (gross output minus the value of intermediate consumption) by stating that it comprises mainly "salaries and wages, overheads and profits",[34] ie, factor incomes.[35] The definition is thus pure tautology, production is represented by factor income which equals factor income!

The NPI Response was published because that institution had received numerous enquiries from its subscribers regarding the 'accusations' in the Fosatu Challenge. In support of the method used by the South African national accounting statisticians to produce what have been shown to be a rather strange set of results, the NPI declared that:

> "...official procedure was confirmed in 1981 by OECD experts and statisticians of the Statistical Office of the United Nations as correct and in line with methods employed internationally." (NPI, 1983, p7)

Given the political climate at the time - an atmosphere of rabid anti-communism - and (possibly) the blessing of the international authorities in this matter, it was perhaps inevitable that quasi-state organisations such as the SARB and the NPI should respond so unthinkingly to criticism. It was, after all, couched in strong left-wing ideological terms, and it was published by a trade union federation whose relations with both the state and capital were notable for their hostility. As has been shown in Part II, there has, since then, been some (glacially slow) movement, to the extent that the SARB is now prepared to engage in the critical evaluation of statistics produced by the CSS. It is, however, by no means obvious that the SARB, in particular, is any more receptive to criticism of its own workmanship now than what it was

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34 See *South African Statistics 1982*, p12.77. The most common measure of GDP at the time was that at factor incomes. The Central Statistical Services (CSS) version of the national accounts defined the GDP at factor incomes as "the total remuneration, before deduction of depreciation allowances, of the production factors labour and capital, employed in the domestic sectors". See *South African Statistics 1982*, p21.25.

35 The process recommended by the NPI for estimating the value of output in constant prices in this passage is that of double deflation, the limitations and application of which have been considered at length in Part II of the study.

then, regardless of the terms in which that criticism is couched. The NPI has begun moving in the direction of greater openness, but as has been argued in Part II of the study, this has been crucially dependent on the location of a liberal individual in a key position.

In any event, the confidence these two organisations displayed in convention may be seen to have been misplaced - the conventions for valuing commodities whose prices fluctuate significantly are inadequate. Even the briefest of detours into the literature on national accounting and on the terms of trade effects would quickly have revealed a need for a tentative approach to the measurement problems of the type encountered here. The certitude of the NPI (and the SARB) in this matter was a mistake.

It is obvious that under conditions such as those which obtained in the late 1970s and early 80s, the separation of the production accounts from the income accounts needs to be far more thoroughgoing. Factor incomes form the dubious bridge between the two - that link, which cannot be severed, needs to be treated in a way that will not mislead users. The challenge is to devise a method of presenting accounts which will not suffer from the weakness revealed in this study. It may not be possible to do this in a wholly satisfactory manner, but that should not constitute grounds for a public display of complacency similar to that put on by the SARB, the NPI and less visibly, the CSS, when the gold price boom hit the economy. The technique described above by the NPI quite correctly has an improvement in the gold price leading to an improvement in the terms of trade. When, however, it is asserted that a price effect can lead to an increase in real national product, warning bells should start to ring. The tension to which this odd usage gives rise serves only to compound the weaknesses of a measure often used as a surrogate welfare index in this country (mistakenly, some would argue)[36] namely, GDP.

Breaking out of the impasse is going to require more than a retreat into the conventions which are strained, if not actually shattered, on occasion by fluctuating prices. The consequent rupture of the income/product nexus may readily be demonstrated. This has implications which stretch beyond simple internal inconsistencies in the national accounts. As noted above, the phenomenon has attracted considerable attention from the very bodies on whom the SARB and NPI rely for support in their adherence to the 'old' conventions, and over a lengthy period of time. The UN international comparison project looking at gross product and purchasing power commenced in 1968. In Phase One of this project the authors discuss under the heading "The

36 The use of this indicator as a welfare measure here is not intended to imply approval. There is an extensive literature dealing with the inadequacies of it in this application, see for example Seers, 1975. That paper contains a discussion of the problems involved in estimating the value of output, especially in developing countries. Further questions about the adequacy of the measure are raised in Seers, 1976.

Meaning of Output" some of the conceptual problems involved in defining GDP and they note that:

> "For some questions, the outcome has been a clear resolution based on underlying theoretical considerations; but for others, where theory could not resolve the issues, conventions commanding international agreement have been developed. These resolutions and conventions have been set out in the System of National Accounts (SNA)" (Kravis *et al*, 1975, p20)

Commodity price changes have, as has been demonstrated, place some of these conventions under severe strain. Amongst the theoretical issues which have not been resolved is the problem of terms of trade effects. Here, economists can do little more than issue warnings. Wells, for example, distinguishing among the different forms the terms of trade effect can take, offers the following advice:

> "Whatever index of the terms of trade is used, its message must be interpreted with caution, and with due allowance for the special circumstances of any given situation." (1973, p67)

Under certain conditions, it may be possible to make categorical statements about the impact of a change in the terms of trade, such as that by the NPI cited above, but in general, caution is called for. As Meier observes:

> "... though policy debates commonly refer to the terms of trade, the economist cannot accept any one of the measures of the terms of trade as a reliable indicator of changes in economic welfare. Any index of the terms of trade remains only a summary index of changes in other variables that have welfare significance in their own right and require independent assessment." (1980, p70)

The OECD, which reportedly confirmed that the South African procedures were correct, had been working on the problem of terms of trade effects since well before 1978.[37] Gutmann of the OECD in Paris published the results of these deliberations in 1981 and he stated explicity that:

> "...it seems clear that...measures of the effects of terms of trade on real national income can only be conventional... The situation today", he said, "is still ambiguous." (1981, pp443 and 446)

In other words, there is no such thing as a 'correct' procedure in these matters. There is merely an agreement, a convention, which may or may not be appropriate. At about the same time as Pretoria claimed that the UN statisticians confirmed that their procedures were 'correct', the UN was also busy preparing for publication the Phase Three report of the International Comparison Project. By that time, the problem of price changes and the effect that these could have on accounting magnitudes had grown to the point where its discussion

37 Angermann (1978, p378n) refers to a preliminary OECD paper, submitted in 1978, which presumably is the forerunner of the Gutmann (1981) piece.

merited a full chapter of the report. Acknowledging that international comparisons are bedevilled by the fact that GDP and GDY[38] may differ because of changes in the terms of trade, the mountain of statistics processed by Kravis *et al* led them to the following general conclusion:

> "In contrast to the stability (despite substantial changes in relative prices) of relative incomes of all large countries and of small ones with varied exports and imports, other small and medium countries with concentrated exports in one or a few commodities are subject to wide fluctuations in income relative to the fluctuations in their production. Again the generalization applied to both developing and developed countries (for example, Zambia and Luxembourg)." (1982, p332)

The impact which this has had on the relationship between GDP and GDY in certain countries is shown by the fact that in 'real' terms, these two parted company in Iran by as much as 40 percent in 1962, in Zambia by 39 percent in 1970, in Syria by 12 percent in 1972. The ratio GDY/GDP obviously may be above or below unity, and the terms of trade effect can be so marked as to cause a shift from one state to the other. Zambia in 1974 had a GDY/GDP ratio of 1,34 and by 1977 this had fallen to 0,91. In Iran the ratio grew from 0,59 in 1970 to 0,99 in 1974 (1982, Table 8-4). The explanations offered by Kravis *et al*, are price changes for oil in Iran's case and copper for Zambia (1982, p14).

South Africa belongs in this company - at the time of the gold price surges, it shared some of the more important characteristics of the group of countries referred to above, and it is indeed a pity that it was not amongst those chosen for study by the UN. Since the officials of the SARB, the CSS and the NPI are impressed by other UN pronouncements, it is conceivable that results compiled by statisticians at the Statistical Office of the United Nations showing how GDP and GDY differed from each other in South Africa would have caused them to reconsider their position on the adequacy of the South African national accounts.

It seems that world trade may be susceptible to waves of instability. The potential for prices of key commodities, particularly oil and gold, to fluctuate wildly has been referred to above. Prices are relatively stable at the moment, and were surprisingly so during the Iraqi war. There is, however, no guarantee that this will last, especially in view of the latent instability of the international financial system. Officials inhabiting a comfortable world of complacency over national accounting practices, a world which balances precariously on a set of conventions that are easily disrupted by the impact of price changes, need to become more sensitive. Periods of commodity price instability, of which the 'oil shocks' are the most prominent example, have the ability to shake the large capitalist economies of the world to the very core. Bruno, for example, has argued that much of the alleged slowdown in productivity growth in the USA,

38 Kravis *et al* use these terms rather than the more precise GDP(P) and GDP(I).

UK, Germany and Japan through the 1970s may be attributed to rises in raw material prices (1983, p3).[39] Oil price increases, both for old producers such as Saudi Arabia and new producers such as Norway and Great Britain, and for all of the nations in the world which are net importers of oil, have had dramatic impacts on inflation, development rates and general levels of welfare.[40] The world recessions that followed the oil shocks ushered in slumps that brought about significant improvements in the welfare of oil-purchasing nations. The producers, of course, suffered correspondingly - witness the continuing travail of the OPEC countries. Whether the existing national accounting conventions (made in more stable times) are capable of dealing with this is an open question.

'Correct' solutions to these problems, as noted above, do not exist - a pragmatic approach is necessary - one in which the starting point must be the question of what purpose the national accounting series is intended to serve. The production accounts, rather obviously, are most suited to the analysis of productivity, and the income accounts to welfare. Concern, at least for policy purposes, is not so much with the absolute levels of welfare or production but rather with the way in which these are changing, and it is precisely these changes which the SNA sets out to measure. When neither production nor income can be measured correctly, some fundamental rethinking is called for.

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39 It is worthwhile noting here that doubts have been expressed as to whether this slowdown has actually occurred or not. See for example Henrici (1981) and Darby (1984).

40 North Sea oil and the accounting problems which it causes have given rise to a sizable literature, with the *Bank of England Quarterly Bulletin* being particularly prolific in this regard. Amongst the rash of articles that appeared in the late 1970s and early 1980s were the following:
September 1978, *18*(3), "The terms of trade".
September 1979, *19*(3), "North Sea oil and gas in the UK balance of payments since 1970".
September 1980, *20*(3), "Recent developments in the terms of trade".
March 1982, *22*(1), "North Sea oil and gas - costs and benefits".

APPENDIX 2-2

Correspondence with the CSS and the Statistics Council

REPUBLIEK VAN SUID-AFRIKA REPUBLIC OF SOUTH AFRICA

STATISTIEKERAAD • STATISTICS COUNCIL

(012) 3108-429

Navrae/Enquiries H Riekert
Verw. No./Ref. No. 10/1/6/1

Steynsarkade/Steyn's Arcade
Schoemanstraat 274 Schoeman Street
Privaatsak X44 Private Bag
0001 PRETORIA
Faks (012) 3226325 Fax

1991 -09- 1 8

Mr C Meth
University of Natal
Faculty of Economics and Management
King George V Avenue
DURBAN
4001

Dear Mr Meth

MANUFACTURING SECTOR DATA PROBLEMS

Due to the technical nature of the above paper the Council referred it to the CSS and the SA Reserve Bank for comment.

The comments received from these two institutions were tabled at the last Council meeting and are attached for your information.

Council is of the opinion that the comments received address the majority of the issues raised in your paper.

Regards

SECRETARY

COMMENTS OF THE CENTRAL STATISTICAL SERVICE ON THE PAPER ENTITLED: "MANUFACTURING SECTOR DATA PROBLEMS" BY C. METH

Manufacturing sector employment estimates (pp 1-5)

Much is made of the erroneous data published in Statistical News Release P0242.2 on 7 August 1989 and which were corrected in the news release dated 19 October 1989. The latter was clearly marked, on the title page, as replacing the earlier issue. It would serve no purpose to comment on Mr Meth's analysis of these data.

The major remaining issue in this section relates to the extent to which the earlier estimates understated the levels of employment as published in 1989. It should be noted that panel surveys of this nature tend to become progressively more unreliable as time goes by due to attrition of the sample (because of non-response and closure of businesses) and since the sample cannot always be kept completely current (and particularly with regard to those enterprises, not in the sample, which exhibit above average growth). This problem was exacerbated by the fact that the results of the 1982 Census of Manufacturing only became available at a very late stage. An obvious solution would be to return to the earlier two-yearly cycle of censuses and to process the results more speedily but budget constraints do not permit this.

Constructing constant price estimates (pp 7-13)

The problems discussed in this section are inherent to base-weighted indices which constant price series in effect are.

Percentage contributions or shares derived from such series have no meaning other than that related to the weights of the base year (prices in the case of a volume index series) and comparisons of series with different base years cannot be expected to yield consistent results when relative prices change.

It is standard practice to apply linking when indices are rebased and the loss of additivity is a necessary consequence. While it is readily noticeable in the case of the national accounts convention of providing data in a constant price format, it will also be encountered if, for example, an attempt is made to recalculate aggregates of the Consumer Price Index using published weights and indices.

Errors in Manufacturing sector output estimates (pp 13-14)

As regards the comparison of manufacturing output for different base years (as per Table A1.6), the differences can be ascribed to the fact that the CSS in the past, when changing to a new base year, recalculated in detail the entire series of year-to-year volume changes, using the weights of the new base year.

This procedure has since been changed with a view to complying with the two major requirements of the estimates of GDP at Constant Prices, viz (i) that they should enable valid comparison between any two periods and (ii) that the weights (relative prices) underlying the measurement of changes in production over a particular period should reflect the price structure of that period reasonably closely. Thus, in rebasing the estimates for the year 1980 to 1985, the CSS (as explained in Statistical News Release P0441 of February 1989) ...
volume series ...

whilst existing rates of change in volumes are retained for the earlier years, the sub-totals and totals (as pointed out by Mr Meth), will not equal the sums of their components, in other words the figures will not add up in an accounting sense. Although this is an inconvenience to those using the figures, the advantages are, as already pointed out, that the appropriate year-to-year volume changes are retained and that the price weights (relative prices) reflect the price structure of that period as closely as possible. To obtain new sub-totals and totals as the sums of the rebased components would amount to re-weighting the components at 1985 prices, and would therefore be contrary to the principles set out above.

This procedure will be applied retrospectively in order to eliminate anomalies such as that pointed out (for the period 1964 to 1965) as soon as the CSS's limited resources permit.

<u>Revision errors - The Manufacturing Sector PVMP</u> (pp 14-16).

The index of physical volume of manufacturing production (which forms the basis for the relevant gross domestic product estimate at constant prices) is discussed in more detail in a later section. It would appear to be necessary at this stage to state the following with regard to the general procedure followed in calculating this index:

- Volumes are collected each month for a number of "indicator" products from a stratified sample of manufacturers. The sample is redrawn from time to time on the basis of a census of manufacturing (but not necessarily after each census).

- Weights are derived from each census and are used for the census year and the subsequent intercensal years. Because of the time lapse before census results become available, previously published aggregated indices will need revision due to the subsequent reweighting.

- The index series resulting is "benchmarked" to correspond with the deflated values of gross output obtained from the censuses.

- Arithmetic rebasing is also carried out from time to time, often independently of the previous operations.

Due to a shortage of skilled manpower reweighting was not carried out on the basis of the 1982 census and "benchmarking" since the 1979 census. This task is presently being carried out.

<u>The SARB's 1985-based manufacturing sector output estimates</u> (pp 16-18).

The comparison of the various 1985-based GDP estimates shown in Table A1.7 (and attributed to the SA Reserve Bank) should be seen against the background of a preliminary rebasing to the 1985 base year by the CSS in order to make provision for structural changes which occurred in the economy since the rebasing to 1980 prices. However, it was clearly stated in the relevant statistical news releases that it was a <u>preliminary</u> rebasing and for that reason economic growth rates based on both 1985 and 1980 prices were published by the CSS.

published in Statistical News Release P0441 of 27 February 1989.

The CSS's 1985-based manufacturing sector output estimates (pp 18-20).

The issues addressed here have been dealt with elsewhere in this reply.

Number 1: The PPI and Gross Output, or Value of Sales (pp 20-26).

With regard to the analysis in Table A1.9, it should be noted that the sales data used in column 1 have been "benchmarked" to all the relevant censuses for the period covered while the volume indices have not been "benchmarked" further than for 1979. In the light of this it is interesting to note the close correspondence between the ratios of deflated sales to the volume indices on the one hand, and the ratios shown in the column of Table A1.1. It is clear that the factors responsible for the "drift" in the employment series had a similar effect on the volume index series.

Number 2: The CPI and Net Output (The Euler Test revisited) (pp 26-34).

The deviations shown in Table A1.11 in respect of the data for South Africa can undoubtedly be ascribed to the factors described elsewhere in this comment. It should be pointed out that the deflator is correlated to the business cycle since gross operating surplus forms part of the current price estimate of GDP.

The CSS has taken note of the methodology being taken into use in the United Kingdom and is considering its application for use in South Africa. The fact that the deflated series yields a Paasche volume index for the month to month movement of the series needs to be taken into account.

"Salaries and wages" vs " Remuneration" (pp 35-36).

It should be noted that "remuneration" includes estimates for salaries and wages for the TBVC states and for Namibia [illegible]

NAVRAE
ENQUIRIES R J P van Tonder

VERWYSING
REFERENCE 12/1/00/2

TELEFOON
TELEPHONE (012) 310-8349

1992 -07- 0 3

REPUBLIEK VAN SUID-AFI
REPUBLIC OF SOUTH AFI

SENTRAL
STATISTIEKDIEN
CENTRA
STATISTICAL SERVI

STEYNSARKADE
SCHOEMANSTRAAT 274
PRETORIA 0002
PRIVAATSAK X44
PRETORIA 0001

STEYN'S ARCADE
274 SCHOEMAN STREET
PRETORIA 0002
PRIVATE BAG X44
PRETORIA 0001

TEL. (012) 310-8911
FAKS (012) 310-8500
FAX (012) 310-8501
TELEKS 320-450
TELEX 320-523

Mr Charles Meth
University of Natal
Department of Economics
King George V Avenue
DURBAN
4001

Dear Mr Meth

Your letter dated 27 March 1992 refers.

Regarding your doubts as to the credibility of the bench-marked manufacturing production indices, published in Statistical News Release P3041.3 of 9 March 1992, I wish to draw your attention to a number of facts that might have been overlooked by you.

The average annual production indices (as published in the aforementioned news release) relate to the period January to December of the relevant years. The census information, however, relates to the gross output of manufacturing establishments during their financial years which ended on any date during the period 1 July to 30 June (i.e. 1 July 1984 to 30 June 1985 in the case of the 1985 Manufacturing Census). This fact is clearly specified in the second-last paragraph of the notes on page iii of the said news release, as well as in the different statistical publications regarding the manufacturing census. You will no doubt agree that it is important that the production indices and the real gross output should relate to approximately similar periods before any valid comparisons can be made. It is similarly of importance that the periods to which the price indices relate correspond to the period for which the gross output has been calculated. Thus (as discussed in the last paragraph of the notes on page ii of the news release) the increase in the average production index for the census year 1984/85 compared with that for the census year 1978/79 amounts to 17,6%, whereas the increase in the real gross output for the 1985 census compared with that for the 1979 census amounts to 22,2% (or 19,2% using fixed, gross output weights). The table contained in your letter to the Statistics Council has been updated with the aforementioned data and is attached for your information. It is clear that a difference of only 4,6 percentage points remain.

This difference can be ascribed to three factors, namely the implicit index formulae involved, the weighting bases used and adjustment of the census data.

-2-

Regarding your comments on the two ways to obtain a benchmark estimate of the real output of the manufacturing sector, I wish to assure you that the method used by the CSS is not only the statistically correct method, but also the practice recommended by the Statistical Office of the United Nations. I quote: "A frequent practice is to use Laspeyres price indexes to deflate current price values at the most detailed level for which both prices and values are available". (See UN publication "Guidlines on Principles of a System of Price and Quantity Statistics", ST/ESA/STAT/SER.M/59). I might add that if the total gross value of manufacturing output is deflated by the appropriate aggregate Production Price Index (a base-weighted Laspeyres index) for the manufacturing sector, a current weighted (Paasche) volume index is derived, in contrast to the internationally recommended base-weighted (Laspeyres) form that should be used for a regular monthly series of volume indexes of production (see UN publications "Index Numbers of Industrial Production", ST/STAT/SER.F/1 and "Guidelines on Principles of a System of Price and Quantity Statistics").

The basis for the calculation of the weighting systems for the volume indices of industrial production and the Production Price Index differ substantially. In the case of the volume indices of production, the net output is used for weighting, whereas in the case of the PPI total sales value of the components is used for weighting.

The census data were adjusted as detailed under the heading "Comparability with the 1982 and 1985 census results" on page iii of the aforementioned news release.

I furthermore disagree with the statement in your letter to the Statistics Council that the total volume index as well as the total price index will be more accurate than their sub-indices. While the totals are more reliable (in a statistical sense) since they are based on larger samples than the components they are not more correct in view of the fact that the volume and price trends for the components are normally not the same as those of the totals. Measured against the demand for subindices regarding both volume and price, the CSS cannot do away with these as you suggest.

I trust that these matters are now resolved to your satisfaction.

Your sincerely

HEAD: CENTRAL STATISTICAL SERVICE

ANNEXURE

Raw data				
Year		1978/79	1981/82	1984/85
Gross output (R m)		29 926,64	55 735,63	75 092,19
Production Price Index * (1985 = 100)		45,16	68,15	92,70
Deflated to constant 1985 prices				
Gross output (R m)	(a)	66 268,02	81 783,76	81 005,60
	(b)	68 706,20	82 568,38	81 947,69
Expressed in Index form with 1978/79 = 100	(a)	100,0	123,41	122,24
	(b)	100,0	120,18	119,27

Official estimates of the physical volume of manufacturing production

		1978/79	1981/82	1984/85
1	Unbenchmarked series	90,89	112,90	102,28
	Converted so that 1978/79 = 100	100,0	124,22	112,53
2	Newly benchmarked series	87,85	110,54	103,29
	Converted so that 1978/79 = 100	100,0	125,83	117,58

Notes:

* The average of June of one year to July of the next year.

(a) Total gross output (manufacturing) deflated by total Production Price Index (manufacturing).

(b) Total of major groups deflated by appropriate sub-indices of the Production Price Index.

NAVRAE ENQUIRIES Mr R J P van Tonder
VERWYSING REFERENCE 12/1/00/2
TELEFOON TELEPHONE (012)310-8349

REPUBLIEK VAN SUID-AF
REPUBLIC OF SOUTH AFI

C SSD S

SENTRAL
STATISTIEKDIEI
CENTRA
STATISTICAL SERVI

STEYNSARKADE
SCHOEMANSTRAAT 274
PRETORIA 0002
PRIVAATSAK X44
PRETORIA 0001

STEYN'S ARCADE
274 SCHOEMAN STREET
PRETORIA 0002
PRIVATE BAG X44
PRETORIA 0001

TEL. (012) 310-8911
FAKS (012) 310-8500
FAX (012) 310-8501
TELEKS 320-450
TELEX 320-523

1992 -08- 10

Mr Charles Meth
University of Natal
King George V Avenue
DURBAN
4001

Dear Mr Meth

DATA PROBLEMS IN THE MANUFACTURING SECTOR

Thank you for your letter of 14 July 1992 and the document which accompanied it. Cognisance has been taken of the contents of these documents.

As previously indicated, the CSS intends to study the methodology employed by Britain's CSO, as and when resources allow.

Meanwhile the CSS will continue using the method that has been employed to date, as this method, the resulting manufacturing production indices and the additional information which becomes available, are generally regarded as reliable and conformable to international practice by the CSS and the users of the statistics. Consequently there is at present no reason to deviate from a method that has been used for years without the necessary research into the possible alternative.

The CSS agrees fully with the statement by Rushbrook (Rushbrook, 1978, p.106), as quoted by you. This statement confirms the validity of the methods used by the CSS to obtain benchmark estimates.

The CSS, therefore, has nothing to add to its previous correspondence.

Yours faithfully

HEAD: CENTRAL STATISTICAL SERVICE

c.c. Secretary: Statistics Council

REPUBLIEK VAN SUID-AFRIKA REPUBLIC OF SOUTH AFRICA

STATISTIEKERAAD • STATISTICS COUNCIL

☎ (012) 310-8429

Navrae/Enquiries H Riekert

Verw. No./Ref. No. 10/1/6/1(a)

Steynsarkade/Steyn's Arcade
Schoemanstraat 274 Schoeman Street
Privaatsak X44 Private Bag
0001 PRETORIA
Faks (012) 3108504 Fax

1 October 1993

Mr Charles Meth
Economic Research Unit
University of Natal
King George V Avenue
DURBAN
4001

Dear Mr Meth

"MANUFACTURING DATA PROBLEMS"

You will most probably be aware that - in response to your several submissions over the years concerning flaws and errors in the South African manufacturing production and various other statistics - the Statistics Council at its meeting of 25 September 1992 resolved that a sub-committee be established (to be headed by Dr Jaap Meijer of the Reserve Bank) to assess the validity, weight and implications of your criticisms, and to explore ways in which the manner of compilation of the relvant statistical series could possibly be amended, so as to meet your objections where called for and for the improvement of these statistics generally.

Because of unremitting pressure of work in his position at the Reserve Bank, Dr Meijer experienced difficulty in finding time for familiarising himself adequately with the various problems you have raised and elaborated on over the years, and for activating the sub-committee. A meeting to arrange for the establishment of the sub-committee was, however, eventually called in early May of this year. This meeting was attended by Dr A.P.T. du Toit and Mr John Lynch of the CSS and by Dr Meijer and Mr J. Prinsloo of the Reserve Bank.

At this meeting, it was made known by Dr Du Toit that two documents pertaining to your comments and criticisms were, in fact, already available at the CSS. These two documents consisted of -

(A) a *report* (by staff of the Directorate National Accounts at the CSS) on an investigation (commissioned by Dr Du Toit) into the merits and deficiencies, and the comparative results, of estimates of -

(1) the output of manufacturing industry, when based on -

(a) total sales of manufacturing, deflated by the overall production price index (the PPI), and

(b) a summation of sales of manufacturing by principal category, each such category of sales having been deflated by an appro-

(2) the total value added by manufacturing industry, when based on

(a) the PVMP indices, and on
(b) deflated sales by principal category, respectively;

(B) a *memorandum* by Dr Du Toit to Minister Schutte, setting out (i) the nature of your various questionings and criticisms (notably your criticisms of the real-output data in respect of manufacturing), (ii) the CSS's view as to how the manufacturing data should henceforth be estimated, and (iii) reasons for the various real and apparent inconsistencies in subsequent sets of published statistics, and for your inability to replicate or reconstruct the CSS calculations from the published information that was available to you.

The principal finding in the report (docment A) was that, although fairly significant differences to occur between the results of the two ways tested for estimating real value added in manufacturing, the order of magnitude of these differences, historically at least, has been sufficiently minor to suggest that no different economic-policy decisions would have resulted from the availability of one set of estimates rather than the other. Important from your point of view would probably be that -

* document (A) concludes that deflation of manufacturing sales data by principal category should probably be considered the "best" available way of estimating aggregate real value added in manufacturing, and that

* document (B) informs the Minister, among other things, that the CSS have, in fact, already decided to change over to this "best" method (the so-called "indirect" method) of estimating this index series. Reasons for doing so also include the fact that this "indirect" way is now also recommended by the Statistical Office of the United Nations; document (B) also notes that a similar change has recently been made by the statistical service in the United Kingdom. A few "technical aspects" would, however, still have to be cleared up by the CSS before effecting this change.

In this report-back to the Statistics Council at the Council's meeting on 30 August 1993, Dr Meijer informed Council members of these developments. Council members expressed their satisfaction about the CSS's decision and were gratified that your various submissions could be considered to have contributed to this outcome. They requested that you be advised accordingly.

I may note that the Council has also taken note of the various reasons mentioned by Dr Du Toit in document (B), that give rise to perplexities such as you have experienced in your research into (a selection of) South African statistics. Such reasons include the sometimes extreme dereliction and tardiness of respondents in submitting returns to the CSS; errors in the data submitted by respondents that are not "obvious" and may, therefore, come to light only at a (much) later stage; and errors occasionally committed by CSS staff members themselves in the compilation of the statistics. The slowness of respondents, and the extensive periods regularly needed for the processing of returns, may sometimes cause the results of one census to be overtaken by information yielded by a more recent one. This may mean that it becomes unwarranted, if not wholly pointless, to effect adjustments (and to publish full details of such adjustments) to data that already stand to be revised in any case again in the light of the more recent census results.

It is hoped that the recently enhanced status of the CSS as an autonomous government "department" will allow restructuring of its personnel within a generally more satisfactory overall staff position. This should then permit some of these problems to be addressed. The possibility should be faced, however, that the CSS will for some time continue to experience the kinds of difficulties that are associated with the limited availability of experienced, suitably qualified and adequately trained staff.

Yours sincerely

pp C.F. CROUSE (PROF)
CHAIRMAN

APPENDIX 2-3

Selected pages from the SNA

The following pages have been reproduced from the draft of Chapter XVI, (Price and Volume Measures) of the SNA (UN, 1992). The draft has been used because the photostats I have of the final version (UN, 1993) are not of sufficiently high quality to permit reproduction. There are few differences between the two versions.

contrast to price, value is independent of the choice of quantity unit. lues have quite different dimensions from prices and the terms "value" and rice" cannot be used interchangeably for each other. Certain important operties of quantities, prices and values may be briefly noted:

(1) Quantities are additive only for a single homogeneous product. Quantities of different products are not commensurate and not additive even when measured in the same kinds of physical units. For example, it is not economically meaningful to add 10 tons of coal to 20 tons of sugar, even though their combined weight of 30 tons may provide relevant information for other purposes, such as loading ships or vehicles. Less obviously, the addition of 10 automobiles of one type to 20 automobiles of another type may also not be economically meaningful (see below).

(2) The price of a good or service is defined as the value of one unit of that good or service. It therefore varies inversely with the size of the unit of quantity selected. Prices, like quantities, are not additive across different goods or services. An average of the prices of different goods or services has no economic significance and cannot be used to measure price changes over time.

(3) Values are expressed in terms of a common unit of currency and are commensurate and additive across different products. As already noted, values are invariant to the choice of quantity unit.

The aggregation of the values of different goods and services is ified by the fact that, in a market system, the relative prices of erent goods and services should reflect both their relative costs of uction and their relative utilities to purchasers, whether the latter nd to use them for production or consumption. Relative costs and relative ities influence the rates at which sellers and buyers are prepared to ange goods and services on markets.

Volumes

A volume index is an average of the proportionate changes in the ities of a specified set of goods or services between two periods of The quantities compared must be homogeneous, while the changes for rent goods and services must be weighted by their economic importance as red by their values in one or other, or both, periods. The concept of a e index may be illustrated by a simple example. Consider an industry produces two different models of automobile, one selling for twice the of the other. From an economic point of view these are two quite rent products even though described by the same generic term mobile". Suppose that between two periods of time:

(1) the price of each model remains constant;

(2) the total number of automobiles produced remains constant;

(3) the proportion of higher priced models produced increases from 50 to 80 per cent.

It follows that the total value of the output produced increases by 20 per cent because of the increase in the proportion of higher period models. This constitutes a volume increase of 20 per cent. As each higher priced automobile constitutes twice as much output as each lower priced automobile, a switch in production from low to high priced models increases the volume of output even though the total number of automobiles produced remains unchanged. The fact that the value increase is entirely attributable to an increase in volume also follows from the fact that no price change occurs for either model. The price index must remain constant in these circumstances.

12. The term "volume increase" is used in preference to "quantity increase" because there is a possible ambiguity about the use of the term "quantity increase". It is sometimes argued that the situation described in the example is one in which the quantities remain unchanged (because the total number of automobiles remain unchanged), whereas the average quality of the automobiles produced increases (because of the increase in the proportion of higher priced models). However, such an interpretation is based on a semantic confusion due to the fact that the same generic term, "automobile", is applied to two products that are actually quite different from an economic point of view. It is not legitimate to add together quantities that are not identical with each other, even though they may be measured in the same kind of physical units. Adding together quite different models of "automobiles" is no more meaningful than adding together tons of different kinds of "foods" - for example, adding tons of rice to tons of apples or beef. In general, it is not possible to decompose a volume change into a quantity change and a change in average quality. The so-called "quantity index" has no meaning from an economic point of view if it involves adding quantities that are not commensurate. For quite different purposes, however, such as loading aircraft, ships or vehicles, adding quantities may provide useful information. Similarly, for purposes of traffic control or pollution, it may be useful to know the increase in the total numbers of vehicles produced or imported, irrespective of their price. However, such measures are not volume measures in an economic sense.

a. Quantity and unit value indices

13. Unfortunately, it may sometimes happen, especially in the field of foreign trade statistics, that as a result of lack of information the data on which price and volume indices have to be calculated are not adequate for the purpose. For example, the basic information available may be limited to the total numbers of units of some group of products imported or exported, or their total weight: for example, the total numbers of pairs of shoes, or total weight of equipment of certain type. Indices built up from information of this kind are not volume indices when the numbers, or weights, cover different items selling at different prices. They are sometimes described as

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ntity indices" for this reason. The "price" indices associated with such ces are usually described as average or "unit value" indices as they ure the change in the average value of units that are not homogeneous and therefore be affected by changes in the mix of items as well as by changes heir prices. Unit value indices cannot therefore be expected to provide measures of average price changes over time.

C. Intertemporal Index Numbers of Prices and Volumes

Introduction

A price index is an average of the proportionate changes in the prices specified set of goods and services between two periods of time. arly, a volume index is an average of proportionate changes in the ities of a specified set of goods and services. As already emphasised, rice and quantity changes refer to individual goods or services as nct from groups of similar products. Different qualities of the same of product must be treated as separate goods or services in this context.

In line with normal conventions, the period that serves as the reference will be designated as period o and the period which is compared with it ated as period t. The two periods may be consecutive or be separated by rening periods. The ratio of the price, or quantity, of a specific :t in period t to the price, or quantity, of the same product in period described as a price relative, or quantity relative: namely, p_t/p_o or Price and quantity relatives are pure numbers that are independent of its in which the quantities are measured and the prices are quoted. Most numbers can be expressed as, or derived from, weighted averages of these or quantity relatives, the various formulae differing from each other in the weights which they attach to the individual price or quantity ves and the particular form of averages used - arithmetic, geometric, ic, etc.

Laspeyres and Paasche indices

The two most commonly used indices are the Laspeyres and Paasche :. Both may be defined as weighted averages of price or quantity res, the weights being the values of the individual goods or services in other of the two periods being compared.

Let $v_{ij} = p_{ij}\, q_{ij}$: the value of the ith product in period j

peyres price index (Lp) is defined as a weighted arithmetic average of ce relatives using the values of the earlier period o as weights: that

$$Lp = \frac{\sum_i v_{io} \cdot p_{it}/p_{io}}{\sum_i v_{io}} \qquad (1)$$

where the summation takes place over different goods and services. The Laspeyres volume index (Lq) is a similar weighted average of the quantity relatives that is:

$$Lq = \frac{\sum_i v_{io} \cdot q_{it}/q_{io}}{\sum_i v_{io}} \qquad (2)$$

The period that provides the weights for an index is described as the "base" period. It usually (but not always) coincides with the reference period to which the comparisons relate. As the summation always takes place over the same set of goods and services it is possible to dispense with the subscript i in expressions such as (1) and (2). As v_j is equal to $p_j q_j$ by definition, it is also possible to substitute for v_j in (1) and (2) to obtain:

$$Lp = \frac{\Sigma p_t q_o}{\Sigma p_o q_o} \qquad (3)$$

and

$$Lq = \frac{\Sigma p_o q_t}{\Sigma p_o q_o} \qquad (4)$$

Expressions (1) and (3) are algebraically identical with each other, as are (2) and (4).

17. Paasche price and volume indices are defined reciprocally to Laspeyres indices by using the values of the later period t as weights and a harmonic average of the relatives instead of an arithmetic average. A Paasche index (P_p or P_q) is defined as follows:

$$P_p = \frac{\Sigma v_t}{\Sigma v_t \cdot p_o/p_t} = \frac{\Sigma p_t q_t}{\Sigma p_o q_t} \qquad (5)$$

and

$$P_q = \frac{\Sigma v_t}{\Sigma v_t \cdot q_o/q_t} = \frac{\Sigma p_t q_t}{\Sigma p_t q_o} \qquad (6)$$

en a time series of Paasche indices is compiled, the weights therefore vary om one period to the next.

. The Paasche index may also be interpreted as the reciprocal of a ackward looking" Laspeyres: that is, the reciprocal of a "Laspeyres" index r period o that uses period t as the base period. Because of this :iprocity between Laspeyres and Paasche indices there are important mmetries between them. In particular, the product of a Laspeyres price)lume) index and the corresponding Paasche volume (price) index is identical th the proportionate change in the total value of the flow of goods or rvices in question: that is,

$$L_p . P_q = \frac{\Sigma p_t q_o}{\Sigma p_o q_o} \frac{\Sigma p_t q_t}{\Sigma p_t q_o} = \frac{\Sigma v_t}{\Sigma v_o} \quad (7)$$

$$L_q . P_p = \frac{\Sigma p_o q_t}{\Sigma p_o q_o} \frac{\Sigma p_t q_t}{\Sigma p_o q_t} = \frac{\Sigma v_t}{\Sigma v_o} \quad (8)$$

s relationship can be exploited whenever the total values for both periods known. When both Σv_t and Σv_o are known, one or other out of a plementary pair of Laspeyres and Paasche indices can be derived indirectly.

example,

$$L_q = \frac{\Sigma v_t / \Sigma v_o}{P_p} \quad (9)$$

$$P_q = \frac{\Sigma v_t / \Sigma v_o}{L_p} \quad (10)$$

;, the Laspeyres volume index can be derived indirectly by dividing the ortionate change in values by the Paasche price index, a procedure :ribed as <u>price deflation</u>. As it is usually easier, and less costly, to :ulate direct price than direct volume indices, it is common to obtain me measures indirectly both in national accounts and economic statistics rally.

a. <u>Values at constant prices</u>

19. Consider a time series of Laspeyres volume indices, namely,

$$\frac{\Sigma p_o q_o}{\Sigma p_o q_o}, \frac{\Sigma p_o q_1}{\Sigma p_o q_o} \dots \frac{\Sigma p_o q_t}{\Sigma p_o q_o} \quad (11)$$

Multiplying through the series by the common denominator $\Sigma p_o q_o$ yields the <u>constant price</u> series:

$$\Sigma p_o q_o \quad , \quad \Sigma p_o q_1 \quad \dots \quad \Sigma p_o q_t \quad (12)$$

The relative movements from period to period for this series are identical with those of the associated Laspeyres volume indices given by (11), the two series differing only by a scalar. Constant price series of the kind illustrated by (12) are easy to understand and used extensively in national accounts. The term volume "measure" is used to cover both time series of monetary values at constant prices and the corresponding series of volume index numbers.

3. <u>The relationship between Laspeyres and Paasche indices</u>

20. Before considering other possible formulae, it is necessary to establish the behaviour of Laspeyres and Paasche indices vis-a-vis each other. In general, a Laspeyres index tends to register a larger increase over time than a Paasche index:

that is, <u>in general</u>

$$\text{both } L_p > P_p \text{ and } L_q > P_q \quad (13)$$

It can be shown that relationship (13) holds whenever the price and quantity relatives (weighted by values) are negatively correlated. Such negative correlation is to be expected for price takers who react to changes in <u>relative</u> prices by substituting goods and services that have become relatively less expensive for those that have become relatively more expensive. In the vast majority of situations covered by index numbers, the price and quantity relatives turn out to be negatively correlated so that Laspeyres indices tend systematically to record greater increases than Paasche with the gap between them tending to widen with the passage of time.

a. The economic theoretic approach to index numbers

From the point of view of economic theory, the observed quantities may assumed to be functions of the prices, as specified in some utility or duction function. Assuming that a consumer's expenditures are related to underlying utility function, a cost of living index may then be defined as ratio of the minimum expenditures required to enable a consumer to attain same level of utility under the two sets of prices. It is equal to the unt by which the money income of a consumer needs to be changed in order to ve the consumer as well off as before the price changes occurred. This ınt depends not only on the consumer's preferences, or indifference map, also on the initial level of income and expenditures of the consumer. The ıe of the theoretic index is not the same for different consumers with a ferent set of preferences, nor even for the same consumer starting from 'erent income levels.

The following conclusions may be drawn about the relationships between ıeyres, Paasche and the underlying theoretic cost of living indices.

(1) The Laspeyres index provides an upper bound to the theoretic index. Suppose the consumer's income were to be increased by the same proportion as the Laspeyres index. It follows that the consumer must be able to purchase the same quantities as in the base period and must therefore be at least as well off as before. However, by substituting products that have become relatively less expensive for ones that have become relatively more expensive the consumer should be able to obtain a higher level of utility. This substitution will set up a negative correlation between the price and quantity relatives. As the consumer can thereby attain a higher level of utility, the Laspeyres price index must exceed the theoretic index.

(2) Similarly, the Paasche index can be shown to provide a lower bound to the theoretic index based on the later period. The reasoning behind this runs along the same lines as that just used for the Laspeyres index.

While these conclusions show that the Laspeyres and Paasche indices de upper and lower bounds to the corresponding theoretic indices, it must ted that two theoretic indices are involved and not one. The theoretic depends upon the situation in the base period and income level which are he same in the two periods. However, if it can be assumed that the rences of the consumer are homothetic - that is, if each indifference is a uniform enlargement, or contraction, of each other - the two ıtic indices coincide. In this case, the Laspeyres and Paasche indices le upper and lower bounds to the same underlying theoretic index. This ll not sufficient to identify the latter. In order to do this it is .ary to go one step further by specifying the precise functional form of .difference curves. As early as 1925 it was proved that if the utility on can be represented by a homogeneous quadratic function (which is

homothetic) Fisher's Ideal Index is equal to the underlying theoretic index. Although a special case, this result has had a considerable influence on attitudes towards index numbers.

24. Fisher's Ideal Index (F) is defined as the geometric mean of the Laspeyres and Paasche indices: that is,

$$F_p = (L_p \cdot P_p)^{1/2} \qquad (14)$$

and

$$F_q = (L_q \cdot P_q)^{1/2} \qquad (15)$$

Fisher described this index as "ideal" because it satisfies various tests that he considered important, such as the "time reversal" and "factor reversal" tests. The time reversal test requires that the index for t based on o should be the reciprocal of that for o based on t. The factor reversal test requires that the product of the price index and the volume index should be equal to the proportionate change in the current values, $\Sigma v_t/\Sigma v_o$. Laspeyres and Paasche indices on their own do not pass either of these tests. On the contrary, assuming the relationships given in (13) hold, it follows from (7), (8) and (13) that:

$$L_p \cdot L_q > \Sigma v_t/\Sigma v_o \qquad (16)$$

while

$$P_p \cdot P_q < \Sigma v_t/\Sigma v_o \qquad (17)$$

so that neither index passes the factor reversal test.

25. The Fisher index therefore has a number of attractions that have led it to be extensively used in general economic statistics. However, it is worth noting that it also has some disadvantages, some practical, some conceptual.

(1) The Fisher index is demanding in its data requirements as both the Laspeyres and the Paasche indices have to be calculated, thereby not only increasing costs but also possibly leading to delays in calculation and publication.

(2) The Fisher index is not so easy to understand as Laspeyres or Paasche indices which can be interpreted simply as measuring the change in the value of a specified basket of goods and services.

(3) The particular preference function for which Fisher provides the exact measure of the underlying theoretic index is only a special case.

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(4) The Fisher index is not additively consistent. As explained below, it cannot be used to create an additive set of "constant price" data.

. Although the underlying theoretic index may be unknown, the Fisher index ems likely to provide a much closer approximation to it than either the speyres or Paasche indices on their own. However, the Fisher index is not one in this respect. It has been shown that any symmetric mean of the speyres and Paasche indices is likely to approximate the theoretic index ite closely, the Fisher index being only one example of such a symmetric in.

The notion of symmetry can be extended to describe any index that aches equal weight or importance to the two situations being compared. other important example of a symmetric index is the Tornqvist, or translog, lex (T) the volume version of which is defined as follows:

$$= \prod \{ (q_t/q_0)^{1/2(s_0+s_t)} \} \quad (18)$$

re s_0 and s_t denote the share of the total values ($v/\Sigma v$) accounted for by h product in the two periods. The Tornqvist index is a weighted geometric rage of the quantity relatives using arithmetic averages of the value res in the two periods as weights. The Tornqvist price index is obtained replacing the quantity relatives (q_t/q_0) in (20) by price relatives (p_t/p_0).

The Tornqvist index is commonly used to measure volumes changes for poses of productivity measurement. When the production possibilities being lysed can be represented by a homogeneous translog production function, it be shown that the Tornqvist index provides an exact measure of the erlying theoretic volume index. Thus, the Tornqvist index, like the Fisher ex, provides an exact measure under certain very specific circumstances. indices are examples of "superlative indices": that is, indices that ride exact measures for some underlying functional form that is "flexible", homogeneous quadratic and homogeneous translog functions being particular mples of such flexible functional forms.

The Tornqvist index, like the Fisher, utilises information on the values both periods for weighting purposes and attaches equal importance to the ues in both periods. For this reason, its value may be expected to be e to that of an average of the Laspeyres and Paasche indices, such as the er, especially if the index number spread between them is not very large. difference between the numerical values of the Tornqvist and Fisher ces is likely to be small compared with the difference between either of and the Laspeyres or Paasche indices.

Thus, economic theory suggests that, in general, a symmetric index that gns equal weight to the two situations being compared is to be preferred

to either the Laspeyres or Paasche indices on their own. The precise choice of symmetric index - whether Fisher, Tornqvist or other superlative index - may be of only secondary importance as all the symmetric indices are likely to approximate each other, and the underlying theoretic index, fairly closely, at least when the index number spread between the Laspeyres and Paasche is not very great.

D. Chain Indices

1. The rebasing and linking of indices

31. It is convenient to start by considering the example of a time series of Laspeyres volume indices on a fixed base period and its associated series of values at constant prices. In the course of time, the pattern of relative prices in the base period tends to become progressively less relevant to the economic situations of later periods to the point at which it becomes unacceptable to continue using them to measure volume measures from one period to the next. It may then be necessary to update the base period and to link the old series to the series on the new base period.

32. For a single index taken in isolation linking is a simple arithmetic operation. However, within an accounting framework it is not possible to preserve the accounting relationships between an aggregate and its components while at the same time linking the aggregate and its components separately. The difficulties involved are best explained by referring to the numerical example given in the table XVI.1, The Rebasing and Linking of Volume Indices and Series at Constant Prices.

33. Part I of the table presents the underlying price, quantity and value data for two products, A and B, and the aggregate (A+B). It is assumed that constant price series are calculated for periods 0 to 10 using period 0 prices, with a change of base year in period 10. Constant price data for periods 10 onwards are calculated at period 10 prices. The resulting constant price data, and the Laspeyres volume indices for the aggregate, are shown in Part II. The question to be addressed is the best way to link these two <u>sets</u> of data as a whole.

34. Assuming it is desired to present a continuous run of "constant price" data from period 0 to period 15, there are several ways in which such data could be compiled. One possibility is to scale down the constant price data from periods 10 to 15 (calculated at period 10 prices) to the general level of prices in period 0 by multiplying through by a constant equal to $\Sigma p_0 q_{10}/\Sigma p_{10} q_{10}$. This ensures that there is no break in continuity for the <u>aggregate</u> when the weights are switched from period 0 prices to period 10 prices. It yields a set of data which, from period 10 onwards, is expressed at the <u>general</u> price level of period 0 but at the <u>relative</u> prices of period 10. This solution is illustrated in Part III of the table.

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The difficulty with this solution is apparent from the table. In period in which the link occurs two different sets of relative prices have to be :d. As a result, discontinuities are introduced into the "constant price" ies for A and B at the point at which the switch is made from one set of ative prices to the other. For this reason, the linked measures for A and o not reflect the underlying volume movements. For example, the ratio of "constant price" figure for A in period 15 to the corresponding value in iod 0, namely 71.9/30 = 2.40, is very different from the actual change in quantity of A, namely 15/5 = 3.

The same difficulties would arise if the series before the link were to scaled up to the general price level of period 10. As illustrated in Part of the table the constant price data valued at the prices of period 0 can scaled up to the prices of period 10 by multiplying by the constant $_{10}/\Sigma p_0 q_0$. Discontinuities are again created for A and B at the point at :h the switch is made from one set of relative prices to the other. The io of the "constant price" for A in period 15 to that in period 0 is '56.4 = 2.23 which again is very different from the actual quantity change,

In order to preserve the volume movements at each level of aggregation, onents have to be linked as well as the aggregates. This procedure is owed in parts V and VI of table XVI.1. In part V the linked values are at constant prices of period 0 while in part VI they are at the constant es of period 10. The linked volume movements for A and B reflect the rlying quantity changes, while the linked volume movements for the egate A + B take account of the change in weights in period 10. The lem that emerges with this method is that the constant price values for components do not add up to the constant price values of the aggregates the series have been linked. This can be seen in part V for the linked :s of period 15 at prices of 0 and in part VI for the linked values of id 0 at the prices of 15. In other words when every series at each level igregation is individually linked, the resulting constant price data are dditively consistent after the linking has taken place.

When data are not additively consistent, as in the last column of part V he first column of part VI, there is a discrepancy between the sum of the nents and the corresponding aggregate at each individual level of gation. One way of eliminating the discrepancy would be to distribute it oportion to the components. For example, the figures of 45 and 80 in the column could be scaled down 42.9 and 74.6 to make them add to 116.5, the red total. However, this would automatically distort the volume risons for both A and B in period 0 as compared with periods 10 and 15. natively, the total for (A+B) could be adjusted to make it equal to the the components i.e., 125 instead of 116.5. By distorting the volume isons at the aggregate level, however, this would defeat the main e of the exercise.

A choice has to be made between the two different methods illustrated in ble. The first approach, using the scalar adjustment as illustrated in

parts III and IV of the table, preserves additive consistency at the expense of distorting the linked comparisons at a detailed level. The second approach, illustrated in parts V and VI, preserves the validity of the linked comparisons at each level of aggregation at the cost of destroying additive consistency. The volume movements for the overall aggregate are the same in both cases. On balance, the second method seems preferable, given that the main purpose is to obtain good price and volume measures.

40. When the base year is updated for constant price series in national accounts, the problem is how to present data for years prior to the new base year. In practice, the method illustrated in part VI of the table is usually followed which preserves the integrity of the volume movements at each level of aggregation at the cost of destroying additivity for years prior to the new base year. The question of how to deal with the resulting discrepancies is considered further below.

2. Rebasing and linking each period

a. Introduction

41. If the objective is to measure the actual movements of prices and volumes from period to period indices should be compiled only between consecutive time periods. Changes in prices and volumes between periods that are separated in time are then obtained by cumulating the short-term movements: that is, by linking the indices between consecutive periods together to form "chain indices". Such chain indices have a number of practical as well as theoretical advantages. For example, it is possible to obtain a much better match between products in consecutive time periods than between periods that are far apart, given that products are continually disappearing from markets to be replaced by new products, or new qualities. Chain indices are also being increasingly demanded by economists and others for analytical purposes and are being increasingly used for special purpose indices, such as consumer price indices, in order to have indices whose weighting structures are as up-to-date and relevant as possible.

b. Chain Laspeyres and Paasche indices

42. In order to understand the properties and behaviour of chain indices in general, it is necessary to establish first how chain Laspeyres and Paasche indices behave in comparison with fixed base indices. A chain Laspeyres volume index connecting periods 0 and n is an index of the following form:

$$L_q^c = \frac{\Sigma p_0 q_1}{\Sigma p_0 q_0} \cdot \frac{\Sigma p_1 q_2}{\Sigma p_1 q_1} \cdot \ldots \frac{\Sigma p_{t-1} q_t}{\Sigma p_{t-1} q_{t-1}} \cdot \ldots \frac{\Sigma p_{n-1} q_n}{\Sigma p_{n-1} q_{n-1}} \qquad (19)$$

chain Paasche volume index P_q^c is obtained by adding 1 to each of the price bscripts in (19). Laspeyres and Paasche price indices are obtained by terchanging the p's and q's in the expressions for the volume indices.

. In general, Laspeyres indices, whether volume or price, tend to increase re (or decrease less) than Paasche indices, but if fixed base indices are)laced by chain indices, the index number spread between Laspeyres and ısche is likely to be greatly reduced. The relationship between a fixed :e index and the corresponding chain index is not always the same, however, it must depend upon the paths followed by individual prices and quantities r time.

If individual prices and quantities tend to increase or decrease otonically over time it can be shown that the chain Laspeyres will tend to rease less than the fixed weight Laspeyres while the chain Paasche will 1 to increase more than the fixed Paasche. In these circumstances, -efore, chaining will reduce the index number spread, possibly almost ıinating it.

On the other hand, if individual prices and quantities fluctuate so that relative price and quantity changes occurring in earlier periods are rsed in later periods, it can be shown that the chain Laspeyres may ease faster than the fixed base Laspeyres, while the chain Paasche may ease less than the fixed Paasche. In this case, the index number spread ncreased by chaining, thereby accentuating the problem of choice of ıla. It is possible to give a simple demonstration of this effect.

Suppose that the changes in prices and quantities that occur between the period 0 and some intervening period t are subsequently reversed so that ıe time the final period n is reached all the individual prices and ities have returned to their initial levels in period 0. As the prices uantities for period n are identical with those in period 0, it would be nable to require the price and volume indices for period n based on d 0 to be unity. The direct Laspeyres and Paasche for period n based on d 0 would clearly both be unity in these circumstances. However, a chain yres (or Paasche) that used the intervening period t as a link would not ity. The chain volume index is given the following expression:

$$\frac{\Sigma p_o q_t}{\Sigma p_o q_o} \cdot \frac{\Sigma p_t q_n}{\Sigma p_t q_t}$$

= q_o by assumption for every product, then the chain index can be n as:

$$\frac{\Sigma p_o q_t}{\Sigma p_o q_o} \cdot \frac{\Sigma p_t q_o}{\Sigma p_t q_t} = L_q/P_q$$

where L_q and P_q are the Laspeyres and Paasche volume indices for period t based on period 0. As L_q may be expected to be greater than P_q, it follows that the chain Laspeyres is greater than unity (and therefore greater than the direct Laspeyres for period n on period 0). This reflects the fact that a Laspeyres index does not satisfy Fisher's "time reversal" text. The more the prices and quantities in period t diverge from those in periods 0 and n (i.e., the more the prices and quantities fluctuate), the greater the difference between L_q and P_q, and hence the more the chained Laspeyres volume index exceeds unity in this example.

47. If the whole process is repeated again and again, the chain Laspeyres volume index linking successive rounds together will drift further and further away from unity, even though the prices and quantities keep returning to their initial values by assumption. Such drifting is a signal that the circumstances are not appropriate for a chain index. When the sets of relative prices and quantities in two time periods are similar to each other they should be compared directly and not indirectly via another period whose relative prices and quantities are very different. A chain Laspeyres, or Paasche, index should <u>not</u> be used if the chaining involves an <u>economic detour</u>; that is, linking through a period, or periods, in which the sets of relative prices and quantities differ more from those in both the first and the last period than the latter do from each other.

48. Conversely, a chain index should be used when the relative prices in the first and last periods are very different from each other and chaining involves linking through intervening periods in which the relative prices and quantities are intermediate between those in the first and last periods. Relative prices and quantities are described as intermediate when they may be approximated by some average of those in the first and last periods. This will happen when the opening prices and quantities are transformed into those of the final period by the gradual accumulation of successive changes which tend to be in the same direction. In this case, the individual links in the chain are strong as they involve comparisons between situations that are very similar to each other.

49. On balance, situations favourable to the use of chain Laspeyres and Paasche indices over time seem more likely than those that are unfavourable. The underlying economic forces that are responsible for the observed long term changes in relative prices and quantities, such as technological progress and increasing incomes, do not often go into reverse. However, when data are collected more frequently than once per year, regular fluctuations occur in certain monthly or quarterly data as a result of seasonal factors affecting the supply or demand for individual goods or services. Applying the conclusions reached above suggests that if it is desired to measure the change in prices or volumes between a given month, or quarter, and the same month, or quarter, in the following year, the change should be measured <u>directly</u> and not through a chain index linking the data over all the intervening months, or quarters. As already noted, even if the prices and quantities for a particular month, or quarter, were to be identical with those in the previous year, a chained Laspeyres volume index could not be expected to return to its

revious level. Chaining seasonal data that are not adjusted for seasonal luctuations is not desirable and fixed weight indices would be preferable. his does not preclude the use of chain indices to measure year to year hanges in the corresponding annual data.

c. Chain Fisher or Tornqvist indices

). As explained in the previous section, the index number spread between aspeyres and Paasche indices may be greatly reduced by chaining when prices d quantities move smoothly over time, even if the cumulative changes in the lative prices and quantities are quite large in the long run leading to a de spread between the direct Laspeyres and Paasche. Indeed, in the limit, the time paths of prices and quantities converge on steady exponential tes of increase or decline, the chain Laspeyres and Paasche converge on a ngle chain index.

. When the index number spread can be reduced by chaining, the choice of dex number formula assumes less significance as all relevant index numbers within the upper and lower bounds of the Laspeyres and Paasche indices. vertheless, there may still be some advantages to be gained by choosing an dex such as the Fisher or Tornqvist that treats both periods being compared metrically.

Such indices are likely to more closely approximate the theoretic ices based on underlying utility or production functions even though ining may reduce the extent of their advantages over their Laspeyres or sche counterparts in this respect. A chained symmetric index, such as her or Tornqvist, is also likely to perform better when there are ctuations in prices and quantities. The example given in the previous tion showed that if all the price and quantity changes that occur between iod 0 and t are subsequently reversed between t and n, the chain Laspeyres king 0 to n through t does not return to unity. In other words, Laspeyres ices do not satisfy Fisher's time reversal test. However, the Fisher index satisfy this test and returns to unity in the circumstances postulated. ay be conjectured that, in general, chain Fisher indices are likely to d results that are more acceptable in the presence of fluctuations. While emains desirable to avoid economic detours when compiling chain indices t is, linking through periods with very different economic structures) n Fisher indices are likely to be much less sensitive to such detours than n Laspeyres or Paasche indices.

d. Chaining and data coverage

53. One major practical problem in the construction of index numbers is the fact that products are continually disappearing from markets to be replaced by new products as a result of technological progress, new discoveries, changes in tastes and fashions, catastrophes of one kind or another, and so on. Thus, it is not possible to compile price and quantity relatives for every product available in one or other period. In such situations the best that can be done is to compile price or quantity relatives for as many products as possible and then to assume that either the price or the volume changes for the remaining products, which include products available in only one of the two periods, are the same as for some similar product, or group of products, for which price or quantity relatives can be calculated. In general, it would be more reasonable to assume equality of price than volume changes, given that some quantities are zero in one or other period.

54. In a time series context, the overlap between the products available in the two periods is almost bound to be greatest for consecutive time periods (except for sub-annual data subject to seasonal fluctuations). The amount of price and quantity information that can be utilised directly for the construction of the price or volume indices is therefore likely to be maximised by compiling chain indices linking adjacent time periods. Conversely, the further apart the two time periods are, the smaller the overlap between the ranges of products available in the two periods is likely to be, and the more necessary it becomes to resort to indirect methods of price comparisons based on assumptions. Thus, the difficulties created by the large spread between the direct Laspeyres and Paasche indices for time periods that are far apart are compounded by the practical difficulties created by the poor overlap between the sets of products available in the two periods.

e. Additivity and chaining

55. Additivity is a property pertaining to a set of inter-dependent index numbers related by definition or by accounting constraints. An aggregate is defined as the sum of its components. Additivity requires this identity to be preserved when the values of both an aggregate and its components in some reference period are extrapolated over time using a set of volume index numbers. Although desirable from an accounting viewpoint, additivity is actually a very restrictive property. As already noted, Laspeyres volume indices are additive because extrapolating the base period values by Laspeyres volume indices is equivalent to revaluing quantities in later periods by the same set of base period prices. Additivity implies that, at each level of aggregation, the volume index for an aggregate takes the form of a weighted arithmetic average of the volume indices for its components that uses their base period values as weights. This requirement virtually defines the Laspeyres index. Other volume indices in common use are therefore not additive.

56. As already shown, a single link is sufficient to destroy additivity in the linked data expressed in value terms even when additive indices such as Laspeyres volume indices, are linked together. If, therefore, chain volume indices are converted into time series of values by using the indices to extrapolate the values of the base period, components fail to add to aggregates in later periods. For this reason, it is common to publish the data only in the form of index numbers. However, this procedure cannot be recommended in general because it may merely conceal the problem from users who may be unaware of the breakdown in additivity and its consequences. Even if they are aware of the non-additivity, they are not able to assess its seriousness for the kinds of analysis on which they may be engaged if the data ire published only in index number form. Users may be confused when the index for an aggregate is patently not a weighted arithmetic average of those for its components and may wrongly conclude that there must be errors in the data.

.7. A perverse form of non-additivity occurs when the chain index for the ggregate lies outside the range spanned by the chain indices for its omponents, a result that may be regarded as intuitively unacceptable by many sers. This case cannot be dismissed as very improbable. In fact, it may asily occur when the range spanned by the components is very narrow and it as been observed on various occasions. In any case, publishing data only in he form of index numbers and not as values means abandoning any attempt to onstruct accounts at constant prices.

!. When base year values are extrapolated by chain volume indices there are fectively three ways of dealing with the ensuing non-additivity. The first simply to publish the non-additive "constant price" data as they stand thout any adjustment. This method is transparent and indicates to users the tent of the problem. Users may, or may not, choose to eliminate the screpancies for analytical purposes, choosing whatever method they consider st appropriate for their purposes. Some countries prefer to publish adjusted non-additive data for these reasons. The second possibility is to stribute the discrepancies over the components at each level of aggregation. is is equivalent to methods V and VI in the table. As already explained, is procedure is not without its cost as the volume movements for the ponents are distorted as a result. For certain types of analysis such tortion could be a serious disadvantage. On balance, it would seem ferable to let users decide whether or not to eliminate the discrepancies that users mainly interested in volume changes for particular components not disadvantaged. A third possibility would be to eliminate the crepancies by building up the values of the aggregates as the sum of the ues of the components at each level of aggregation. This procedure cannot recommended in general. Not only would it introduce distortions into the ume movements of the aggregates but it would also make the results for the egates depend quite arbitrarily on the level of disaggregation inguished within the accounts. By distorting the volume movements for the egates this method would appear to defeat the whole objective of trying to in improved volume measures at an aggregate level through chaining.

59. Similar considerations have to be taken into account when time series of fixed base Laspeyres volume indices and their accompanying constant price series have to be rebased. As already noted, assuming the rebasing is not carried backwards, the linked data for series prior to the new base year will not be additive. For reasons just given, the transparent procedure is simply to publish the non-additive data without adjustment leaving it to users to decide whether, or how, to deal with the resulting discrepancies. This does not preclude the possibility that there may be circumstances in which compilers may judge it preferable to eliminate the discrepancies in order to improve the overall reliability of the data.

E. Volume Measures for Gross Value Added and GDP

60. The gross value added of an establishment, enterprise, industry or sector is measured by the amount by which the value of the outputs produced by that establishment, enterprise, industry or sector exceeds the value of the intermediate inputs consumed, the goods and services produced and consumed being valued using the same vector of prices: that is, by:

$$\Sigma pQ - \Sigma pq$$

where the Q's refer to outputs and the q's to intermediate inputs. Value added in year t at current prices is given by:

$$\Sigma p_t Q_t - \Sigma p_t q_t$$

while value added in year t at the prices of the base year is given by:

$$\Sigma p_0 Q_t - \Sigma p_0 q_t$$

This measure of value added is generally described as being obtained by "double deflation" as it can be obtained by deflating the current value of output by an appropriate (Paasche type) price index <u>and</u> by similarly deflating the current value of intermediate consumption.

61. Within an integrated set of price and volume measures such as those relating to the flows of goods and services in the use matrix or an input-output table, gross value added has to be measured by double deflation method. Otherwise, it will not possible to balance uses and resources identically. However, the measurement of gross value added in year t at the prices of some base year is liable to throw into sharp relief some underlying index number problems. Vectors of prices and quantities are not independent of each other. In practice, relative quantities produced or consumed are functions of the relative prices at the time. If relative prices change, relative quantities will be adjusted in response. A process of production which is efficient at one set of prices may not be very efficient at another set of relative prices. If the other set of prices is very different the inefficiency of the process may reveal itself in a very conspicuous form, namely negative gross value added. Even if the revalued gross value added is

not actually negative, the gross operating surplus may change from positive to negative, thereby signalling the fact that the production process would not be used at those prices.

62. Thus, the measurement of value added using a vector of prices that is very different from that prevailing at the time the production process is carried out may lead to results that are not very acceptable for analytical purposes. In a time series context, this implies that the relative prices of the base year must not be too divergent from those of the current year, so that base years may have to be updated frequently and some form of chaining used. Chain indices for value added are considered in the next section.

1. <u>Chain indices for value added and GDP</u>

63. In order to derive balancing items such as gross value added residually the various elements involved must be additive. Consider the following example:

Let

O_o = the value of output in period o
I_o = the value of intermediate consumption in period o
C_t = the chain volume index for output in period t
B_t = the chain volume index for intermediate consumption in period t

)ne possibility would be to measure the change in the volume of value added)etween periods 0 and t by extrapolating the base period values of both output ınd intermediate input by the relevant chain indices, as follows:

$$\frac{O_oC_t - I_oB_t}{O_o - I_o} \qquad (20)$$

›wever, an index such as (20) would have no clear meaning because the chain ıdices C_t and B_t are not additive. In addition, its behaviour could be ıpredictable and erratic, especially if the difference between O_o and I_o is ıall compared with their absolute levels. This method must be rejected on ıth conceptual and practical grounds.

. When chain indices are used for output and intermediate consumption, an <u>ditional</u> chain index must be compiled for value added itself. Suppose chain speyres type volume indices are calculated for output and intermediate nsumption. A Laspeyres type chain volume index for volume added can then be lculated, each link in the chain being defined as follows:

$$= \frac{\Sigma p_{t-1}Q_t - \Sigma p_{t-1}q_t}{\Sigma p_{t-1}Q_{t-1} - \Sigma p_{t-1}q_{t-1}} \qquad (21)$$

where the capital letters refer to outputs and the small letters to intermediate inputs. The denominator in (21) is value added in period t-1 while the numerator is obtained by revaluing the outputs and inputs in period t at t-1 prices. Expression (21) can be interpreted as measuring the change in value added between t-1 and t at the prices of t-1. As constant prices are used, the resulting measures are additively consistent.

65. A chain volume index for value added can be compiled in this way using Laspeyres type volume indices for each link in the chain. However, in common with all chain indices, it should be noted that the three indices involved - the output index, the input index and the value added index - are not additively consistent among themselves. This can produce counter intuitive and
unacceptable results in the long run. For example, for each individual link in the chain it is impossible for the output index to lie outside the range spanned by the intermediate consumption and value added indices. However, because chain indices are not additively consistent, in the long run the chain index for output may drift outside the range spanned by the other two chain indices. Such cases have been observed and documented.

66. It is equally possible, of course, to compile a chain volume index for value added using Paasche type volume indices linking successive periods, each link being defined as follows:

$$P_q^{VA} = \frac{\Sigma p_tQ_t - \Sigma p_tq_t}{\Sigma p_tQ_{t-1} - \Sigma p_tq_{t-1}} \qquad (22)$$

Each link provides an economically meaningful measure of the volume change in value added by using the prices of period t to value output and intermediate consumption in both periods.

67. A third possibility is to compile a chain volume index for value added that uses a Fisher volume index for each link - that is, the geometric mean of the Laspeyres and Paasche indices given by (21) and (22). Such an index may provide the best volume measure of value added from a theoretical point of view. However, the chain Laspeyres index should provide a very close approximation to the chain Fisher in situations in which it is too difficult or time consuming to calculate the Fisher.

2. <u>Single indicators</u>

68. As value added at constant prices is equal to the difference between output at constant prices and intermediate consumption at constant prices it is affected by errors of measurement in both series. Assuming that such errors are at least partly random, the errors will tend to be cumulative making value added extremely sensitive to error, especially in industries or sectors where value added accounts for only a relatively small proportion of

the value of the total output. In some cases, it may be better to abandon the attempt to measure value added as the difference between two series subject to error and to try to estimate the volume movements of value added directly using only one time series - that is, a "single indicator" instead of double deflation. Although single indicators may be biassed, they are much less sensitive to error. Over the short run, the potential bias involved in using single indicators may be negligible compared with the potential errors in the double deflation estimates.

69. If there are good data on gross value added at current prices, one alternative to double deflation is to deflate current value added directly by a price index for gross output. This procedure can be described as single deflation. It is likely to yield a close approximation to the change in value added at constant prices, at least in the short run. Another possible procedure is to extrapolate value added in the base year by a volume index for output. This method is likely to yield similar results to the first method and can be used when data are not available for value added at current prices. The volume index used to extrapolate base year value added can itself be calculated either directly from quantity data or by deflating the current value of output by an appropriate price index. If the data on output at current prices are comprehensive and reliable, the latter method is likely to yield the better estimates.

70. The estimation of changes in value added at constant prices by deflating current value added by an output price index or extrapolating base year value added by an output volume index is an acceptable second-best solution when the data available are not sufficiently reliable and robust to permit the use of double deflation. Unfortunately, however, it is sometimes not even possible to obtain satisfactory estimates of price or volume changes for output - for example, in certain market and non-market service industries such as finance, business services, education or defence. In these cases, it may be necessary to resort to third-best solutions by estimating movements of value added at constant prices on the basis of the estimated volume changes of the inputs into the industries. The inputs may be total inputs, labour inputs on their own or intermediate inputs on their own. For example, it is not uncommon to find the movement of value added at constant prices estimated by means of changes in compensation of employees at constant wage rates, or even simply by changes in numbers employed, in both market and non-market service industries. Compilers of data may be forced to adopt such expedients, even when there is no good reason to assume that labour productivity remains unchanged in the short or long term. Sometimes, volume changes for intermediate inputs may be used: for example, short-term movements of value added at constant prices for the construction industry may be estimated from changes in the volume of building materials consumed - cement, bricks, timber, etc. The use of indicators of this kind may be the only way in which to estimate short term movements in output or value added, but they are not acceptable over long time periods.

3. Real GDP

71. Volume movements in GDP for the total economy are often described as movements in "real" GDP. Only in the special case in which time series of fixed base Laspeyres volume indices are used, however, is it legitimate to equate time series of real GDP with time series in GDP "at constant prices". When chain indices are used, it is not appropriate to describe real GDP as GDP at constant prices.

72. Changes in GDP for the total economy may be calculated from the expenditure side from data on final expenditures and imports. The double deflation method used to measure gross value added at the level of an industry or sector may be applied at the level of the total economy by replacing output and intermediate consumption by final expenditures and imports.

73. The conclusions reached above with regard to the measurement of real value added by industry or sector apply equally at the level of the total economy and may be summarised as follows:

(1) the preferred measure of year to year movements of real GDP is a Fisher volume index, changes over longer periods being obtained by chaining: that is, by cumulating the year to year movements;

(2) the preferred measure of year to year inflation for GDP is therefore a Fisher price index, price changes over long periods being obtained by chaining the year to year price movements: the measurement of inflation is accorded equal priority with the volume movements;

(3) chain indices that use Laspeyres volume indices to measure movements in real GDP and Paasche price indices to measure year to year inflation provide acceptable alternatives to Fisher indices;

(4) the chain indices for total final expenditures, imports and GDP cannot be additively consistent whichever formula is used, but this need not prevent time series of values being compiled by extrapolating base year values by the appropriate chain indices;

(5) chain indices should only be used to measure year to year movements and not quarter to quarter movements.

74. Two further advantages of using chain indices for GDP may be noted. The quality of the inflation measures is greatly improved compared with the year to year movements in the implicit Paasche type deflators calculated on a reference period. A second advantage is that chaining avoids introducing apparent changes in growth or inflation as a result of changing the base year. When the base year for a time series of fixed weight Laspeyres type volume indices is brought forward, the underlying trend rate of growth may appear to slow down if the previous base has become very out of date. This slowing down

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is difficult to explain to users and may bring the credibility of the measures into question.

4. <u>The publication of alternative volume and price series</u>

75. Although the preferred measure of real growth and inflation for GDP is a chain Fisher index, or alternatively a chain Laspeyres or Paasche index, it must be recognised that the lack of additive consistency can be a serious disadvantage for many types of analysis in which the inter-relationships between various flows in the economy are the main focus of interest. Most macro-econometric models fall into this category. It is therefore recommended that disaggregated constant price data should be compiled and published in addition to the chain indices for the main aggregates. The need to publish two sets of data that may appear to conflict with each other should be readily appreciated by analysts engaged in macro-econometric modelling and forecasting. Users whose interests are confined to a few global measures of real growth and inflation can be advised to utilise the chain indices and ignore the more detailed constant price estimates.

76. Constant price series have nevertheless to be rebased in the course of time. In general, constant price series should not be allowed to run for more than five, or at most ten, years without rebasing. It is therefore recommended that disaggregated constant price data should be published for as many of the flows of goods and services in the System as possible, with a change of base year about every five years. When the base year is changed it is customary to <u>link</u> the data on the old base to the data on the new base rather than to carry the rebasing backwards.

77. In effect, the underlying issue is not whether to chain or not but how often to rebase. Sooner or later the base year for fixed weight Laspeyres volume indices and their associated constant price series has to be updated because the prices of the base year become increasingly irrelevant. When the base year is updated, series on the old base have to be linked to those on the new base. Thus, sooner or later additivity is lost as a result of linking (assuming the rebasing is not carried backwards). Long runs of data therefore almost inevitably involve some form of chain indices. Annual chaining is simply the limiting case in which rebasing is carried out each year instead of every five or ten years.

F. <u>International Price and Volume Indices</u>

78. It is possible to compare prices and volumes between countries using the same general methodology as for intertemporal comparisons within a single country. International volume indices are needed in order to compare levels of productivity or standards of living in different countries, while comparisons of prices can be used to measure purchasing power parities between different currencies.

Table XVI.1

The Rebasing and Linking of Volume Indices and Series at Constant Prices

A numerical example

I. The basic data

Product	Period 0			Period 10			Period 15		
	p_0	q_0	v_0	p_{10}	q_{10}	v_{10}	p_{15}	q_{15}	v_{15}
A	6	5	30	9	12	108	11	15	165
B	4	8	32	10	11	110	14	11	154
A+B	-	-	62			218			319

II.

	Laspeyres base year 0 Period 0	Period 10	Laspeyres: base year 10 Period 10	Period 15
	p_0q_0	p_0q_{10}	$p_{10}q_{10}$	$p_{10}q_{15}$
A	30	72	108	135
B	32	44	110	110
A+B	62	116	218	245
Index	100	187.1	100	112.4
Linked index (0)	100	187.1	187.1	210.3
Linked index (10)	53.4	100	100	112.4

III. Linking by scaling down values from periods 10 to 15 by ratio $\Sigma p_0q_{10}/\Sigma p_{10}q_{10}$ = 116/218

	Actual values		Scaled down to 0 price level	
	p_0q_0	p_0q_{10}	$p_{10}q_{10}$	$p_{10}q_{15}$
A	30	72	57.5	71.9
B	32	44	58.5	58.5
A+B	62	116	116	130.4
Linked index	100	187.1	187.1	210.3

Table XVI.1, continued

IV. Linking by scaling up values from periods 0 to 10 by ratio $\Sigma p_{10}q_{10}/\Sigma p_0q_{10}$ = 218/116

	Scaled up to 10 price level		Actual values	
	p_0q_0	p_0q_{10}	$p_{10}q_{10}$	$p_{10}q_{15}$
A	56.4	135.3	108	135
B	60.1	82.7	110	110
A+B	116.5	218	218	245
Linked index	53.4	100	100	112.4

V. Linking individual series at prices of period 0

	p_0q_0	p_0q_{10}	p_0q_{15} (linked)
A	30	72	90
B	32	44	44
A+B	62	116	130.4
Linked index	100	187.1	210.3

VI. Linking individual series at prices of period 10

	$p_{10}q_0$ (linked)	$p_{10}q_{10}$	$p_{10}q_{15}$
A	45	108	135
B	80	110	110
A+B	116.5	218	245
Linked index	53.4	100	112.4

APPENDIX 2-4

Measurement of simulated performance of an hypothetical economy using Paasche and Laspeyres indices.

Appendix 2-4a Moderate structural changes with incorrect price index in one industry

Appendix 2-4b Major structural changes

Appendix 2-4a - Measurement of simulated performance
of an hypothetical economy using Paasche and Laspeyres indices
Moderate structural changes with incorrect price index in one industry
Basic Data

Volume of output	Year 0	Year t	Year t+1	Year t+2
Sector	Σqo	Σqt	Σqt+1	Σqt+2
a	10.0	11.0	13.0	15.0
b	20.0	21.0	22.0	25.0
c	30.0	31.0	34.0	35.0
Industry	qo	qt	qt+1	qt+2
a1	2.0	2.4	2.9	3.5
a2	2.5	2.7	4.0	4.5
a3	5.5	5.9	6.1	7.0
b1	3.0	3.2	3.4	3.5
b2	7.5	8.0	8.5	9.0
b3	9.5	9.8	10.1	12.5
c1	12.0	12.3	12.7	13.0
c2	15.5	16.0	17.5	18.5
c3	2.5	2.7	3.8	3.5

Prices	po	pt	pt+1	pt+2
a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	5.2	8.6	10.7	13.3
b3	4.8	7.7	11.3	12.9
c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5
b2 (incorrect)	5.2	10.4	13.2	19.0

Relative prices

Prices	po	pt	pt+1	pt+2
a1	100.0	233.3	266.7	333.3
a2	100.0	219.4	267.7	306.5
a3	100.0	258.6	269.0	348.3
b1	100.0	160.0	220.0	260.0
b2	100.0	165.4	205.8	255.8
b3	100.0	160.4	235.4	268.8
c1	100.0	183.3	233.3	300.0
c2	100.0	201.8	240.4	310.5
c3	100.0	179.4	220.6	293.7
b2 (incorrect)	100.0	200.0	253.8	365.4

Value of output (qtpt)	qopo	qtpt	qt+1.pt+1	qt+2.pt+2
a1	6.0	16.8	23.2	35.0
a2	7.8	18.4	33.2	42.8
a3	16.0	44.3	47.6	70.7
b1	15.0	25.6	37.4	45.5
b2	39.0	68.8	91.0	119.7
b3	45.6	75.5	114.1	161.3
c1	72.0	135.3	177.8	234.0
c2	88.4	184.0	239.8	327.5
c3	15.8	30.5	52.8	64.8
Total	305.4	599.1	816.8	1101.1

Check Total	305.4	599.1	816.8	1101.1
Weights (correct)				
Sector a	9.7	13.3	12.7	13.5
Sector b	32.6	28.4	29.7	29.6
Sector c	57.7	58.4	57.6	56.9
Industry a1	2.0	2.8	2.8	3.2
a2	2.5	3.1	4.1	3.9
a3	5.2	7.4	5.8	6.4
b1	4.9	4.3	4.6	4.1
b2	12.8	11.5	11.1	10.9
b3	14.9	12.6	14.0	14.6
c1	23.6	22.6	21.8	21.3
c2	28.9	30.7	29.4	29.7
c3	5.2	5.1	6.5	5.9
Total	100.0	100.0	100.0	100.0
Results of first simulation:- base year = 0				
Paasche price index (Correct prices)				
Sector a	100.0	243.0	268.1	331.7
Sector b	100.0	162.3	221.1	262.6
Sector c	100.0	192.2	235.3	304.7
Total economy	100.0	187.6	234.5	294.0
Paasche price index (Incorrect b2 prices)				
Sector a	100.0	243.0	268.1	331.7
Sector b	100.0	176.1	240.5	303.9
Sector c	100.0	192.2	235.3	304.7
Total economy	-	-	-	-
Laspeyres price index (Correct prices)				
Sector a	100.0	243.3	268.2	334.3
Sector b	100.0	162.3	221.5	262.3
Sector c	100.0	192.2	235.7	304.7
Total economy	100.0	187.4	234.2	293.8
Laspeyres price index (Incorrect b2 prices)				
Sector a	100.0	243.3	268.2	334.3
Sector b	100.0	175.9	240.3	305.3
Sector c	100.0	192.2	235.7	304.7
Total economy	-	-	-	-
Value of output using Paasche deflator				
Sector a	297.0	326.8	387.9	447.5
Sector b (correct prices)	996.0	1046.4	1096.8	1243.0
Sector b (incorrect p)	996.0	964.6	1008.4	1074.2
Sector c	1761.0	1820.1	1998.9	2055.0
Total economy (correct p)	3054.0	3193.3	3483.6	3745.5
Sum of components	3054.0	3193.3	3483.6	3745.5
Total economy (incorrect)	-	-	-	-
Sum of components	3054.0	3111.5	3395.2	3576.7
Value of output using Laspeyres deflator				
Sector a	297.0	326.4	387.7	444.0

Sector b (incorrect prices)	996.0	965.9	1009.0	1069.4
Sector c	1761.0	1819.8	1995.5	2055.0
Total economy (correct prices)	3054.0	3196.3	3487.2	3748.1
Sum of components	3054.0	3192.9	3478.0	3743.4
Total economy (incorrect prices)	-	-	-	-
Sum of components	3054.0	3112.2	3392.2	3568.4
Compare total output estimates derived using Paasche				
Laspeyres indices (correct prices)				
Paasche	3054.0	3193.3	3483.6	3745.5
Laspeyres	3054.0	3196.3	3487.2	3748.1
Express in index form				
Paasche	100.0	104.6	114.1	122.6
Laspeyres	100.0	104.7	114.2	122.7
Compare total output estimates derived using Paasche				
Laspeyres indices (incorrect prices)				
Paasche	3054.0	3111.5	3395.2	3576.7
Laspeyres	3054.0	3112.2	3392.2	3568.4
Express in index form				
Paasche	100.0	101.9	111.2	117.1
Laspeyres	100.0	101.9	111.1	116.8
Compare output estimates derived using				
Paasche and Laspeyres indices by sector				
Sector a - Paasche	297.0	326.8	387.9	447.5
Sector a - Laspeyres	297.0	326.4	387.7	444.0
Sector b - Paasche (correct)	996.0	1046.4	1096.8	1243.0
Sector b - Laspeyres	996.0	1046.6	1094.8	1244.3
Sector b - Paasche (incorrect)	996.0	964.6	1008.4	1074.2
Sector b - Laspeyres	996.0	965.9	1009.0	1069.4
Sector c - Paasche	1761.0	1820.1	1998.9	2055.0
Sector c - Laspeyres	1761.0	1819.8	1995.5	2055.0
First simulation - calculations				
Paasche price index - sector a				
Σqt.pt	29.7	79.4	104.0	148.5
Σqt.po	29.7	32.7	38.8	44.8
Σqt.pt/Σqt.po	1.00	2.43	2.68	3.32
x100	100.0	243.0	268.1	331.7
Paasche price index - sector b (correct prices)				
Σqt.pt	99.6	169.9	242.5	326.5
Σqt.po	99.6	104.6	109.7	124.3
Σqt.pt/Σqt.po	1.00	1.62	2.21	2.63
x100	100.0	162.3	221.1	262.6
Paasche price index - sector b (incorrect prices)				
Σqt.pt (incorrect)	99.6	184.3	263.7	377.8
Σqt.po	99.6	104.6	109.7	124.3
Σqt.pt/Σqt.po	1.00	1.76	2.40	3.04
x100	100.0	176.1	240.5	303.9
Paasche price index - sector c				

Σqt.po	176.1	182.0	199.9	205.5
Σqt.pt/Σqt.po	1.00	1.92	2.35	3.05
x100	100.0	192.2	235.3	304.7
Paasche price index - total economy (correct prices)				
Σqt.pt	305.4	599.1	816.8	1101.1
Σqt.po	305.4	319.3	348.4	374.6
Σqt.pt/Σqt.po	1.00	1.88	2.34	2.94
x100	100.0	187.6	234.5	294.0
Laspeyres price index - sector a				
Σqo.pt	29.7	72.3	79.7	99.3
Σqo.po	29.7	29.7	29.7	29.7
Σqo.pt/Σqo.po	1.00	2.43	2.68	3.34
x100	100.0	243.3	268.2	334.3
Laspeyres price index - sector b (correct prices)				
Σqo.pt	99.6	161.7	220.6	261.3
Σqo.po	99.6	99.6	99.6	99.6
Σqo.pt/Σqo.po	1.00	1.62	2.21	2.62
x100	100.0	162.3	221.5	262.3
Laspeyres price index - sector b (incorrect prices)				
Σqo.pt	99.6	175.2	239.4	304.1
Σqo.po	99.6	99.6	99.6	99.6
Σqo.pt/Σqo.po	1.00	1.76	2.40	3.05
x100	100.0	175.9	240.3	305.3
Laspeyres price index - sector c (correct prices)				
Σqo.pt	176.1	338.5	415.1	536.6
Σqo.po	176.1	176.1	176.1	176.1
Σqo.pt/Σqo.po	1.00	1.92	2.36	3.05
x100	100.0	192.2	235.7	304.7
Laspeyres price index - total economy (correct prices)				
Σqo.pt	305.4	572.4	715.4	897.2
Σqo.po	305.4	305.4	305.4	305.4
Σqo.pt/Σqo.po	1.00	1.87	2.34	2.94
x100	100.0	187.4	234.2	293.8
Value of output using Paasche deflator - sector a				
Σqt.pt x R1000	29700	79410	103980	148450
Σqt.pt/Index	297.0	326.8	387.9	447.5
Convert to index form	100.0	110.0	130.6	150.7
Value of output using Paasche deflator - sector b (correct prices)				
Σqt.pt x R1000	99600	169860	242480	326450
Σqt.pt/Index	996.0	1046.4	1096.8	1243.0
Convert to index form	100.0	105.1	110.1	124.8
Value of output using Paasche deflator - sector b (incorrect prices)				
Σqt.pt x R1000	99600	169860	242480	326450
Σqt.pt/Index	996.0	964.6	1008.4	1074.2
Convert to index form	100.0	96.8	101.2	107.9
Value of output using Paasche deflator - sector c				

Σqt.pt x R1000	176100	349810	470370	626200	225
Σqt.pt/Index	1761.0	1820.1	1998.9	2055.0	226
Convert to index form	100.0	103.4	113.5	116.7	227
					228
Value of output using Paasche deflator - total economy					229
Σqt.pt x R1000	305400	599080	816830	1101100	230
Σqt.pt/Index	3054.0	3193.3	3483.6	3745.5	231
Check sum of components (correct)	3054.0	3193.3	3483.6	3745.5	232
Sum of components (incorrect)	3054.0	3111.5	3395.2	3576.7	233
Weighted Index (0 weights (correct))	100.0	104.6	114.1	122.6	234
Compare Row 234 with 231 total	100.0	104.6	114.1	122.6	235
Index of output (incorrect)	100.0	101.9	111.2	117.1	236
Weighted Index (t+2 weights)	100.0	104.8	114.8	123.7	237
					238
Value of output using Laspeyres deflator - sector a					239
Σqt.pt x R1000	29700	79410	103980	148450	240
Σqt.pt/Index	297.0	326.4	387.7	444.0	241
Convert to index form	100.0	109.9	130.5	149.5	242
					243
Value of output using Laspeyres deflator - sector b (correct prices)					244
Σqt.pt x R1000	99600	169860	242480	326450	245
Σqt.pt/Index	996.0	1046.6	1094.8	1244.3	246
Convert to index form	100.0	105.1	109.9	124.9	247
					248
Value of output using Laspeyres deflator - sector b (incorrect prices)					249
Σqt.pt x R1000	99600	169860	242480	326450	250
Σqt.pt/Index	996.0	965.9	1009.0	1069.4	251
Convert to index form	100.0	97.0	101.3	107.4	252
					253
Value of output using Laspeyres deflator - sector c					254
Σqt.pt x R1000	176100	349810	470370	626200	255
Σqt.pt/Index	1761.0	1819.8	1995.5	2055.0	256
Convert to index form	100.0	103.3	113.3	116.7	257
					258
Value of output using Laspeyres deflator - total economy					259
Σqt.pt x R1000	305400	599080	816830	1101100	260
Σqt.pt/Index	3054.0	3196.3	3487.2	3748.1	261
Check sum of components	3054.0	3192.9	3478.0	3743.4	262
Sum of components (incorrect)	3054.0	3112.2	3392.2	3568.4	263
Weighted Index (0 weights (correct))	100.0	104.5	113.9	122.6	264
Compare Row 264 with 261 total	100.0	104.7	114.2	122.7	265
Index of output (incorrect)	100.0	101.9	111.1	116.8	266
Sum with year t+2 weights	100.0	104.7	114.6	123.6	267
					268
Second simulation - calculations					269
					270
					271
Paasche price index - sector a					272
Σqt.pt	29.7	79.4	104.0	148.5	273
Σqt.po	99.3	109.2	128.6	148.5	274
Σqt.pt/Σqt.po	0.30	0.73	0.81	1.00	275
x100	29.9	72.7	80.8	100.0	276
					277
Paasche price index - sector b					278
Σqt.pt	99.6	169.9	242.5	326.5	279
Σqt.po	261.3	274.4	287.5	326.5	280

Σqt.pt/Σqt.po	0.38	0.62	0.84	1.00
x100	38.1	61.9	84.3	100.0
Paasche price index - sector c				
Σqt.pt	176.1	349.8	470.4	626.2
Σqt.po	536.6	554.6	608.7	626.2
Σqt.pt/Σqt.po	0.33	0.63	0.77	1.00
x100	32.8	63.1	77.3	100.0
Paasche price index - total economy				
Σqt.pt	305.4	599.1	816.8	1101.1
Σqt.po	897.2	938.2	1024.8	1101.1
Σqt.pt/Σqt.po	0.34	0.64	0.80	1.00
x100	34.0	63.9	79.7	100.0
Laspeyres price index - sector a				
Σqo.pt	44.8	107.6	120.0	148.5
Σqo.po	148.5	148.5	148.5	148.5
Σqo.pt/Σqo.po	0.30	0.72	0.81	1.00
x100	30.1	72.5	80.8	100.0
Laspeyres price index - sector b				
Σqo.pt	124.3	201.7	276.1	326.5
Σqo.po	326.5	326.5	326.5	326.5
Σqo.pt/Σqo.po	0.38	0.62	0.85	1.00
x100	38.1	61.8	84.6	100.0
Laspeyres price index - sector c				
Σqo.pt	205.5	395.3	484.1	626.2
Σqo.po	626.2	626.2	626.2	626.2
Σqo.pt/Σqo.po	0.33	0.63	0.77	1.00
x100	32.8	63.1	77.3	100.0
Laspeyres price index - total economy				
Σqo.pt	374.6	704.6	880.1	1101.1
Σqo.po	1101.1	1101.1	1101.1	1101.1
Σqo.pt/Σqo.po	0.34	0.64	0.80	1.00
x100	34.0	64.0	79.9	100.0
Value of output using Paasche deflator - sector a				
Σqt.pt x R1000	29700.0	79410.0	103980.0	148450.0
Σqt.pt/Index	993.0	1092.4	1286.1	1484.5
Convert to index form	100.0	110.0	129.5	149.5
Value of output using Paasche deflator - sector b				
Σqt.pt x R1000	99600.0	169860.0	242480.0	326450.0
Σqt.pt/Index	2613.0	2744.2	2875.4	3264.5
Convert to index form	100.0	105.0	110.0	124.9
Value of output using Paasche deflator - sector c				
Σqt.pt x R1000	176100.0	349810.0	470370.0	626200.0
Σqt.pt/Index	5366.0	5545.5	6086.5	6262.0
Convert to index form	100.0	103.3	113.4	116.7
Value of output using Paasche deflator - total economy				
Σqt.pt x R1000	305400	599080	816830	1101100

Σqt.pt/Index	8972.0	9382.1	10248.0	11011.0	337
Check sum of components	8972.0	9382.1	10248.0	11011.0	338
Sum with year 0 weights	100.0	104.5	113.9	122.6	339
Compare with Row 273 total	100.0	104.6	114.2	122.7	340
Sum with year t+2 weights	100.0	104.7	114.6	123.6	341
					342
					343
					344
Value of output using Laspeyres deflator - sector a					345
Σqt.pt x R1000	29700	79410	103980	148450	346
Σqt.pt/Index	985.2	1095.6	1286.9	1484.5	347
Convert to index form	100.0	111.2	130.6	150.7	348
					349
Value of output using Laspeyres deflator - sector b					350
Σqt.pt x R1000	99600	169860	242480	326450	351
Σqt.pt/Index	2615.8	2749.9	2867.5	3264.5	352
Convert to index form	100.0	105.1	109.6	124.8	353
					354
Value of output using Laspeyres deflator - sector c					355
Σqt.pt x R1000	176100	349810	470370	626200	356
Σqt.pt/Index	5366.1	5541.4	6084.4	6262.0	357
Convert to index form	100.0	103.3	113.4	116.7	358
					359
Value of output using Laspeyres deflator - total economy					360
Σqt.pt x R1000	305400	599080	816830	1101100	361
Σqt.pt/Index	8978.1	9362.7	10219.4	11011.0	362
Check sum of components	8967.2	9386.8	10238.8	11011.0	363
Sum with year 0 weights	100.0	104.6	113.8	122.6	364
Compare with Row 298 total	100.0	104.3	113.8	122.6	365
Sum with year t+2 weights	100.0	104.9	114.6	123.7	366
					367
					368
					369
Comparative growth rates					370
Simulation 1 - Index with period 0 = 100					371
Paasche - Sector a	100.0	110.0	130.6	150.7	372
Sector b	100.0	105.1	110.1	124.8	373
Sector c	100.0	103.4	113.5	116.7	374
Total economy	100.0	104.6	114.1	122.6	375
Simulation 2 - Index with period t+2 = 100					376
Paasche - Sector a	100.0	110.0	129.5	149.5	377
Sector b	100.0	105.0	110.0	124.9	378
Sector c	100.0	103.3	113.4	116.7	379
Total economy	100.0	104.6	114.2	122.7	380
					381
Simulation 1 - Index with period 0 = 100					382
Laspeyres - Sector a	100.0	109.9	130.5	149.5	383
Sector b	100.0	105.1	109.9	124.9	384
Sector c	100.0	103.3	113.3	116.7	385
Total economy	100.0	104.7	114.2	122.7	386
Simulation 2 - Index with period t+2 = 100					387
Laspeyres - Sector a	100.0	111.2	130.6	150.7	388
Sector b	100.0	105.1	109.6	124.8	389
Sector c	100.0	103.3	113.4	116.7	390
Total economy	100.0	104.3	113.8	122.6	391

mod-pa1					393
Sum with year 0 weights	100.0	104.6	114.1	122.6	394
Compare with Row 173 total	100.0	104.6	114.1	122.6	395
Sum with year t+2 weights	100.0	104.8	114.8	123.7	396
mod-la1					397
Sum with year 0 weights	100.0	104.5	113.9	122.6	398
Compare with Row 198 total	100.0	104.7	114.2	122.7	399
Sum with year t+2 weights	100.0	104.7	114.6	123.6	400
mod-pa2					401
Sum with year 0 weights	100.0	104.5	113.9	122.6	402
Compare with Row 273 total	100.0	104.6	114.2	122.7	403
Sum with year t+2 weights	100.0	104.7	114.6	123.6	404
mod-la2					405
Sum with year 0 weights	100.0	104.6	113.8	122.6	406
Compare with Row 298 total	100.0	104.3	113.8	122.6	407
Sum with year t+2 weights	100.0	104.9	114.6	123.7	408
mod-ta					409
Comparative growth rates					410
Simulation 1 - Index with period 0 = 100					411
Paasche - Sector a	100.0	110.0	130.6	150.7	412
Sector b	100.0	105.1	110.1	124.8	413
Sector c	100.0	103.4	113.5	116.7	414
Total economy	100.0	104.6	114.1	122.6	415
Simulation 2 - Index with period t+2 = 100					416
Paasche - Sector a	100.0	110.0	129.5	149.5	417
Sector b	100.0	105.0	110.0	124.9	418
Sector c	100.0	103.3	113.4	116.7	419
Total economy	100.0	104.6	114.2	122.7	420
					421
Simulation 1 - Index with period 0 = 100					422
Laspeyres - Sector a	100.0	109.9	130.5	149.5	423
Sector b	100.0	105.1	109.9	124.9	424
Sector c	100.0	103.3	113.3	116.7	425
Total economy	100.0	104.7	114.2	122.7	426
Simulation 2 - Index with period t+2 = 100					427
Laspeyres - Sector a	100.0	111.2	130.6	150.7	428
Sector b	100.0	105.1	109.6	124.8	429
Sector c	100.0	103.3	113.4	116.7	430
Total economy	100.0	104.3	113.8	122.6	431

Appendix 2-4b - Measurement of simulated performance
of an hypothetical economy using Paasche and Laspeyres indices
Major structural changes

Basic Data

Volume of output	Year 0	Year t	Year t+1	Year t+2
Sector	Σqo	Σqt	Σqt+1	Σqt+2
a	10	6	3	1
b	20	25	22	20
c	30	52	60	80
Industry	qo	qt	qt+1	qt+2
a1	2.0	1.0	0.5	0.3
a2	2.5	2.0	1.0	0.2
a3	5.5	3.0	1.5	0.5
b1	3.0	3.5	3.0	4.0
b2	7.5	9.5	9.0	6.5
b3	9.5	12.0	10.0	9.5
c1	12.0	18.0	22.0	25.0
c2	15.5	30.0	32.0	44.0
c3	2.5	4.0	6.0	11.0
Prices	po	pt	pt+1	pt+2
a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	5.2	8.6	10.7	13.3
b3	4.8	7.7	11.3	12.9
c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5

Relative prices

Prices	po	pt	pt+1	pt+2
a1	100.0	233.3	266.7	333.3
a2	100.0	219.4	267.7	306.5
a3	100.0	258.6	269.0	348.3
b1	100.0	160.0	220.0	260.0
b2	100.0	165.4	205.8	255.8
b3	100.0	160.4	235.4	268.8
c1	100.0	183.3	233.3	300.0
c2	100.0	201.8	240.4	310.5
c3	100.0	179.4	220.6	293.7
Weights				
Sector a	9.7	5.2	2.2	0.6
Sector b	32.6	24.3	22.1	15.3
Sector c	57.7	70.6	75.7	84.1
Industry a1	2.0	0.8	0.4	0.2
a2	2.5	1.6	0.8	0.1
a3	5.2	2.7	1.1	0.3
b1	4.9	3.4	3.0	3.1
b2	12.8	9.8	8.8	5.1
b3	14.9	11.1	10.3	7.2
c1	23.6	23.8	[illegible]	[illegible]

c2	28.9	41.4	40.0	45.7
c3	5.2	5.4	7.6	11.9
Total	100.0	100.0	100.0	100.0
Gross output-current prices	305.4	833.4	1096.1	1703.25
Results of first simulation:- base year = 0				
Paasche price index				
Sector a	100.0	240.8	268.2	335.0
Sector b	100.0	162.3	220.7	262.6
Sector c	100.0	193.4	235.6	304.7
Total economy	100.0	186.6	232.7	297.5
Laspeyres price index				
Sector a	100.0	243.3	268.2	334.3
Sector b	100.0	162.3	221.5	262.3
Sector c	100.0	192.2	235.7	304.7
Total economy	100.0	187.4	234.2	293.8
Value of output using Paasche deflator				
Sector a	297.0	179.0	89.5	29.7
Sector b	996.0	1245.0	1098.0	994.0
Sector c	1761.0	3042.0	3522.0	4701.0
Total economy	3054.0	4466.0	4709.5	5724.7
Check sum of components	3054.0	4466.0	4709.5	5724.7
Value of output using Laspeyres deflator				
Sector a	297.0	177.2	89.5	29.8
Sector b	996.0	1245.2	1094.0	994.9
Sector c	1761.0	3060.0	3520.3	4700.5
Total economy	3054.0	4446.5	4679.5	5797.7
Check sum of components	3054.0	4482.4	4703.8	5725.1
Compare total output estimates derived				
using Paasche and Laspeyres indices				
Paasche	3054.0	4466.0	4709.5	5724.7
Laspeyres	3054.0	4446.5	4679.5	5797.7
Express in index form				
Paasche	100.0	146.2	154.2	187.4
Laspeyres	100.0	145.6	153.2	189.8
Compare output estimates derived using				
Paasche and Laspeyres indices by sector				
Sector a - Paasche	297.0	179.0	89.5	29.7
Sector a - Laspeyres	297.0	177.2	89.5	29.8
Sector b - Paasche	996.0	1245.0	1098.0	994.0
Sector b - Laspeyres	996.0	1245.2	1094.0	994.9
Sector c - Paasche	1761.0	3042.0	3522.0	4701.0
Sector c - Laspeyres	1761.0	3060.0	3520.3	4700.5
First simulation - calculations				
Paasche price index - sector a				
Σqt.pt	29.7	43.1	24	9.95
Σqt.po	29.7	17.9	8.95	2.97
Σqt.pt/Σqt.po	1.00	2.41	2.68	3.35
x100	100.0	240.8	268.2	335.0

Paasche price index - sector b				
Σqt.pt	99.6	202.1	242.3	261.0
Σqt.po	99.6	124.5	109.8	99.4
Σqt.pt/Σqt.po	1.00	1.62	2.21	2.63
x100	100.0	162.3	220.7	262.6
Paasche price index - sector c				
Σqt.pt	176.1	588.2	829.8	1432.3
Σqt.po	176.1	304.2	352.2	470.1
Σqt.pt/Σqt.po	1.00	1.93	2.36	3.05
x100	100.0	193.4	235.6	304.7
Paasche price index - total economy				
Σqt.pt	305.4	833.4	1096.1	1703.25
Σqt.po	305.4	446.6	470.95	572.47
Σqt.pt/Σqt.po	1.00	1.87	2.33	2.98
x100	100.0	186.6	232.7	297.5
Laspeyres price index - sector a				
Σqo.pt	29.7	72.25	79.65	99.3
Σqo.po	29.7	29.7	29.7	29.7
Σqo.pt/Σqo.po	1.00	2.43	2.68	3.34
x100	100.0	243.3	268.2	334.3
Laspeyres price index - sector b				
Σqo.pt	99.6	161.65	220.6	261.3
Σqo.po	99.6	99.6	99.6	99.6
Σqo.pt/Σqo.po	1.00	1.62	2.21	2.62
x100	100.0	162.3	221.5	262.3
Laspeyres price index - sector c				
Σqo.pt	176.1	338.5	415.1	536.6
Σqo.po	176.1	176.1	176.1	176.1
Σqo.pt/Σqo.po	1.00	1.92	2.36	3.05
x100	100.0	192.2	235.7	304.7
Laspeyres price index - total economy				
Σqo.pt	305.4	572.4	715.35	897.2
Σqo.po	305.4	305.4	305.4	305.4
Σqo.pt/Σqo.po	1.00	1.87	2.34	2.94
x100	100.0	187.4	234.2	293.8
Value of output using Paasche deflator - sector a				
Σqt.pt x R1000	29700	43100	24000	9950
Σqt.pt/Index	297	179	89.5	29.7
Convert to index form	100.0	60.3	30.1	10.0
Value of output using Paasche deflator - sector b				
Σqt.pt x R1000	99600	202100	242300	261000
Σqt.pt/Index	996	1245	1098	994
Convert to index form	100.0	125.0	110.2	99.8
Value of output using Paasche deflator - sector c				
Σqt.pt x R1000	176100	588200	829800	1432300
Σqt.pt/Index	1761	3042	3522	4701

Convert to index form	100.0	172.7	200.0	267.0	169
					170
Value of output using Paasche deflator - total economy					171
Σqt.pt x R1000	305400	833400	1096100	1703250	172
Σqt.pt/Index	3054	4466	4709.5	5724.7	173
Check sum of components	3054	4466	4709.5	5724.7	174
Sum with year 0 weights	100.0	146.2	154.2	187.4	175
Compare with Row 173 total	100.0	146.2	154.2	187.4	176
Sum with year t+2 weights	100.0	164.8	185.3	239.8	177
					178
					179
					180
Value of output using Laspeyres deflator - sector a					181
Σqt.pt x R1000	29700	43100	24000	9950	182
Σqt.pt/Index	297.0	177.2	89.5	29.8	183
Convert to index form	100.0	59.7	30.1	10.0	184
					185
Value of output using Laspeyres deflator - sector b					186
Σqt.pt x R1000	99600	202100	242300	261000	187
Σqt.pt/Index	996.0	1245.2	1094.0	994.9	188
Convert to index form	100.0	125.0	109.8	99.9	189
					190
Value of output using Laspeyres deflator - sector c					191
Σqt.pt x R1000	176100	588200	829800	1432300	192
Σqt.pt/Index	1761.0	3060.0	3520.3	4700.5	193
Convert to index form	100.0	173.8	199.9	266.9	194
					195
Value of output using Laspeyres deflator - total economy					196
Σqt.pt x R1000	305400	833400	1096100	1703250	197
Σqt.pt/Index	3054.0	4446.5	4679.5	5797.7	198
Check sum of components	3054.0	4482.4	4703.8	5725.1	199
Sum with year 0 weights	100.0	146.8	154.0	187.5	200
Compare with Row 198 total	100.0	145.6	153.2	189.8	201
Sum with year t+2 weights	100.0	165.6	185.1	239.8	202
					203
					204
					205
Second simulation - calculations					206
					207
Paasche price index - sector a					208
Σqt.pt	29.7	43.1	24	9.95	209
Σqt.po	99.3	59.3	29.65	9.95	210
Σqt.pt/Σqt.po	0.30	0.73	0.81	1.00	211
x100	29.9	72.7	80.9	100.0	212
					213
Paasche price index - sector b					214
Σqt.pt	99.6	202.1	242.3	261.0	215
Σqt.po	261.3	326.7	287.7	261.0	216
Σqt.pt/Σqt.po	0.38	0.62	0.84	1.00	217
x100	38.1	61.9	84.2	100.0	218
					219
Paasche price index - sector c					220
Σqt.pt	176.1	588.2	829.8	1432.3	221
Σqt.po	536.6	929.0	1073.4	1432.3	222
Σqt.pt/Σqt.po	0.33	0.63	0.77	1.00	223
x100	32.8	[illegible]	[illegible]	[illegible]	[illegible]

Paasche price index - total economy

Σqt.pt	305.4	833.4	1096.1	1703.25
Σqt.po	897.2	1314.95	1390.75	1703.25
Σqt.pt/Σqt.po	0.34	0.63	0.79	1.00
x100	34.0	63.4	78.8	100.0

Laspeyres price index - sector a

Σqo.pt	2.97	7.21	7.96	9.95
Σqo.po	9.95	9.95	9.95	9.95
Σqo.pt/Σqo.po	0.30	0.72	0.80	1.00
x100	29.8	72.5	80.0	100.0

Laspeyres price index - sector b

Σqo.pt	99.4	161.05	220.9	261
Σqo.po	261	261	261	261
Σqo.pt/Σqo.po	0.38	0.62	0.85	1.00
x100	38.1	61.7	84.6	100.0

Laspeyres price index - sector c

Σqo.pt	470.1	905.3	1105.7	1432.3
Σqo.po	1432.3	1432.3	1432.3	1432.3
Σqo.pt/Σqo.po	0.33	0.63	0.77	1.00
x100	32.8	63.2	77.2	100.0

Laspeyres price index - total economy

Σqo.pt	572.47	1073.56	1334.56	1703.25
Σqo.po	1703.25	1703.25	1703.25	1703.25
Σqo.pt/Σqo.po	0.34	0.63	0.78	1.00
x100	33.6	63.0	78.4	100.0

Value of output using Paasche deflator - sector a

Σqt.pt x R1000	29700	43100	24000	9950
Σqt.pt/Index	993	593	296.5	99.5
Convert to index form	100.0	59.7	29.9	10.0

Value of output using Paasche deflator - sector b

Σqt.pt x R1000	99600	202100	242300	261000
Σqt.pt/Index	2613	3266.5	2877	2610
Convert to index form	100.0	125.0	110.1	99.9

Value of output using Paasche deflator - sector c

Σqt.pt x R1000	176100	588200	829800	1432300
Σqt.pt/Index	5366	9290	10734	14323
Convert to index form	100.0	173.1	200.0	266.9

Value of output using Paasche deflator - total economy

Σqt.pt x R1000	305400	833400	1096100	1703250
Σqt.pt/Index	8972	13149.5	13907.5	17032.5
Check sum of components	8972	13149.5	13907.5	17032.5
Sum with year 0 weights	100.0	146.4	154.2	187.5
Compare with Row 273 total	100.0	146.6	155.0	189.8
Sum with year t+2 weights	100.0	165.1	185.3	239.8

Value of output using Laspeyres deflator - sector a					281
Σqt.pt x R1000	29700	43100	24000	9950	282
Σqt.pt/Index	995.0	594.8	300.0	99.5	283
Convert to index form	100.0	59.8	30.2	10.0	284
					285
Value of output using Laspeyres deflator - sector b					286
Σqt.pt x R1000	99600	202100	242300	261000	287
Σqt.pt/Index	2615.3	3275.3	2862.8	2610.0	288
Convert to index form	100.0	125.2	109.5	99.8	289
					290
Value of output using Laspeyres deflator - sector c					291
Σqt.pt x R1000	176100	588200	829800	1432300	292
Σqt.pt/Index	5365.4	9306.1	10749.1	14323.0	293
Convert to index form	100.0	173.4	200.3	267.0	294
					295
Value of output using Laspeyres deflator - total economy					296
Σqt.pt x R1000	305400	833400	1096100	1703250	297
Σqt.pt/Index	9086.5	13222.3	13989.1	17032.5	298
Check sum of components	8975.7	13176.1	13911.9	17032.5	299
Sum with year 0 weights	100.0	146.7	154.2	187.4	300
Compare with Row 298 total	100.0	145.5	154.0	187.4	301
Sum with year t+2 weights	100.0	165.4	185.4	239.8	302
					303
					304
					305
Comparative growth rates					306
Simulation 1 - Index with period 0 = 100					307
Paasche - Sector a	100.0	60.3	30.1	10.0	308
Sector b	100.0	125.0	110.2	99.8	309
Sector c	100.0	172.7	200.0	267.0	310
Total economy	100.0	146.2	154.2	187.4	311
Simulation 2 - Index with period t+2 = 100					312
Paasche - Sector a	100.0	59.7	29.9	10.0	313
Sector b	100.0	125.0	110.1	99.9	314
Sector c	100.0	173.1	200.0	266.9	315
Total economy	100.0	146.6	155.0	189.8	316
					317
Simulation 1 - Index with period 0 = 100					318
Laspeyres - Sector a	100.0	59.7	30.1	10.0	319
Sector b	100.0	125.0	109.8	99.9	320
Sector c	100.0	173.8	199.9	266.9	321
Total economy	100.0	145.6	153.2	189.8	322
Simulation 2 - Index with period t+2 = 100					323
Laspeyres - Sector a	100.0	59.8	30.2	10.0	324
Sector b	100.0	125.2	109.5	99.8	325
Sector c	100.0	173.4	200.3	267.0	326
Total economy	100.0	145.5	154.0	187.4	327
					328
maj-pal					329
Sum with year 0 weights	100.0	146.2	154.2	187.4	330
Compare with Row 173 total	100.0	146.2	154.2	187.4	331
Sum with year t+2 weights	100.0	164.8	185.3	239.8	332
maj-lal					333
Sum with year 0 weights	100.0	146.8	154.0	187.5	334
Compare with Row 198 total	100.0	145.6	153.2	189.8	335
Sum with year t+2 weights	100.0	165.6	185.1	[illegible]	

maj-pa2					337
Sum with year 0 weights	100.0	146.4	154.2	187.5	338
Compare with Row 273 total	100.0	146.6	155.0	189.8	339
Sum with year t+2 weights	100.0	165.1	185.3	239.8	340
maj-la2					341
Sum with year 0 weights	100.0	146.7	154.2	187.4	342
Compare with Row 298 total	100.0	145.5	154.0	187.4	343
Sum with year t+2 weights	100.0	165.4	185.4	239.8	344
maj-ta					345
Comparative growth rates					346
Simulation 1 - Index with period 0 = 100					347
Paasche - Sector a	100.0	60.3	30.1	10.0	348
Sector b	100.0	125.0	110.2	99.8	349
Sector c	100.0	172.7	200.0	267.0	350
Total economy	100.0	146.2	154.2	187.4	351
Simulation 2 - Index with period t+2 = 100					352
Paasche - Sector a	100.0	59.7	29.9	10.0	353
Sector b	100.0	125.0	110.1	99.9	354
Sector c	100.0	173.1	200.0	266.9	355
Total economy	100.0	146.6	155.0	189.8	356
					357
Simulation 1 - Index with period 0 = 100					358
Laspeyres - Sector a	100.0	59.7	30.1	10.0	359
Sector b	100.0	125.0	109.8	99.9	360
Sector c	100.0	173.8	199.9	266.9	361
Total economy	100.0	145.6	153.2	189.8	362
Simulation 2 - Index with period t+2 = 100					363
Laspeyres - Sector a	100.0	59.8	30.2	10.0	364
Sector b	100.0	125.2	109.5	99.8	365
Sector c	100.0	173.4	200.3	267.0	366
Total economy	100.0	145.5	154.0	187.4	367

APPENDIX 2-5

Measurement of simulated performance of an hypothetical economy using Paasche and Laspeyres indices.

Appendix 2-5a Double deflation approach - no changes in net/gross output ratio

Appendix 2-5b Double deflation approach - major structural changes in net/gross output ratio in industry b2

Appendix 2-5a - Measurement of simulated performance
of an hypothetical economy - double deflation approach
No changes in net/gross output ratio

Actual data from P3001, 28 June 1993

	1979	1982	1985	1988
Other Chemicals, Gross and Net Output				
Gross Output	3030.4	5938.7	9728.8	13307.8
Net Output	974.0	1992.3	4956.9	5972.4
Net/Gross %	32.1	33.5	51.0	44.9
Total Manufacturing, Gross & Net Output				
Gross Output	29768.9	55651.9	75351.1	118242.8
Net Output	11237.9	21717.9	31296.5	47783.1
Net/Gross %	37.8	39.0	41.5	40.4
Gross % tot	10.2	10.7	12.9	11.3
Net % tot	8.7	9.2	15.8	12.5
Intermediate Inputs				
% GO -Oth Ch	67.9	66.5	49.0	55.1
% GO -Total	62.2	61.0	58.5	59.6
OtCh/Tot %	11.1	11.6	10.8	10.4

Basic Data for simulation

Volume of gross output	Year 0	Year t	Year t+1	Year t+2
Sector	ΣQo	ΣQt	ΣQt+1	ΣQt+2
a	10.0	11.0	13.0	15.0
b	20.0	21.6	23.7	25.5
c	30.0	31.0	34.0	35.0
	Qo	Qt	Qt+1	Qt+2
Industry a1	2.0	2.4	2.9	3.5
a2	2.5	2.7	4.0	4.5
a3	5.5	5.9	6.1	7.0
b1	3.0	3.2	3.4	3.5
b2	7.5	8.6	10.2	9.5
b3	9.5	9.8	10.1	12.5
c1	12.0	12.3	12.7	13.0
c2	15.5	16.0	17.5	18.5
c3	2.5	2.7	3.8	3.5

Copy original Gross Outputs as reference

Industry a1	2.0	2.4	2.9	3.5
a2	2.5	2.7	4.0	4.5
a3	5.5	5.9	6.1	7.0
b1	3.0	3.2	3.4	3.5
b2	7.5	8.0	8.5	9.0
b3	9.5	9.8	10.1	12.5
c1	12.0	12.3	12.7	13.0
c2	15.5	16.0	17.5	18.5
c3	2.5	2.7	3.8	3.5

Gross Output Prices	po	pt	pt+1	pt+2
Industry a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	4.1	7.6	10.4	13.3
b3	4.8	7.7	[illegible]	[illegible]

c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5

Copy original price structure as ref	po	pt	pt+1	pt+2
Industry a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	5.2	8.6	10.7	13.3
b3	4.8	7.7	11.3	12.9
c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5

Gross Outputs - Relative prices	po	pt	pt+1	pt+2
Industry a1	100.0	233.3	266.7	333.3
a2	100.0	219.4	267.7	306.5
a3	100.0	258.6	269.0	348.3
b1	100.0	160.0	220.0	260.0
b2	100.0	185.4	253.7	324.4
b3	100.0	160.4	235.4	268.8
c1	100.0	183.3	233.3	300.0
c2	100.0	201.8	240.4	310.5
c3	100.0	179.4	220.6	293.7

Gross output (Total revenue) (Q.p)	Qo.po	Qt.pt	Qt+1.pt+1	Qt+2.pt+2
Industry a1	6.0	16.8	23.2	35.0
a2	7.8	18.4	33.2	42.8
a3	16.0	44.3	47.6	70.7
b1	15.0	25.6	37.4	45.5
b2	30.7	65.0	106.1	126.4
b3	45.6	75.5	114.1	161.3
c1	72.0	135.3	177.8	234.0
c2	88.4	184.0	239.8	327.5
c3	15.8	30.5	52.8	64.8
Total	297.2	595.3	832.0	1107.8
Gross output-current prices	297.2	595.3	832.0	1107.8

Gross Outputs - Weights				
Sector a	10.0	13.3	12.5	13.4
Sector b	30.7	27.9	31.0	30.1
Sector c	59.3	58.8	56.5	56.5
Industry a1	2.0	2.8	2.8	3.2
a2	2.6	3.1	4.0	3.9
a3	5.4	7.4	5.7	6.4
b1	5.0	4.3	4.5	4.1
b2	10.3	10.9	12.8	11.4
b3	15.3	12.7	13.7	14.6
c1	24.2	22.7	21.4	21.1
c2	29.7	30.9	28.8	29.6
c3	5.3	5.1	6.3	5.8
Total	100.0	100.0	100.0	100.0

Net output (Q.p-q.p)

Industry a1	2.2	6.2	8.6	13.0
a2	2.9	6.8	12.3	15.8
a3	5.9	16.4	17.6	26.2
b1	5.9	10.0	14.6	17.7
b2	12.0	25.3	41.4	49.3
b3	17.8	29.4	44.5	62.9
c1	26.6	50.1	65.8	86.6
c2	32.7	68.1	88.7	121.2
c3	5.8	11.3	19.5	24.0
Total	111.8	223.6	313.0	416.5
Net/Gross Output (%) (Actual ratios)				
Industry a1	37.0	37.0	37.0	37.0
a2	37.0	37.0	37.0	37.0
a3	37.0	37.0	37.0	37.0
b1	39.0	39.0	39.0	39.0
b2	39.0	39.0	39.0	39.0
b3	39.0	39.0	39.0	39.0
c1	37.0	37.0	37.0	37.0
c2	37.0	37.0	37.0	37.0
c3	37.0	37.0	37.0	37.0
Total	37.6	37.6	37.6	37.6
Copy original Net/Gross Output ratios as reference				
Industry a1	37.0	37.0	37.0	37.0
a2	37.0	37.0	37.0	37.0
a3	37.0	37.0	37.0	37.0
b1	39.0	39.0	39.0	39.0
b2	39.0	39.0	39.0	39.0
b3	39.0	39.0	39.0	39.0
c1	37.0	37.0	37.0	37.0
c2	37.0	37.0	37.0	37.0
c3	37.0	37.0	37.0	37.0
Total	37.6	37.6	37.6	37.6
Live table for varying Net/Gross Output ratio				
Industry a1	2.2	6.2	8.6	13.0
a2	2.9	6.8	12.3	15.8
a3	5.9	16.4	17.6	26.2
b1	5.9	10.0	14.6	17.7
b2	12.0	25.3	41.4	49.3
b3	17.8	29.4	44.5	62.9
c1	26.6	50.1	65.8	86.6
c2	32.7	68.1	88.7	121.2
c3	5.8	11.3	19.5	24.0
Net Output Weights				
Industry a1	2.0	2.8	2.7	3.1
a2	2.6	3.0	3.9	3.8
a3	5.3	7.3	5.6	6.3
b1	5.2	4.5	4.7	4.3
b2	10.7	11.3	13.2	11.8
b3	15.9	13.2	14.2	15.1
c1	23.8	22.4	21.0	20.8
c2	29.2	30.5	28.3	29.1
c3	5.2	5.0	6.2	5.8
Total	100.0	100.0	100.0	100.0

Volume of int inputs	Year			
Sector	Σqo	Σqt	Σqt+1	Σqt+2
a	6.3	6.9	8.2	9.5
b	12.2	13.1	14.5	15.6
c	18.9	19.5	21.4	22.1
	qo	qt	qt+1	qt+2
Industry a1	1.3	1.5	1.8	2.2
a2	1.6	1.7	2.5	2.8
a3	3.5	3.7	3.8	4.4
b1	1.8	2.0	2.1	2.1
b2	4.6	5.2	6.2	5.8
b3	5.8	6.0	6.2	7.6
c1	7.6	7.7	8.0	8.2
c2	9.8	10.1	11.0	11.7
c3	1.6	1.7	2.4	2.2

Prices of int. inputs	po	pt	pt+1	pt+2
Industry a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	4.1	7.6	10.4	13.3
b3	4.8	7.7	11.3	12.9
c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5

Relative prices - Intermediate input	po	pt	pt+1	pt+2
Industry a1	100.0	233.3	266.7	333.3
a2	100.0	219.4	267.7	306.5
a3	100.0	258.6	269.0	348.3
b1	100.0	160.0	220.0	260.0
b2	100.0	185.4	253.7	324.4
b3	100.0	160.4	235.4	268.7
c1	100.0	183.3	233.3	300.0
c2	100.0	201.8	240.4	310.5
c3	100.0	179.4	220.6	293.7

Weights				
Sector a	10.1	13.5	12.6	13.5
Sector b	30.1	27.2	30.3	29.4
Sector c	59.8	59.3	57.1	57.1
Industry a1	2.0	2.8	2.8	3.2
a2	2.6	3.1	4.0	3.9
a3	5.4	7.5	5.8	6.4
b1	4.9	4.2	4.4	4.0
b2	10.1	10.7	12.5	11.2
b3	15.0	12.4	13.4	14.2
c1	24.5	22.9	21.6	21.3
c2	30.0	31.2	29.1	29.8
c3	5.4	5.2	6.4	5.9
Total	100.0	100.0	100.0	100.0

Value of int inputs (q.p)	qo.po	qt.pt	qt+1.pt+1	qt+2.pt+2

Industry a1	3.8	10.6	14.6	22.1
a2	4.9	11.6	20.9	26.9
a3	10.0	27.9	30.0	44.5
b1	9.2	15.6	22.8	27.8
b2	18.8	39.6	64.7	77.1
b3	27.8	46.0	69.6	98.4
c1	45.4	85.2	112.0	147.4
c2	55.7	115.9	151.0	206.3
c3	9.9	19.2	33.3	40.8
Total	185.4	371.7	519.0	691.2
Int inputs-current prices	185.4	371.7	519.0	691.2
Net/gross output (%)	37.6	37.6	37.6	37.6
Calculations				
Paasche price index (gross output) - sector a				
ΣQt.pt	29.7	79.4	104.0	148.5
ΣQt.po	29.7	32.7	38.8	44.8
ΣQt.pt/ΣQt.po	1.00	2.43	2.68	3.32
x100	100.0	243.0	268.1	331.7
Paasche price index (gross output) - sector b				
ΣQt.pt	91.4	166.0	257.6	333.1
ΣQt.po	91.4	98.1	107.3	116.5
ΣQt.pt/ΣQt.po	1.00	1.69	2.40	2.86
x100	100.0	169.3	240.1	286.0
Paasche price index (gross output) - sector c				
ΣQt.pt	176.1	349.8	470.4	626.2
ΣQt.po	176.1	182.0	199.9	205.5
ΣQt.pt/ΣQt.po	1.00	1.92	2.35	3.05
x100	100.0	192.2	235.3	304.7
Paasche price index (gross output) - total economy				
ΣQt.pt	297.2	595.3	832.0	1107.8
ΣQt.po	297.2	312.8	346.0	366.7
ΣQt.pt/ΣQt.po	1.00	1.90	2.40	3.02
x100	100.0	190.3	240.5	302.1
Paasche price index (intermediate inputs) - sector a				
Σqt.pt	18.7	50.0	65.5	93.5
Σqt.po	18.7	20.6	24.4	28.2
Σqt.pt/Σqt.po	1.00	2.43	2.68	3.32
x100	100.0	243.0	268.1	331.7
Paasche price index (intermediate inputs) - sector b				
Σqt.pt	55.7	85.7	157.1	203.2
Σqt.po	55.7	59.8	65.5	71.0
Σqt.pt/Σqt.po	1.00	1.43	2.40	2.86
x100	100.0	143.2	240.1	286.0
Paasche price index (intermediate inputs) - sector c				
Σqt.pt	110.9	220.4	296.3	394.5
Σqt.po	110.9	114.7	125.9	129.5
Σqt.pt/Σqt.po	1.00	1.92	2.35	3.05

x100	100.0	192.2	235.3	304.7
Paasche price index (intermediate inputs) - total economy				
Σqt.pt	185.4	371.7	519.0	691.2
Σqt.po	185.4	195.1	215.8	228.7
Σqt.pt/Σqt.po	1.00	1.91	2.40	3.02
x100	100.0	190.5	240.5	302.2
Value of gross output - sector a				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	29700	32680	38790	44750
Convert to index form	100.0	110.0	130.6	150.7
Value of net output - sector a				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000				
	10989	12092	14352	16558
Convert to index form	100.0	110.0	130.6	150.7
Value of gross output - sector b				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	91350	98095	107300	116450
Convert to index form	100.0	107.4	117.5	127.5
Value of net output - sector b				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000				
	35627	38257	41847	45416
Convert to index form	100.0	107.4	117.5	127.5
Value of gross output - sector c				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	176100	182010	199890	205500
Convert to index form	100.0	103.4	113.5	116.7
Value of net output - sector c				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000				
	65157	67344	73959	76035
Convert to index form	100.0	103.4	113.5	116.7
Value of gross output - total economy				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	297150	312785	345980	366700
Convert to index form	100.0	105.3	116.4	123.4
Value of net output - total economy				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000				
	111772	117692	130159	138008
Convert to index form	100.0	105.3	116.4	123.5

Appendix 2-5b - Measurement of simulated performance
of an hypothetical economy - double deflation approach
Major structural changes in net/gross output ratio in industry b2

Actual data from P3001, 28 June 1993

	1979	1982	1985	1988
Other Chemicals, Gross & Net Output				
Gross Output	3030.4	5938.7	9728.8	13307.8
Net Output	974.0	1992.3	4956.9	5972.4
Net/Gross %	32.1	33.5	51.0	44.9
Total Manufacturing, Gross & Net Output				
Gross Output	29768.9	55651.9	75351.1	118242.8
Net Output	11237.9	21717.9	31296.5	47783.1
Net/Gross %	37.8	39.0	41.5	40.4
Gross % tot	10.2	10.7	12.9	11.3
Net % tot	8.7	9.2	15.8	12.5
Intermediate Inputs				
% GO -Oth Ch	67.9	66.5	49.0	55.1
% GO -Total	62.2	61.0	58.5	59.6
OtCh/Tot %	11.1	11.6	10.8	10.4

Basic Data for simulation

Volume of gross output	Year 0	Year t	Year t+1	Year t+2
Sector	ΣQo	ΣQt	ΣQt+1	ΣQt+2
a	10.0	11.0	13.0	15.0
b	20.0	21.6	23.7	25.5
c	30.0	31.0	34.0	35.0
	Qo	Qt	Qt+1	Qt+2
Industry a1	2.0	2.4	2.9	3.5
a2	2.5	2.7	4.0	4.5
a3	5.5	5.9	6.1	7.0
b1	3.0	3.2	3.4	3.5
b2	7.5	8.6	10.2	9.5
b3	9.5	9.8	10.1	12.5
c1	12.0	12.3	12.7	13.0
c2	15.5	16.0	17.5	18.5
c3	2.5	2.7	3.8	3.5

Copy original Gross Outputs as reference

Industry a1	2.0	2.4	2.9	3.5
a2	2.5	2.7	4.0	4.5
a3	5.5	5.9	6.1	7.0
b1	3.0	3.2	3.4	3.5
b2	7.5	8.0	8.5	9.0
b3	9.5	9.8	10.1	12.5
c1	12.0	12.3	12.7	13.0
c2	15.5	16.0	17.5	18.5
c3	2.5	2.7	3.8	3.5

Gross Output Prices	po	pt	pt+1	pt+2
Industry a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	4.1	7.6	10.4	13.3
b3	4.8	7.7	11.3	[illegible]

c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5

Copy original price structure as ref	po	pt	pt+1	pt+2
Industry a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	5.2	8.6	10.7	13.3
b3	4.8	7.7	11.3	12.9
c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5

Gross Outputs - Relative prices	po	pt	pt+1	pt+2
Industry a1	100.0	233.3	266.7	333.3
a2	100.0	219.4	267.7	306.5
a3	100.0	258.6	269.0	348.3
b1	100.0	160.0	220.0	260.0
b2	100.0	185.4	253.7	324.4
b3	100.0	160.4	235.4	268.8
c1	100.0	183.3	233.3	300.0
c2	100.0	201.8	240.4	310.5
c3	100.0	179.4	220.6	293.7

Gross output (Total revenue) (Q.p)	Qo.po	Qt.pt	Qt+1.pt+1	Qt+2.pt+2
Industry a1	6.0	16.8	23.2	35.0
a2	7.8	18.4	33.2	42.8
a3	16.0	44.3	47.6	70.7
b1	15.0	25.6	37.4	45.5
b2	30.7	65.0	106.1	126.4
b3	45.6	75.5	114.1	161.3
c1	72.0	135.3	177.8	234.0
c2	88.4	184.0	239.8	327.5
c3	15.8	30.5	52.8	64.8
Total	297.2	595.3	832.0	1107.8
Gross output-current prices	297.2	595.3	832.0	1107.8

Gross Outputs - Weights				
Sector a	10.0	13.3	12.5	13.4
Sector b	30.7	27.9	31.0	30.1
Sector c	59.3	58.8	56.5	56.5
Industry a1	2.0	2.8	2.8	3.2
a2	2.6	3.1	4.0	3.9
a3	5.4	7.4	5.7	6.4
b1	5.0	4.3	4.5	4.1
b2	10.3	10.9	12.8	11.4
b3	15.3	12.7	13.7	14.6
c1	24.2	22.7	21.4	21.1
c2	29.7	30.9	28.8	29.6
c3	5.3	5.1	6.3	5.8
Total	100.0	100.0	100.0	100.0

Net output (Q.p-q.p)

Industry a1	2.2	6.2	8.6	13.0	113
a2	2.9	6.8	12.3	15.8	114
a3	5.9	16.4	17.6	26.2	115
b1	5.9	10.0	14.6	17.7	116
b2	9.8	21.4	54.1	55.6	117
b3	17.8	29.4	44.5	62.9	118
c1	26.6	50.1	65.8	86.6	119
c2	32.7	68.1	88.7	121.2	120
c3	5.8	11.3	19.5	24.0	121
Total	109.6	219.7	325.7	422.8	122
Net/Gross Output (%) (Actual ratios)					123
Industry a1	37.0	37.0	37.0	37.0	124
a2	37.0	37.0	37.0	37.0	125
a3	37.0	37.0	37.0	37.0	126
b1	39.0	39.0	39.0	39.0	127
b2	32.0	33.0	51.0	44.0	128
b3	39.0	39.0	39.0	39.0	129
c1	37.0	37.0	37.0	37.0	130
c2	37.0	37.0	37.0	37.0	131
c3	37.0	37.0	37.0	37.0	132
Total	36.9	36.9	39.1	38.2	133
					134
Copy original Net/Gross Output ratios as reference					135
Industry a1	37.0	37.0	37.0	37.0	136
a2	37.0	37.0	37.0	37.0	137
a3	37.0	37.0	37.0	37.0	138
b1	39.0	39.0	39.0	39.0	139
b2	39.0	39.0	39.0	39.0	140
b3	39.0	39.0	39.0	39.0	141
c1	37.0	37.0	37.0	37.0	142
c2	37.0	37.0	37.0	37.0	143
c3	37.0	37.0	37.0	37.0	144
Total	37.6	37.6	37.6	37.6	145
					146
Live table for varying Net/Gross Output ratio					147
Industry a1	2.2	6.2	8.6	13.0	148
a2	2.9	6.8	12.3	15.8	149
a3	5.9	16.4	17.6	26.2	150
b1	5.9	10.0	14.6	17.7	151
b2	9.8	21.4	54.1	55.6	152
b3	17.8	29.4	44.5	62.9	153
c1	26.6	50.1	65.8	86.6	154
c2	32.7	68.1	88.7	121.2	155
c3	5.8	11.3	19.5	24.0	156
					157
Net Output Weights					158
Industry a1	2.0	2.8	2.6	3.1	159
a2	2.6	3.1	3.8	3.7	160
a3	5.4	7.5	5.4	6.2	161
b1	5.3	4.5	4.5	4.2	162
b2	9.0	9.8	16.6	13.1	163
b3	16.2	13.4	13.7	14.9	164
c1	24.3	22.8	20.2	20.5	165
c2	29.8	31.0	27.2	28.7	166
c3	5.3	5.1	6.0	5.7	167
Total	100.0	100.0	[illegible]	[illegible]	

Volume of int inputs	Year			
Sector	Σqo	Σqt	Σqt+1	Σqt+2
a	6.3	6.9	8.2	9.5
b	12.7	13.7	13.2	15.1
c	18.9	19.5	21.4	22.1
	qo	qt	qt+1	qt+2
Industry a1	1.3	1.5	1.8	2.2
a2	1.6	1.7	2.5	2.8
a3	3.5	3.7	3.8	4.4
b1	1.8	2.0	2.1	2.1
b2	5.1	5.7	5.0	5.3
b3	5.8	6.0	6.2	7.6
c1	7.6	7.7	8.0	8.2
c2	9.8	10.1	11.0	11.7
c3	1.6	1.7	2.4	2.2
Prices of int. inputs	po	pt	pt+1	pt+2
Industry a1	3.0	7.0	8.0	10.0
a2	3.1	6.8	8.3	9.5
a3	2.9	7.5	7.8	10.1
b1	5.0	8.0	11.0	13.0
b2	4.1	7.6	10.4	13.3
b3	4.8	7.7	11.3	12.9
c1	6.0	11.0	14.0	18.0
c2	5.7	11.5	13.7	17.7
c3	6.3	11.3	13.9	18.5
Relative prices - Intermediate input	po	pt	pt+1	pt+2
Industry a1	100.0	233.3	266.7	333.3
a2	100.0	219.4	267.7	306.5
a3	100.0	258.6	269.0	348.3
b1	100.0	160.0	220.0	260.0
b2	100.0	185.4	253.7	324.4
b3	100.0	160.4	235.4	268.7
c1	100.0	183.3	233.3	300.0
c2	100.0	201.8	240.4	310.5
c3	100.0	179.4	220.6	293.7
Weights				
Sector a	10.0	13.3	12.9	13.7
Sector b	30.9	28.0	28.5	28.7
Sector c	59.2	58.7	58.5	57.6
Industry a1	2.0	2.8	2.9	3.2
a2	2.6	3.1	4.1	3.9
a3	5.4	7.4	5.9	6.5
b1	4.9	4.2	4.5	4.1
b2	11.2	11.6	10.3	10.3
b3	14.8	12.3	13.8	14.4
c1	24.2	22.7	22.1	21.5
c2	29.7	30.9	29.8	30.1
c3	5.3	5.1	6.6	6.0
Total	100.0	100.0	100.0	100.0
Value of int inputs (q.p)	qo.po	qt.pt	qt+1 pt+1	qt+2 pt+2

Industry a1	3.8	10.6	14.6	22.1
a2	4.9	11.6	20.9	26.9
a3	10.0	27.9	30.0	44.5
b1	9.2	15.6	22.8	27.8
b2	20.9	43.5	52.0	70.8
b3	27.8	46.0	69.6	98.4
c1	45.4	85.2	112.0	147.4
c2	55.7	115.9	151.0	206.3
c3	9.9	19.2	33.3	40.8
Total	187.5	375.6	506.3	684.9
Int inputs-current prices	187.5	375.6	506.3	684.9
Net/gross output (%)	36.9	36.9	39.1	38.2

Calculations

Paasche price index (gross output) - sector a				
ΣQt.pt	29.7	79.4	104.0	148.5
ΣQt.po	29.7	32.7	38.8	44.8
ΣQt.pt/ΣQt.po	1.00	2.43	2.68	3.32
x100	100.0	243.0	268.1	331.7
Paasche price index (gross output) - sector b				
ΣQt.pt	91.4	166.0	257.6	333.1
ΣQt.po	91.4	98.1	107.3	116.5
ΣQt.pt/ΣQt.po	1.00	1.69	2.40	2.86
x100	100.0	169.3	240.1	286.0
Paasche price index (gross output) - sector c				
ΣQt.pt	176.1	349.8	470.4	626.2
ΣQt.po	176.1	182.0	199.9	205.5
ΣQt.pt/ΣQt.po	1.00	1.92	2.35	3.05
x100	100.0	192.2	235.3	304.7
Paasche price index (gross output) - total economy				
ΣQt.pt	297.2	595.3	832.0	1107.8
ΣQt.po	297.2	312.8	346.0	366.7
ΣQt.pt/ΣQt.po	1.00	1.90	2.40	3.02
x100	100.0	190.3	240.5	302.1
Paasche price index (intermediate inputs) - sector a				
Σqt.pt	18.7	50.0	65.5	93.5
Σqt.po	18.7	20.6	24.4	28.2
Σqt.pt/Σqt.po	1.00	2.43	2.68	3.32
x100	100.0	243.0	268.1	331.7
Paasche price index (intermediate inputs) - sector b				
Σqt.pt	57.9	89.6	144.4	196.9
Σqt.po	57.9	61.9	60.4	69.1
Σqt.pt/Σqt.po	1.00	1.45	2.39	2.85
x100	100.0	144.6	239.0	285.0
Paasche price index (intermediate inputs) - sector c				
Σqt.pt	110.9	220.4	296.3	394.5
Σqt.po	110.9	114.7	125.9	129.5
Σqt.pt/Σqt.po	1.00	1.92	2.35	3.05

x100	100.0	192.2	235.3	304.7
Paasche price index (intermediate inputs) - total economy				
Σqt.pt	187.5	375.6	506.3	684.9
Σqt.po	187.5	197.2	210.8	226.7
Σqt.pt/Σqt.po	1.00	1.90	2.40	3.02
x100	100.0	190.5	240.2	302.1
Value of gross output - sector a				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	29700	32680	38790	44750
Convert to index form	100.0	110.0	130.6	150.7
Value of net output - sector a				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000	10989	12092	14352	16558
Convert to index form	100.0	110.0	130.6	150.7
Value of gross output - sector b				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	91350	98095	107300	116450
Convert to index form	100.0	107.4	117.5	127.5
Value of net output - sector b				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000	33474	36154	46865	47363
Convert to index form	100.0	108.0	140.0	141.5
Value of gross output - sector c				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	176100	182010	199890	205500
Convert to index form	100.0	103.4	113.5	116.7
Value of net output - sector c				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000	65157	67344	73959	76035
Convert to index form	100.0	103.4	113.5	116.7
Value of gross output - total economy				
ΣQt.pt/(Qt.pt/Qt.po) x R1000	297150	312785	345980	366700
Convert to index form	100.0	105.3	116.4	123.4
Value of net output - total economy				
ΣQt.pt/(Qt.pt/Qt.po) - Σqt.pt/(qt.pt/qt.po) x R1000	109620	115589	135177	139955
Convert to index form	100.0	105.4	123.3	127.7

Appendix 2-6

Do-it-yourself (DIY) benchmarking

Introduction

As noted in Chapter 2-2, a goodly portion of this appendix appeared originally in the body of the text. It then formed part of an argument aimed at persuading the CSS that the benchmarked estimates published in March 1992, although a slight improvement on the unbenchmarked, were still incorrect. That fact having been conceded, the question arises as to what to do with the work that was partly instrumental in securing that concession? As will be seen, the effort involved was somewhat tedious, unleavened as it was by even the faintest glimmer of humour. Extracting the information on procedures necessary to attempt the replication exercise was a tiresome and drawn-out affair, and one which was, in any event, not fully accomplished. Although the appendix does have a certain intrinsic, if limited usefulness - in that it makes available certain information which does not appear in any of the explanatory notes published by the CSS - this would scarcely justify the space taken to present it.

Apart from the fact that a substantial part of the dataset and a fair number of the calculations (especially those concerned with benchmarking ratios) are required to prepare the real net output estimates, there is one other function which this protracted history can serve - it can help to make users aware of how much work is required to galvanise the Statistics Council, let alone the CSS, into responding to constructive criticism. The differences between the (a) and (b) estimates in Table 2-3.3, let alone the catalog of errors in individual PVMP estimates recorded in Table 2-3.1, should have been sufficient to convince any reasonable person that something was amiss. This appendix, which has gone through several versions, provided as conclusive a proof as was possible, given the limited information available, that something was definitely wrong. It narrowed the possible causes of error down to the deflator used on the output of the petro-chemicals industry.

The CSS has changed over to a new (indirect) method of estimating output levels for most industries, but has not provided a full explanation of the reasons for the errors in the benchmarked estimates. As noted, it is now well-nigh impossible to replicate the CSS figures. It is not known why the errors that occurred did so, and it is now not possible to find out without extensive assistance from the CSS. They have been unable (and a little unwilling) to provide this is the past - there is no obvious reason why they should do so now. The calculations below, flawed as they are, represent the full extent of what was possible before the changeover to the new method of measuring output. It is sobering to think that in future it will be more difficult to trace errors to their source.

This appendix commences with a discussion of the mechanics of benchmarking, and then summarises the results of the calculation exercise aimed originally at replicating the CSS benchmarked output estimates, as well as uncovering reasons for the various discrepancies between Real Output (Sum of Components), Real Output (Total) and the PVMP. The calculations are then explained and commented on in some detail.

The mechanics of benchmarking

Users in all countries are in a position where they have to take most of the statistics published by central statistical agencies on trust. With derived statistics, like productivity estimates, it is possible, however, for users to replicate, at least approximately, the official figures. Benchmarking is another example of a process which can be replicated - given the correct basic data and knowledge of the way the job is done, it should be a relatively simple matter for any user to perform their own benchmarking operation.

There are several reasons why a 'non-official' benchmarking was attempted in this study. The first, and most obvious reason was that in doing so, successfully, one confirmed that one had understood the technique - a not unimportant part of comprehending the whole process by which manufacturing output estimates are produced. In addition to that, there remained outstanding at the time the exercise was carried out, the important task of performing a proper benchmarking of the 1985 census results, to say nothing of the then recently-released 1988 figures.

The benchmarking for 1985 needed to be redone because many of the figures used to provide the 1985 benchmarks were subsequently discovered by the CSS to be incorrect. The revisions appeared in two stages - Table 2-5.4 in Chapter 2-5 shows the first (unpublished) set of revisions, whereas the relative contributions to gross and net output, and the net to gross output ratios in Table 2-6.4 in Chapter 2-6 were estimated on the basis of the second set of revised results published - namely those in SNR P3001, of 28 June 1993.

Obtaining the requisite information through the appropriate channels - primarily the Statistics Council - to do the benchmarking proved to be, as observed above, exceptionally difficult.

Matters might have proceeded with greater speed had the inquiry of which the benchmarking exercise is a key part been pursued single-mindedly, rather than as the spare-time research activity of an isolated academic - the three years that it has taken to solve to reach the present, not entirely happy pass is a long time. The official structures did not fare much better - the sub-committee of the Statistics Council appointed early in 1992 to investigate this matter did not report until October 1993. One of the reasons for this is that some members of the committee faced other, more pressing demands on their time. Therein lies an important lesson for the activities of a future Statistics Council, one that is genuinely sensitive to user's needs. Representation on *ad hoc* committees such as that formed to investigate this case should be broadened to include academic and other specialists nominated by user groups, recruited abroad, if necessary.

A frequently-voiced complaint about the CSS's offerings is that the explanatory notes which accompany them are inadequate. There has been some improvement of late, an example being the relatively generous notes provided with the newly-benchmarked estimates in Statistical News Release No. P3041.3 of 9 March 1992. These contain the following description of the benchmarking process:

> "Although it is accepted that the results of a representative sample survey on the short-term accurately reflect the trend of the activities of the relevant industry, the results tend to deviate in the long run from the "true" situation of the industry owing to specific factors. From time to time it is thus necessary that the level of activities as measured by the sample survey, is brought into line with the level of activities as reflected by available census (complete survey) results. This process is known as benchmarking.
>
> The results of the 1979, 1982 and 1985 Manufacturing Censuses were used to adjust the level of the sample survey figures for the period 1978 to November 1991. The total value of gross output of the manufacturing major groups and/or subgroups (which represents the total value of work done by the establishments in these groups) as obtained from the respective manufacturing censuses, was deflated with the appropriate subindices of the Production Price Index in order to calculate real gross output which served as benchmarks to verify or adjust the level of the monthly volume indices. The real gross output thus represents the total volume of work done by the establishments."

Being somewhat hazy as to exactly what 'bringing a level of activities as measured by the sample survey, into line with the level of activities as reflected by available census (complete survey) results' might entail, I went back to the CSS response[1] to the first draft of the "Manufacturing Sector Data Problems" paper (Meth, 1991a). All that is available there is the statement that reads:

> "The index series resulting is "benchmarked" to correspond with the deflated values of gross output obtained from the censuses."

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1 The full response is reproduced as Appendix 1 in Meth, 1992. The passage containing the reference to benchmarking is reproduced on p27 of the same document.

This statement offers no clue as to what the mechanics of securing 'correspondence' might be - all it does is to use the word 'correspond' for the phrase 'bring into line'. Common sense suggests that a benchmark is a reference point against which other observations may be calibrated - what was required was an understanding of the technique of calibration.

Having attempted and failed to replicate the suspect CSS results after being informed in the CSS letter of 3 July 1992 of the official reasons for the two discrepancies noted above, I wrote once again to the Statistics Council, asking for details of the way in which the PVMPs are made "...to correspond with the deflated values of gross output obtained from the censuses..." (letter dated 10 September 1992). After waiting more than two months for a reply, a ten-minute telephone call[2] elicited the desired explanation.

In essence, the process of securing 'correspondence' is analogous to one in which a census observation is used as a 'peg' on which to 'hang' the previously measured monthly PVMPs in each industry. It is usual to use as peg the estimate of Real Output for that industry. For simplicity's sake, imagine for the moment that only calendar and financial year average aggregate PVMPs are available - ie, ignore the fact that all of the other monthly values of the PVMP for each industry have also to be adjusted during the benchmarking process.

The problem facing the national statisticians may be understood by referring back to Figure 1 in Chapter 2-1. The two lower lines in this figure represent benchmarked and unbenchmarked results for the total manufacturing sector. When the 1982 and 1985 manufacturing censuses had been completed, a pair of points identified on the line labelled 'Benchmarked' (the 1981/82 and 1984/85 benchmarks) became available. In essence, the 'Unbenchmarked' series was forced through, or made to pivot on the new pegs.[3]

The benchmarked figures, published in March 1992, were prepared before the results of the 1988 Manufacturing Census became available. The 'predicted' value in the benchmarked series of the 1987/88 output level was 1,3 points higher than the 1984/85 level. For the reconstructed

2 To Mr Roelf van Tonder, the person at the CSS in Pretoria who is in charge of the sub-section that produces the manufacturing sector figures. Having had so many experiences of this sort, one wonders in retrospect why one was so patient? The wisdom of hindsight is a harsh yardstick against which to measure one's past behaviour. As soon as it became clear that a full explanation of the benchmarking process was not forthcoming from the CSS, alternative sources should have been sought - the most obvious place being the United Nations. Indeed, the CSS refers in the letter of 3 July 1992 to UN documents which look as though they may contain the required information. Why did one not seek out these sources? One did not think of it at the time!

3 From the discussion above, it is clear that benchmarking is not performed on aggregate figures such as these - instead, the aggregate series is built up from the separately benchmarked results for each industry. This does not affect the discussion above - the series illustrated could be imagined to be the results for any industry (major group) or sub-group.

figures, the 1987/88 level was 3,4 points higher.[4] The publication of the summary census figures in June 1993 yielded one more benchmark figure, that for 1987/88. Clearly, the difference arises because of the 'better' information available at the later date.

When there are too many of 'predicted' values, ie, when too long a period is allowed to elapse between censuses and benchmarkings, problems are likely to arise. In the case of the benchmarked (March 1992) figures, the 'overhang' (the length of the period from the date of the benchmarking peg to the last observation to be benchmarked) was approximately five years. This is thoroughly unsatisfactory. It is argued in this study (and recently acknowledged by the CSS) that the surveys drifted by at least ten percentage points over six years (1979-85) from the present (and incorrect) deflated values of gross output. There was no reason to suppose that the gap between the unbenchmarked and the later estimates did not continue to widen after 1984/85 - as may be seen in Figure 1 (Chapter 2-1), the gap at 1988/89 did, in fact, widen very considerably.

Obviously, there may be some reasonable period over which one can assume that the monthly surveys which measure the PVMP are accurate enough to pick up the trend of output changes. It could be that the surveys perform reasonably for periods of 24 months, or possibly even longer. There is little cause, however, for feeling confident that the level of output can be measured accurately more than three or four years after the last available manufacturing census results. Yet the implicit assumption underlying the benchmarked results seems to have been that the surveys were picking up the trend fairly accurately - they were merely a little too low on absolute levels. The vertical distance between the benchmarked and unbenchmarked 1984/85 values was 5,1 percentage points. Thereafter, the gap or vertical displacement between the two series narrowed (until 1989/90) to about 4 percentage points. No reasons were offered as to why the gap should have been that size rather than any other. Only the 1988 manufacturing census could have provided the information necessary to locate the line with any confidence, but at the time the benchmarking was done, not even the preliminary results of this census were available.[5]

Returning to the process of benchmarking, and dropping the assumption that there is only a single (aggregate) PVMP to be benchmarked, means a return to the full set of results provided by the manufacturing census - the PVMP for each major group (industry), or in some cases

4 Estimated from SNR P3041.3, 9 March 1992 - Benchmarked, and SNR P3041.3, 12 November 1993 - Reconstructed.

5 According to SNR P3041.3 of 12 September 1990, a new sample survey was implemented in January 1989. Apparently, the decision to do so was delayed for some years, because of the expense and difficulties involved. An official of the CSS has conceded privately that this decision probably contributed significantly to the drift observed between 1978/79 and 1984/85. (*pers. comm.* November 1992)

sub-group, has to be benchmarked. The first step in the process is to deflate the current price estimates of gross output obtained for each industry from the census by the appropriate ('financial year') PPI. The manufacturing census for the year 1985, for example, covers the period July 1984 to June 1985, thus the deflation process yields a 'financial year' real output estimate for each industry. This indirect measure of output is taken to be the figure that would have resulted from a calculation of the average of the monthly PVMP survey estimates covering the same period, if the survey results had not drifted from their 'true' values. 'Filling in' the remainder of the monthly values is a process of juggling or massaging the unbenchmarked observations until such time as the cyclical pattern picked up by the unbenchmarked results is reproduced by the benchmarked figures.[6]

Monthly aggregate PVMPs are the weighted sums of the monthly industry PVMPs, and the aggregate annual (calendar or financial year) figures are the arithmetic averages of the relevant 12 month's results. Aggregate benchmarked financial year PVMPs will differ, hopefully by some reasonably small amount, from Real Gross Output (Sum of Components), because different weighting bases, respectively the proportional distributions of net and gross in the appropriate year, are used in the summation process.

A crude way of estimating an aggregate PVMP for, say, the calendar year 1985, would be to multiply the deflated census estimate (Real Gross Output - Sum of Components) by the average of the monthly aggregate PVMP figures for the period January to December 1985, and divide the outcome of this by the average of the July 1984 to June 1985 monthly aggregate PVMPs. In other words, one may estimate (approximately) the benchmarked calendar year PVMP by multiplying it by the ratio of the calendar year average to the financial year average PVMP as measured by the regular monthly surveys.

So much for the mechanics of benchmarking - it is time to turn to a consideration of some of the other problems encountered in the attempt to replicate the CSS results and to a summary of the most important results of the actual calculations.

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6 New or revised information may come to light in the period between the conducting of a manufacturing census and the completion of the benchmarking exercise. This could affect some or all of the observations concerned. Changes also occur when a new method is introduced, such as that which underpins the reconstructed figures.

The difficulties of replication

Reference was made above to the fact that the absence of one key piece of information, a description of some of the details of the benchmarking process, one that consisted of but a few hundred words, made progress beyond the point reached in the forerunner of this study (Meth, 1992) impossible. Once that piece of technical information had finally been provided, an attempt at replicating the CSS unbenchmarked and benchmarked results could be made. The first draft version of 'More Problems...' (Meth, 1993) attempted that task, but comparisons between PVMPs and deflated gross output estimates were bedevilled by the fact that the information that the 'Petroleum and Coal' price index had been applied to the 'Other Chemicals' industry had not been disclosed. When that fact came to light, the job was tackled once more. The results generated below represent, more or less, the limit of what was possible prior to November 1993. These will be seen to provide confirmation (albeit muted) of the expectation, arising from the application of the Euler Consistency Test (ECT), that there was indeed something wrong with the existing published official benchmarked figures.

In the original version of the report, ie, the version submitted to the Statistics Council in March 1993 (Meth, 1993), the discussion on benchmarking was a prelude to a lengthy attempt first of all to replicate the CSS benchmarked PVMPs from the published data, and then to try to track the sources of the differences between these and Real Output - both (Total) and (Sum of Components). There were four components to the calculation exercise - in the first of these, described as 'pseudo benchmarking', Real Output (Sum of Components) was estimated and compared with the value of Real Output (Total), and with the unbenchmarked and benchmarked PVMPs. The second component consisted of a set of benchmarked estimates of the PVMP, based on the all of the datasets then available. The third part of the exercise attempted to estimate Real Net Output, and the fourth sifted through the various results in an attempt to explain the different anomalies uncovered. In this revised version of the study, the basic calculation framework remains, but it has been reordered, and the results are presented in different places. The attempt to estimate Real Net Output is now held to be of sufficient importance to merit a chapter (2-7), and an appendix (2-7) all to itself.

With the release by the CSS of a partial explanation for the difference between their estimates of Real Output (Total) and Real Output (Sum of Components) - the use of the Petroleum PPI - many of the conclusions flowing from that exercise were apparently rendered superfluous. Implicit in the manner in which the CSS provided me with the Petroleum PPI information seemed to be an assumption that further inquiry into the matter was unnecessary. But the use of the Petroleum PPI is indefensible. In the unlikely event that I were to forget it, the knowledge that properly measured, Real Output (Sum of Components) and Real Output (Total) cannot differ, one from the other, a conclusion that flows inexorably from the underlying algebra of a 'pure' set of accounts like those in Chapter 2-5, would have served as a reminder that no-one should be satisfied with a set of results like those in Table 2-3.3 of Chapter 2-3. The new information was therefore incorporated into the reckoning with some curiosity as to the impact it would have on the differences under investigation. It must, of course, be remembered that as these calculations were performed before the separate results became available for the 'Petroleum and Coal Products' and 'Chemical Products, excluding Products of Petroleum and Coal' industries, the experimentation with the PPIs was on the figures for the major group in which these were two industries were hidden - 'Other Chemical Products'.

The calculations in the original version of this work were performed in an attempt to unravel the two separate discrepancies that required explanation - the first being the difference of 4,6 percentage points between the benchmarked output estimate for 1984/85 of 117,58 (1978/79=100) and the deflated value of total gross output of 122,24 (the difference between the PVMP and Real Gross Output (Total)) and the second being the difference of three percentage points between this latter value and that of the value of the sum of the individual components of gross output separately deflated (119,27) (the difference between Real Gross Output (Total) and Real Gross Output (Sum of Components)).[7] If one were to have accepted the Petroleum PPI as an appropriate deflator, and if one accepted as well, that a discrepancy of three percentage points was tolerable, then the provision by the CSS of the explanation for the latter discrepancy would apparently have reduced the task to that of searching for reasons for a mere 1,6 percent difference between the aggregate PVMP and Real Gross Output (Sum of Components). Such a small difference would scarcely have been worth the energy expended in search of its cause. That, however, was not the reason for persisting - in essence, the argument is over the question of whether or not the Petroleum PPI is suitable to use as deflator. In my view, it is not - a position defended at some length in Chapter 2-6.

Although it appeared to be possible to replicate the CSS unbenchmarked PVMPs to within a percentage point or so, it proved to be impossible to do the same with the benchmarked PVMP figures. No reasonable explanation for the differences between the aggregate PVMP and Real Output (Sum of Components) indices has suggested itself. Since the data used to compile these series come from separate (unconnected) surveys, it would, of course, not be possible to say anything *a priori* about whether the gaps would grow or diminish in the period between benchmarkings. If physical output volumes (PVMPs) could be measured accurately, one might entertain the hope that the two series would show roughly the same trend, but a glance at the

7 The corresponding figures for the year 1981/82 were -2,4 and 3,2 percentage points respectively.

Table 2-3.1 results in Chapter 2-3 reminds us that CSS attempts to measure the PVMP in 'Other Chemicals', and in many other industries besides, have, in the past, been highly unsuccessful. The process of benchmarking, however, forces the two series into 'correspondence', and any differences that exist have to be explained, as the CSS has done, by reference to the different weighting bases used. One would expect these differences to be quite small, because as has been demonstrated in Chapter 2-5, Laspeyres (and Paasche) output indices appear to be quite insensitive to substantial changes in the relative weights of their components.

Some confirmation of this is obtained from the process described below as 'pseudo' benchmarking. In essence, this consists in finding the calendar year values of the indices of Real Output, either in the Total or the Sum of Components forms, using the different PPIs available. A summary of the relevant results is presented in Table A2-6.1. First, the relevant financial year indices are presented. The results labelled 'Step 7' give Real Output (Sum of Components) in index form with the Petroleum PPI applied to the 'Other Chemicals' industry gross output figures. The CSS results directly underneath are the (b) figures from Table 2-3.3 in Chapter 2-3. Similarly, the second set of 'Step 7' results show Real Output (Sum of Components) obtained using the OC PPI. The 'Step 8' are indices of Real Output (Total) obtained by deflating census values of total gross output by the aggregate PPI. Underneath them is given the CSS (a) result from Table 2-3.3. As explained in Chapter 2-3, the Step 7 (OC PPI) figures are very close to the Step 8 (Agg PPI) figures.

Table A2-6.1 Pseudo benchmarking - selected results

1978/79=100	1981/82	1984/85	1987/88	Row
Step 7 (Pet PPI)	121,2	120,9	125,0	800
CSS (b) estimate	120,2	119,3	-	-
Step 7 (OC PPI)	124,9	123,4	123,2	803
Step 8 (Agg PPI)	123,9	123,3	123,4	820
CSS (a) estimate	123,4	122,2	-	-
CSS Benchmarked PVMP	125,8	117,6	-	-
Calendar year Real Output indices (1979=100)				
	1982	1985	1988	
CSS unbenchmarked calendar year PVMPs	113,8	104,7	-	-
CSS benchmarked calendar year PVMPs	116,8	109,5	-	-
(Sum of components) (1978/79 weights)				
STEP 9(i) (Pet PPI)	110,9	112,5	124,0	835
(OC PPI)	114,3	114,8	122,2	839
(Total) (1978/79 weights)				
STEP 9(ii)	113,4	114,7	122,4	848

Source: See calculations below.

The relevant results of the pseudo-benchmarking exercise are probably close enough to the CSS figures to argue that they lie within the limits of experimental error - differences may be accounted for by different weights, or by the possibility that different PPIs have been applied in certain industries. Regardless of the weighting basis used, one notes that when the financial year results are converted to calendar year figures by multiplying them by the ratios of the calendar to financial year PVMPs, the 1985 result for the Real Output (Sum of Components) in index form with the Petroleum PPI applied to the 'Other Chemicals' industry gross output figures comes out at 112,5 - 3 percentage points higher than the official value of 109,5. This difference corresponds to the 1984/85 (financial year) figure of roughly 121 obtained below in the DIY benchmarking exercise as against the CSS figure of 117,6. The corresponding 1985 figure when the 'Other Chemicals' deflator is used is 114,8, ie, about 5 percentage points above the benchmarked PVMP of 109,5. In this case, the 1984/85 figure of 123.4 has to be set against the CSS estimate of 117,6.

Summarising the results of the revised 'do-it-yourself' benchmarking exercise presented below, a collection of calculations that covers most conceivable weighting and data-set combinations, one may say that where the Petroleum PPI was used to obtain estimates of Real Output (Sum of Components), it was possible to get within a percentage point or so of the corresponding CSS figures. Where the 'Other Chemicals' PPI was used, it looks as though the CSS figures systematically under-estimated output levels. This outcome could have been dismissed as the result of simple ignorance on my part were it not for one critical piece of evidence. It is provided by a comparison between the deflator the CSS says has been used to obtain the real value of gross output in 'Other Chemicals' (the Petroleum PPI) and the implicit deflator that may be estimated from the benchmarked PVMP series. As noted above, the Real Output and PVMP series are not directly commensurable, except when benchmarking takes place, at which time, one would expect there to be a rough correspondence between the two deflators - any differences that may arise as a result of the different weighting bases used for the two measures should be insignificant when the level of aggregation gets down to major group (industry) level.

The relevant information is given in Table A2-6.2 below. In the upper half of the table, benchmarked financial year PVMPs estimated from SNR P3041.3 of 9 March 1992 are presented along with two sets of real output estimates, obtained by deflating the unrevised[8] estimates of gross output in current prices given in *South African Statistics 1990* (pp12.19-

8 These have been used because a comparison between the gross output totals used by the CSS (those reproduced in Table 2-3.3 of Chapter 2-3) and the revised figures given in the basic data section of this appendix (Tables A2-6.D7), makes it quite clear that the benchmarking operation by the CSS was performed on the unrevised figures.

12.21) by financial year (July to June) PPIs[9] estimated from the monthly figures given in Statistical News Release No. P0142.4 of 24 March 1992. The first of these uses the 'Petroleum PPI' and the second the 'Other Chemicals PPI'. Whilst it is not known what values the true deflator for the industry should take, the 'Other Chemicals PPI' certainly appeared to do a better job than the 'Petroleum PPI', in the sense that it yielded output indices that were relatively close to the PVMPs. This finding is expressed in a different form in the lower half of the table which gives these PPIs alongside the corresponding implicit deflators obtained by dividing the estimates of gross output in current prices by the PVMPs.

Table A2-6.2 Output and true(?) or implicit deflators (1978/79 = 100)

	1981/82	1984/85	Row
Benchmarked PVMPs	126,5	148,2	1484
Deflated Gross Output:			
Petroleum PPI	97,5	127,2	1484
Other Chemicals PPI	129,8	153,5	1485
Implicit deflator	153,7	211,1	1532
Petroleum PPI	199,4	245,9	1532
Other Chemicals PPI	149,8	203,8	1531

A confusing aspect of this result was that for the year 1984/85 (and 1985), the estimates of the DIY aggregate PVMP were all closer to the value of Real Output (Sum of Components) using the Petroleum PPI applied to the 'Other Chemicals' industry, than they were to the corresponding results obtained using the OC PPI. For 1981/82 (and 1982), this was reversed, and the expected result was obtained. This may be seen in Table A2-6.1 above where the 1981/82 benchmarked PVMP of 125.8 is much closer to the Step 6 (OC PPI) result of 124.9 than it is to the Step 6 (Pet PPI) of 120,9). For interest's sake, the deflated gross output estimates of 97,5 and 127,2 respectively for 1981/82 and 1984/85 were plugged into the spreadsheet used to generate the appendix. The result, not unsurprisingly, was that the relevant aggregate 1984/85 PVMPs were reduced from their average of about 121 to somewhere around the 119 mark - one of them came out at 118,8. This was getting tantalisingly close to the CSS figure of 117,6. Something clearly was wrong, but without access to the actual basic data used, it was impossible to make further headway.

9 As noted in Chapter 2-2, the PPI is estimated for three distinct sets of commodities - 'Commodities for South African consumption', 'Total output of South African industries', and 'Output of South African industries for South African consumption'. It seems most appropriate to use the second of these, because the first includes imports and the third excludes exports.

The exercise that yielded the results in Table A2-6.2 was, in any event, plagued by a 'vicious circle' problem of major proportions which I have was not able to resolve. Benchmarked PVMPs for the industry were constructed by forcing the unbenchmarked PVMPs into 'correspondence' with the deflated values of gross output. In the absence of full information on what PPIs had been used where, it was noted that if the 'Petroleum PPI' had been applied to the manufacturing census estimates of gross output in the industry 'Other Chemicals' to obtain both real output and an index of real output that could be used as a benchmark, then the fact that reversing the operation to estimate the implicit deflator generated contrary results was difficult to understand. Assuming that my arithmetic was correct, one explanation which suggested itself was that the CSS has used the Petroleum PPI to estimate Real Output in 'Other Chemicals', but has not used it to obtain the PVMP benchmark. This seemed so outrageous as to have been impossible, but stranger things have been done by the CSS. In the event, it ultimately became known that the Petroleum PPI had not been applied to the whole output of the industry 'Other Chemical Products'. The matter will not be pursued - the debate has moved on. It is one thing to reorder and edit work already completed and present it for publication - it is another matter altogether to go back to a set of incorrect results and rework part of them to fish for an explanation which one knows, from the attempt in Chapter 2-6 to construct a weighted output estimate for the industry, that one is not going to find. Suffice it to say that the problems caused by the continued use of the Petroleum PPI will not simply go away.

The brute fact is that the discrepancies uncovered in this study are the outcome of two imperfections - one them preventable, the other not. The unpreventable errors are the result of unsolved problems in national accounting techniques - problems such as those caused by extreme variability of net to gross output ratios. The preventable imperfections result from the inability of the CSS to respond imaginatively and critically to changing circumstances. Attempting to minimise the importance of these errors by taking refuge in a UN convention serves merely to highlight the fact that the production of the accounts is very much an inexact science. Of course, one expects there to be measurement errors - the question is - what error level is tolerable? The errors revealed by the publication of the reconstructed output estimates are, in my view, too high to be acceptable. The CSS has to develop procedures for ensuring that similar mistakes are not made in the future. With this in mind, we turn to the calculations themselves.

Calculation and confusion

The arithmetical portion of appendix divides into three parts, the first of which assembles all of the basic data. Calculations on these data are performed in two stages. **Stage I** of the appendix, carried out in a series of **Steps** numbered **1** to **9**, is described as 'pseudo' benchmarking. The stage contains tests of two types. The first of these compares individual industry PVMPs with the corresponding Real Output indices constructed from the various datasets available. This is done for both financial and calendar year estimates (Steps 4, 5 and 6). The second test (Steps 7, 8 and 9), compares estimates of gross output in current prices Real Output (Sum of Components)) with estimates of Real Output (Total). The results are presented in both financial and calendar year forms.

Stage II consists of **Steps 10** to **14**. Steps 10 and 11 each contain two attempts to replicate the CSS unbenchmarked and benchmarked PVMPs - an enterprise that enjoys only limited success. No obvious explanation for this outcome suggests itself. It could well be that I have not understood the mechanics of the benchmarking process, but although that must remain a possibility, it seems unlikely, because in the final instance, there is a limit to the number of ways in which the results can be combined - most of which have been tried. **Step 12** uses the most recent CSS output figures to generate a set of PVMPs, and **Step 13** expresses these in calendar year terms. An attempt is made, with the limited resources at my disposal, to try to isolate some of the possible reasons for the non-replicability problem. Such information as is to hand is analysed in **Step 14**.

Tables in the appendix containing basic data or inputs are numbered Table A2-6.D1, and so on. Those pertaining to the different steps in the argument are numbered Table A2-6.S1 etc. When there are sub-steps within a particular step, then table numbers take as a suffix, the Roman numerals that identify the sub-step, eg, Table A2-6.S11ix. Occasionally, a particular sub-step has more than one table in it. In these cases, the table number takes a lower case letter as suffix after the Roman numeral, eg, Table A2-6.S11iiia. Brief descriptions of the basic inputs into the calculations will now be given.

In order to deflate the values of gross output of the individual industries (major groups) given in the various censuses, a set of Production Price Indices (PPIs) for the relevant financial years (July to June) is required. As noted in the discussion on Table 2-3.4 in Chapter 2-3, in the case of certain industries, for example, Non-metallic Mineral Products and a few others, separate PPIs for the component industries have only been estimated (or published) in recent years - where this occurs, the same index is used for both or all component industries over the period in question. The major difference between the first version of "More Problems..." and this version of it is that wherever necessary, two deflators are now given for the Other Chemicals industry. The first of these is the Petroleum and Coal Products PPI, loosely called the Petroleum PPI, and abbreviated to 'Pet PPI', and the second is the deflator for what was thought to be the whole chemical industry, ie, the deflator for Chemicals and Chemical Products. This is referred to below as the 'Other Chemicals PPI' (sometimes abbreviated to 'OC PPI'), even though it is not. Calendar year PPIs are required for certain of the operations in Stage II - these are given in Table A2-6.D1. The financial year PPIs (estimated from the monthly figures given in Statistical News Release No. P0142.4 of 24 March 1992) appear in Table A2-6.D2.

Next come the PVMPs. Both calendar and financial year benchmarked and unbenchmarked PVMPs are required. The benchmarked PVMPs are required for comparative purposes when the attempt to replicate the CSS benchmarked figures is made. The unbenchmarked estimates provide the ratios required to convert benchmarked financial year estimates into calendar year figures. Published estimates of calendar year PVMPs are available, but financial year PVMPs are not. These have had to be calculated for each industry. The basic data for the unbenchmarked estimates come from Statistical News Release No. P3041.3 of 12 September 1990, and those for the benchmarked figures from Statistical News Release No. P3041.3 of 9 March 1992. The PVMPs are given in Tables A2-6.D3-A2-6.D6.[10]

Following this, the values of net and gross output, both as originally published (described as the 'old' data), as modified by the errors referred to in the discussion on Table 2-5.4 above (referred to as 'revised' data) and finally as published (referred to as the 'new' data) are given respectively in Tables A2-6.D7 to A2-6.D9.

In Table A2-6.D10, the ratios of calendar to financial year PVMPs are estimated, both for the benchmarked and the unbenchmarked figures. The resulting ratios enter into several of the calculations below.

Because the 'revised' data in Table A2-6.D8 was supplied as a set of changes made to the gross output estimates only, values of net output have had to be estimated for those cases. These have been obtained by assuming that the ratios of net to gross output do not differ significantly between the 'old' and the 'revised' data. The 'new' data provide an opportunity to check this assumption. As may be seen in Table A2-6.D11, with a few notable exceptions, eg,

10 The PPIs and PVMPs are stored as spreadsheets under the directory B-DATA. The information brought into Appendix 2-6 is collected in a file called SUMMARY.WK1.

in the Tobacco and Paper industries, the differences between these ratios are, for the most part, negligible.

Stage I - Pseudo-benchmarking

In the absence of an adequate explanation for the differences reported between the official estimates of Real Output (Sum of Components), and the official (and DIY) estimates of Real Output (Total), the calculations in this part of the appendix originally sought to show that of the latter figures, the higher of the two, were correct. This was part of the goal of attempting to show that the unbenchmarked 1984/85 aggregate output estimate (PVMP) was incorrect by at least 10 percentage points (1978/79=100), and that the existing benchmarked estimate for 1984/85 was also incorrect by something in excess of 5 percentage points.

Now that the news of the use of the Petroleum PPI has been made public, it is no longer possible to claim, as was done in the earlier version of the report, that no reasonable explanation exists for the difference between Real Output (Sum of Components) and Real Output (Total) - the relatively higher value of the Petroleum PPI in the year 1984/85 pushes down Real Output in the Other Chemicals industry, and with it, Real Output (Sum of Components). If the 'old' data are used, as was apparently the case with the CSS benchmarked figures and the results provided in Table 2-3.3, then the 1984/85 the respective values for Real Output (Sum of Components) and Real Output (Total) are 119,9 (Row 800) and 122,2 (Row 820) - the former being within a whisker of the official figures. The use of the two revised sets of data may be seen to push both of these up, with the first revision giving somewhat higher results. The figures of approximately 120-122 obtained for the Real Output (Sum of Components) estimates using the Petroleum PPI appear to be significant, because of their proximity to the CSS figures.

The steps of which this stage consists will now be discussed in somewhat greater detail. Some of these are simple conversions, eg, from one base year to another, or from constant price to index form. As has been demonstrated above in the discussion on the impact of major structural change, the choice of base year can have consequences that are far from trivial. The (financial) year 1978/79 is adopted as base for most of the sensitive calculations that follow. This year has been selected because it is the last census year in which some reliance can be placed in the figures. The Sasol shocks in the early 1980s have done damage to the CSS from which it has yet to recover. For many of the tasks, it is convenient to use other years as base, eg, 1984/85. Since the published data are generally given for calendar years, conversion to financial year form is occasionally necessary.

Step 1 is to convert the financial year PPIs from the base year 1985 to the base year 1984/85. Note that there are two PPIs for the industry Other Chemicals. The converted PPIs are used to deflate all three sets of gross output estimates in **Step 2** to 1984/85 constant price terms. These constant price output estimates are converted to index form in **Step 3**. Given that there are three different sets of estimates of the value of gross output in current prices, and that in the case of the Other Chemicals industry, two different PPIs have been applied to these estimates, six sets of Real Output estimates for that industry are obtained. As one would expect, substantial differences result from the use of these two different deflators. In order to make possible a comparison between the Real Output estimates and the official unbenchmarked PVMPs, the latter figures must be converted to the 1984/85 base year. This is done in **Step 4**, in which the differences between what should have been identical results if the surveys had not drifted or become biased, are estimated. The number of percentage points by which the individual real gross output levels in each industry exceed (are less than) the unbenchmarked PVMPs are given in Table A2-6.S4ii. It may be seen that some of the differences, many of which reveal under-estimation of the level of output, are extremely large.

A similar set of calculations performed in **Step 5** compares the benchmarked PVMPs with Real Output in each industry. The Real Output estimates for the 'New' data for 1987/88, which are included for interest's sake only, produce some large discrepancies. A notable feature of this table is the effect on the results of using one or other of the three different data sets available. Since benchmarking is a process that involves dragging the PVMP into rough equality with the deflated value of gross output, the expectation is that a comparison between the appropriate deflated gross output figures and the benchmarked PVMPs should yield differences of approximately zero. Neither the 'Revised' nor the 'New' data sets were available at the time benchmarking was carried out, so it comes as little surprise to see a wide range of differences emerge. One would not expect the 'Old' data set to yield similar discrepancies - and the 1981/82 results do not disappoint - the systematic difference of about one percentage point suggesting some kind of order within the numbers. Some of the 1978/79 figures are, however, decidedly odd, especially in Leather, Printing, Metal Products, Machinery, and the last three industries, Transport Equipment, Professional Equipment and Other Manufacturing. Deflators for the latter two are known to be very poor, but the explanation for the other divergences also has to lie in the deflators, a fact that does little to ease the disquiet one feels on scanning the results.[1]

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1 Given that the benchmarking operation by the CSS has been performed on the unrevised ('Old') figures, it is more than a trifle odd that the CSS letter of 3 July 1992 ascribes part of the difference of 4,6 percentage points between the benchmarked PVMP and Real Gross Output (Total) to "...adjustment of the census data." Unless the CSS has performed the remarkable feat of comparing an aggregate PVMP constructed from individual industry Real Gross Output figures (benchmarks) estimated on the basis of the revised figures with a Real Gross Output (Total) estimated on the basis of the unrevised figures (or *vice-versa*), the revised figures simply cannot have entered into the calculus.

Other Chemicals must, of course be singled out for separate treatment. The CSS appears here to have been doing a little heartsearching in the matter of deflators. The PVMPs for 1978/79, 1981/82 and 1984/85 respectively are 67,5, 85,3 and 100,0 (Table A2-6.S5i). Corresponding Real Output indices obtained by deflating 'Old' dataset gross output figures by the OC PPI are 65,1, 84,5 and 100,0, whereas the Petroleum PPI deflated figures are 78,6, 76,7 and 100,0 (Table A2-6.S3). The OC PPI figures are so close to the PVMPs as to suggest a more than coincidental relationship, but it appears that at some point after the benchmarking of the PVMPs, it was decided that the OC PPI was inappropriate. This raises obvious questions about the conduct of the CSS with regard to the deflators - if it was decided that the Real Output estimate was incorrect, why was the PVMP not revised as well? In any event, the revisions to the estimates have an interesting impact on the results. If the 'Revised' dataset and the OC PPI were used, Real Output in 1978/79 would have stood at 57,8, and using the 'New' dataset it would have been 63,5 - both results indicating a faster growth rate in the industry than that indicated by the benchmarked PVMPs. The Petroleum PPI figures, of course, reverse this finding, yielding Real Output estimates that are way out of line with the PVMPs. A better explanation than that currently available to users must be provided for this contradictory set of results.

Step 6 contains a set of calculations similar to those performed in Steps 4 and 5, but performed this time on the calendar year figures. A comparison is made between the CSS benchmarked calendar year PVMPs for individual industries (major groups) and the DIY output estimates constructed from the financial year output indices given in Step 3 (Real Output estimates). All three sets of gross output estimates are used, despite the fact that the appropriate comparison would appear to be that between the PVMPs and the Real Output indices derived from the 'Old' (unrevised) dataset. As in the comparison between the financial year PVMPs and their Real Output counterparts, one would not expect to find major differences between the PVMPs and the Real Output indices used by the CSS to benchmark those PVMPs. Admittedly, the process of moving from financial year to calendar year figures, involving as it does, another transformation, introduces the possibility of further error. This should however, be slight.

As noted previously, the weight of the evidence favours the conclusion that the CSS has used the 'Old' dataset in performing the benchmarking operation. That being so, the pattern of differences shown in Table A2-6.S6iv under the heading "'Old' data" is even less comforting than the corresponding results obtained in Steps 4 and 5. Gone is the close correspondence in the 1981/82 column - the results take on the appearance now of having randomly distributed errors throughout. This gives some indication that problems lie ahead. By way of consolation, there are some similarities in the 1978/79 and 1979 error patterns.

Once again in **Step 7**, in which the value of the sum of the individually deflated components of output (Real Gross Output (Sum of Components)) is calculated, six sets of results emerge - two series for each of the three available data sets. These are obtained by summing the constant price estimates of output in each industry for the years 1978/79, 1981/82 and 1984/85 (and one set of results estimate for 1987/88) estimated in Step 2, and dividing the totals respectively by the value of output in 1978/79, the base year, ie, $\Sigma Q_t P_o$ is divided by $\Sigma Q_o P_o$ for each industry. If the Petroleum PPI were the correct deflator to apply to use on the Other Chemical industry, then the 1984/85 output level would have been 119,9 (Row 800) approximately what the CSS claims it was. If on the other hand, the true deflator was nearer the Other Chemicals PPI, then the figure of 123,4, obtained from the 'New' data estimates in Row 803 is the better estimate.

Real Output (Total), obtained by deflating the total value of gross output in current price terms ($\Sigma Q_t P_t$) by the aggregate PPI, is given in **Step 8**. The PPIs for this exercise (the financial year PPIs for 1978/89, 1981/82 and 1984/85) are those supplied in the CSS letter of 3 July 1992. These are reproduced in Table 2-3.3 (Chapter 2-3), along with the current price output estimates to which they are applied. The 1987/88 PPI is estimated from Statistical News Release No. P0142.4 of 24 March 1992. As may be seen by a comparison of these results with their Step 7 counterparts, substantial discrepancies arise between the Real Output (Sum of Components) figures in which the Petroleum PPI is used as deflator (Rows 820 and 800). This is not the case with the Sums of Components containing the Other Chemical PPI deflated figures (Rows 820 and 803) - the largest difference between any corresponding pair of results using the 'Other Chemicals' deflator is 1,1 percentage points. For the Petroleum PPI, the largest difference is 2,9 percentage points. Tempting as it is to think that this provides conclusive evidence that the use of the Petroleum PPI is wrong, it is possible, indeed, it is likely, that the aggregate PPI is also incorrect. Unfortunately, therefore, we must remain agnostic on this issue until it can be shown beyond doubt that the use of the Petroleum PPI is, in fact, inappropriate.

In **Step 9i** the Real Output (Sum of Components) financial year aggregate indices are converted to calendar year values. Using the Petroleum PPI on the 'Old' dataset (Row 835) we obtain 1982 and 1985 values of 110,5 and 111,5 respectively. Corresponding estimates from SNR P3041.3 of 9 March 1992 (obtained by converting the 1985-based figures to 1979=100) are 116,8 and 109,5. This is the closest any of the Real Output estimates made in this study get to the CSS's PVMPs. Since the 'Old' dataset is incorrect (by definition) we should be looking to the other values in the row, specifically, the figure of 112,5 - the 1985 estimate yielded by the 'New' dataset. Similarly, if the OC PPI is used, the 1985 result should be 114,8

(Row 839). Comparing these figures with the corresponding Real Output (Total) results in **Step 9ii** the quality of consistency emerges once more.

The process carried out in Step 9 above has been described as 'pseudo benchmarking' because the aggregate output indices that have been derived are all based on deflated values of gross output (Real Gross Output). 'True' benchmarking requires that the PVMP for each industry (a net output-weighted measure) be made to 'correspond' to the deflated value of gross output (Real Gross Output) in that industry. Once these individual benchmarked figures have been obtained, the PVMP for manufacturing as a whole - a weighted average of the industry PVMPs, where the weights are given by the distribution of net output in whatever year is deemed appropriate - can be estimated. Since the implicit weights for the pseudo-benchmarked figures given above are the changing distributions of gross output in constant prices, they are technically incorrect. With the exception of the complication caused by the use of different weighting bases, this pair of calculations can be recognised as the practical application of the two approaches discussed in Chapter 2-4 which produced identical output estimates, given slightly different starting points.

The question is whether or not the use of different weighting bases (gross as opposed to net output) makes any material difference to the end result. Repeated experiments suggest that within the currency of a single base year, the use of Laspeyres (base-weighted) as opposed to a Paasche (current-weighted) indices does not affect output estimates too seriously. Since the differences between the base- and current-weighted distributions in the simulations were at least as large the differences between the net and gross output distributions to be considered below, one would expect the same conclusion to hold. In other words, for the range of changing price and volume relativities considered in this study, there should not be any significant difference between the value of Real Output (Sum of Components) and the PVMP. The formal identity, under hypothetically perfect measurement conditions, of Real Output (Total) and Real Output (Sum of Components) has already been demonstrated - any differences reported between must be due to measurement errors. It must be concluded therefore, that in the absence of significant errors of this type, there should also not be anything more than a minimal difference between any of these three indicators.

With this in mind, we turn to second part of the exercise - the industry figures themselves, to see what happens when net output estimates are used to weight the indices.

Stage II - Checking the industry benchmarks

Reference is made above to the intention to 'replicate' the CSS results, and to perform a DIY benchmarking of the relevant 'raw' results. Before proceeding, a word on the limits of such an enterprise is necessary. Obviously, if one were striving to replicate the CSS results with high precision, then something approaching the full dataset disposed of by the CSS would be required. The aim here is much more modest - all that is sought is to get within a percentage point or two of the CSS results, using whatever approximations to the standard techniques can be devised and applied to the existing published data.

The first of these approximations is used to estimate aggregate PVMPs. It may be recalled from Chapter 2-4, that the procedure described as the 'PVP' method generates an aggregate output index (dimensionless). In the procedure, output in each industry (represented by the expression $Q_t P_o / Q_o P_o$), is multiplied by its net output weight $Q_o P_o / \Sigma Q_o P_o$ to yield the individual industry contribution to output in year t, $Q_t P_o / \Sigma Q_o P_o$. Summing these gives the aggregate PVMP, $\Sigma Q_t P_o / \Sigma Q_o P_o$. This is not the same procedure as that followed by the CSS to produce the published figures. It is, however, argued to be close enough to the actual procedure to provide an indication of areas of agreement.

Clearly, the replication exercise conducted here has nothing to do with benchmarking - replication consists merely in trying to match the weighted sums of industry PVMPs with the published CSS aggregate estimates - most of which are for financial years. Where appropriate, these are converted to calendar year figures, using the ratio of financial to calendar PVMPs as conversion factor. Two sets of ratios of this type may be estimated, one from the unbenchmarked figures, and the other from the benchmarked figures. The latter are obtained from estimates of the former - suitably doctored. Differences between the two sets of ratios should be minimal (this is tested for in Step 14), but in a replication exercise, the correct ratios to use must be drawn from the unbenchmarked figures - those, after all, were what were available to the CSS to perform the original calculations.

Benchmarking, by contrast, is understood to be a process in which existing (incorrect) PVMPs are forced into correspondence with indices of Real Output - indirect volume indices generated from current price gross output estimates suitably deflated. It seems reasonable, from the very nature of this process, to expect the published PVMPs for individual industries to be approximately equal to the Real Output indices, and for their weighted sum to be roughly the same as the value of Real Output (Sum of Components) weighted by the same distribution (Net Output). Part of the differences that arise below may be explained by the fact that the DIY benchmarkings performed are done so at a different level of aggregation from those performed by the CSS. Several of the CSS major group results are built up from weighted sub-group PVMPs. The sub-group PVMPs are, however, not published. Nor indeed are the PPIs, if these differ from the somewhat sparse information given in publications such Statistical News Release No. P0142.4.

Bearing these limitations in mind, we may now look at a comparison between some approximations to 'real' (as opposed to 'pseudo') benchmarked figures, and their official published counterparts. This stage of the proceedings consists of four steps - **Step 10** is an attempt to replicate the CSS unbenchmarked PVMPs. **Step 11** tries to do the same with the benchmarked figures. **Step 12** contains estimates of the aggregate PVMP obtained from the 'New' dataset published by the CSS in SNR P3001 of 28 June 1993. Steps 11 and 12 contain, in addition, Real Output contributions weighted by net output. Steps 10, 11 and 12 each contain two separate sets of estimates of the PVMP. In order to construct these estimates, sets of weights are required. Reference was made in the discussion on linking in Chapter 2-6 to the fact that the weights in the latest estimates were those of each successive manufacturing census, 1979; 1982; 1985 and 1988. My reading of the way in which PVMPs were constructed was that both the benchmarked and unbenchmarked PVMPs were weighted by a set of 1984/85 net output figures.[2] The explanatory notes for the reconstructed estimates suggest that those estimates have not been weighted in the same way. Differences do result when different weightings are used, but these appear, for the most part, to be quite small. That being so, it will not matter greatly which set of weights is used. To check that this is indeed the case, in the calculations below, both the 1978/79 and the 1984/85 distributions of net output are used for weighting.

This manner of proceeding suggests that an approximation of the time reversal test devised by Fisher (and referred to in Chapter 2-4 above) be performed, if possible. As was stated in that chapter:

> "Time reversal requires that an index for year *t* based on year *o* should be the reciprocal of the index for *o* based on *t*." (UN, 1993, p384)

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2 As far as the unbenchmarked PVMPs are concerned, it might seem reasonable to have assumed that since the CSS did not use the 1985 manufacturing census results to perform the benchmarking operation as soon as they became available, they would not have made use of those results to reweight the unbenchmarked figures. This turns out not to have been the case. According to SNR P3041.3 of 12 September 1990, when the CSS rebased the PVMPs to the year 1985, they simultaneously reweighted the indices on the "...basis of the net output data derived from the 1985 Census of Manufacturing..." (pii). Why they did not perform the benchmarking operation at the same time is something of a mystery. The official explanation for the failure to do this (a shortage of skilled manpower) looks decidedly thin when one considers it in the light of the effort required to reweight the unbenchmarked estimates. It is hard to believe that with all the necessary data already stored in computer memories, the CSS could not find the time (for nearly two years!) to carry out the benchmarking, and so prevent all and sundry from working with incorrect data.

Or, as Hansen and Lucas put it:

> "...time reversal requires that time reversed indices be reciprocal, i.e, $P_{ot}.P_{to} = 1$..." (1984, p27).

It is of course obvious that neither Paasche nor Laspeyres indices have this property - the interest in performing the test is to see how great the departure from unity is. Although Hansen and Lucas state that the test for this property of indices is often ignored, it is used to indicate when it becomes inappropriate to use chained Laspeyres indices (UN, 1993, p389). The test is done before the main results have been presented because it suggests that the use of the relativities of different years does not greatly affect outcomes, at least not in the medium term.

From the 1978/79-weighted figures in Row 1208 of Table A2-6.S12i, the result for the year 1978/79 the PVMP estimated from the 'new' data using the OC deflator is 100,0 and for 1984/85, 123,8. Setting the latter year equal to 100,0 yields a 1978/79 figure of 80,8. The corresponding 1984/85-weighted figures in Table A2-6.S12ii are 100,0 for 1978/79 and 125,5 for 1984/85. One can see by inspection that the conditions for time reversal are quite close to being met - in this case $Q_{ot}.Q_{to}$ = 0,808 x 1,255, ie 1,0137. As can be seen, the failure to meet this criterion is not gross - in other words, at the aggregate level it should not make much difference which weights are used.

To continue with the discussion of the replication exercise, since all that was available to the CSS at the time was the set described above as the 'Old' figures, these are the ones that are used here. In **Step 13**, the 1984/85 weighted results from Step 12 are converted to calendar figures which may be compared with the corresponding CSS estimates.

Replicating published data, whether from the CSS or from any other source, is seldom simple. A glance at the two sets of estimates prepared in **Steps 10.i** and **10.ii** (Tables A2-6.S10i(b) and A2-6.S10ii) shows why. The totals obtained for the years 1981/82 and 1984/85 are close enough to suggest that the method used here approximates that used by the CSS. Unfortunately, the results obtained using the 1978/79 weights (Rows 939 and 941) are closer to the official estimates than those that make use of the 1984/85 weights (Rows 977 and 979). Still, the two sets of figures are nowhere much more than two percentage points apart, so they are probably acceptable.

A comparison of the two tables containing the 1978/79- and the 1984/85-weighted unbenchmarked (pre-census) PVMPs is instructive from the point of view of the impact which the shift from one base year to the other has on relative weights. The industry to watch is Other Chemicals - its contribution using the earlier weights rises by a little more than one percentage point from 8,6 in 1978/79 to 9,8 in 1984/85 (Table A2-6.S10i(b)) (Row 924). Using the 1984/85 weights, it grows by nearly two percentage points to 15,5 (Table A2-6.S10ii) (Row 961).[3]

So much for the unbenchmarked results. Checking the benchmarked figures should, it was imagined, have been a mere formality. Tables A2-6.S11i(c) and A2-6.S11ii(b) in **Steps 11.i** and **11.ii** show that this expectation was not met. In these tables, the CSS benchmarked individual and weighted aggregate PVMPs are compared with their Real Output counterparts, estimated from the 'Old' (non-revised) data in Table A2-6.D7 - all individual measures being expressed in the form of a proportional contribution to the total. There are two Real Output estimates for Other Chemicals, one derived from the OC PPI and the other from Petroleum PPI, but the two Other Chemicals PVMPs are obviously identical, as are the two aggregate PVMPs.

As far as the comparisons between the official PVMPs and the DIY PVMPs are concerned, both the 1978/79 and the 1984/85 weights give a reasonably good account of themselves when it comes to estimating the 1981/82 output levels. The difference between the official estimate and the 1978/79 weighted figure is a relatively small 1,2 percentage points (Rows 1088 and 1090), and that between the 1984/85 weighted figures is negligible (Rows 1162 and 1164). The 1984/85 results are, however, a considerable distance from the CSS figures. The totals in the DIY estimates come out at 121 (Row 1088) and 121,3 (Row 1162) as opposed to the CSS figure of 117,6. The Real Output (Sum of Components) estimates corroborate this finding - at least where the aggregates in which Other Chemicals deflated by the OC PPI are concerned (Rows 1088 and 1162) with the 1978/79 weighted figures being a little closer to the 1981/82 figure. In both sets of estimates, the 1984/85 result goes up - in the 1984/85 weighted results to 123 (Row 1162). The aggregates containing the Petroleum PPI deflated results get closer to the CSS figures than any other estimates. Unfortunately, though, when one looks to the differences between the individual PVMPs and Real Output figures for corroboration, one finds that Other Chemicals deflated by the Petroleum PPI is the only industry to register a difference exceeding one percentage point. This confirms, once more, the fact that the CSS has not treated Other Chemicals in the same way as it has the other industries in the benchmarking exercise.

3 At this point, it is probably worthwhile admitting to some confusion in the matter of weighting of the PVMPs. When the CSS publishes a note stating that '1984/85 weights have been used', that has been understood to mean that the weights of that year are held to apply for the currency of the particular base year in question, ie, for a period of five years or so. The 1984/85 or 1978/79 weights used here would either be extrapolated backward or forward to suit. Yet referring back to Chapter 2-6, it will be recalled that the reconstructed estimates are reweighted triennially, to coincide with census figures. This problem will simply be ignored until an explanation can be obtained from the CSS.

As may be expected, growth in the contribution of the Other Chemicals industry, consequent upon the substantial growth reflected in the benchmarked PVMP (compare the figures in Row 140 with those in Row 204) is large, especially when the OC PPI is used. Also as expected, the 1984/85 results yield larger contributions and larger growth, once again, though, muted when the Petroleum PPI is used.[4]

That which it was thought would be a straightforward, almost mechanical task has thrown up one of the more difficult of the problems encountered in the whole of the study. What seems to be a correct application of the CSS technique to what are thought to be the correct CSS data turns out a set of results which strongly suggest that the official figures under-estimate the 1984/85 output levels.[5] Had the errors gone the other way it would have occasioned some dismay - as it is, the revealed errors have served to strengthen my conviction that the CSS results are wrong. The little indication they provide of the reasons why this might be so point once again to the Other Chemicals industry.

Leaving aside this conundrum for the moment, we look in **Steps 12.i** and **12.ii** at a similar set of comparisons to those performed in Step 11, but this time using the 'New' data to estimate Real Output contributions. The 1984/85 weighted results (Table A2-6.S12ii) could, in fact, be regarded as a (crude) benchmarking exercise if it were not for the fact that the Sasol Syndrome makes the technique itself invalid. In other words, the CSS should have arrived at results something like those in Row 1208. It is not intended to work through all of the figures as was done in the case of the Step 11 results. Suffice it to say that the 1984/85 weighted 1984/85 OC Total deflated figure of 124.1 (Row 1250) is a very long way from the CSS's miserly 117,6.

In **Step 13.i** and **13.ii**, the Real Output (Sum of Components) estimates weighted by the 1984/85 distribution are converted to calendar year values. This provides a test of the validity of the argument offered in the first draft of 'More Problems...' that the 1985 output level was in the region of 115/116 as opposed to the CSS estimate of 109,5 (Meth, 1993, p50). The Table A2-6.S13i estimates make use of the ratio of benchmarked financial to calendar year figures (the incorrect ratios) to perform this operation, while the Table A2-6.S13ii figures derive from the corresponding unbenchmarked ratios - the 'correct' ratios. As may be seen in both instances, when the OC PPI is used, totals come out neatly between 115 and 116 (Rows

4 This is beginning to raise a problem similar to that experienced with the mining sector results at the rebasings from 1970 to 1975 and from there to 1980 (Meth, 1992, Table 3). The current prices weight contribution of the industry of 13,5 per cent in 1984/85 compares rather awkwardly with the constant price estimate.

5 Although every reasonable effort has been made to check the data inputs and arithmetical manipulations that generate these results, the possibility of error on my part can obviously not be ruled out. What is difficult to understand is the fact that the techniques and the data seem to generate the 'correct' results in all instances except this one.

1290 and 1331). Notice here that the dip in output levels between 1982 and 1985 from 116,8 to 109,5 (Meth, 1992, Table 14) reported by the CSS almost disappears, a result that would be of some consequence if all the figures with which we were working were not rendered obsolete by the reconstructed figures published in November 1993 and by net output-based estimates in Appendix 2-7.

As a final step in this process, the gross output-weighted estimates of Real Output (Sum of Components) ('New' data) given in Table A2-6.S2 are made comparable with the Table A2-6.S13i and ii results. The totals that include the Petroleum PPI deflated Other Chemical estimates (Row 478) and those that contain the OC PPI deflated figures (Row 479), are first expressed as indices with 1984/85 equal to 100. Both sets are then converted to calendar year values using both the benchmarked and unbenchmarked ratios from Table A2-6.D10. As may be seen from Rows 1355 and 1356, when the OC PPI applies, the 1984/85 results are very close to their net output-weighted counterparts in Rows 1290 and 1331 respectively. The Petroleum PPI-influenced results (Rows 1346 and 1347) produce similar correspondences (Rows 1287 and 1328).

Before leaving this part of the exercise, it is probably worthwhile drawing attention to the fact that reducing individual industry PVMPs (which have a base year value of 100) to their proportional contributions to total output by means of a weighting factor has the obvious effect of reducing differences between say Real Output indices and official PVMPs. It is therefore no contradiction to raise questions about the differences between the unweighted indices (ie, those with base year values of 100) whilst celebrating the fact that comparisons of weighted contributions yield acceptably small divergences.

It is one thing to claim that a particular index is wrong, citing as evidence, competing estimates prepared from other data. It is another matter altogether to show, using only part of the information that one suspects has or should have gone into the construction of the index under suspicion, exactly why it is wrong. Without access to the actual numbers and the arithmetic performed by the CSS, all that one can do is to work backwards from the final published results to see where the numerators or denominators implicit in these results differ from those which supposedly constitute, at least roughly, the basic data from which the estimates were constructed in the first place. So, to bring Stage II to a close, the few checks on the data that can be performed by outsiders are carried out - these are the stuff of **Step 14**.

Two different operations may be distinguished - the first of these is the process of estimating the financial year Real Gross Output figures (by industry) which are then used to benchmark the PVMPs. The second operation is that of estimating calendar year PVMPs from the financial year PVMPs generated in the first process. This *post mortem* of the 1984/85 aggregate PVMP commences with an examination of the latter process.

If I have understood the CSS's description of the benchmarking process correctly, then a comparison of corresponding ratios of calendar to financial year PVMPs for the unbenchmarked and benchmarked results by industry should reveal minimal divergences or differences. Some encouragement is provided by the outcome of **Step 14.i**, in which this test is carried out. Table A2-6.S14i(c) shows that in 46 out of 81 cases for the years 1978/79, 1981/82 and 1984/85 (1987/88 manufacturing census figures were not available when the benchmarking was carried out), the difference between these two was less than 1 percentage point. With few exceptions, notably in the last 4 industries in the table, there are no large differences. There are 14 instances in which the difference is zero - the probability of such an event occurring by chance must be extremely low. These results may therefore be assumed to confirm that the technique of benchmarking using the ratio of financial to calendar year estimates has indeed been correctly understood. Since the benchmarking process involves some massaging or panelbeating of the data, small differences between the expected and the actual ratios are bound to arise. Where the difference is roughly the same at the end of the period as it is at the beginning, as it is in the case of 'Other Chemicals', the growth rate between the two end-points is unaffected - all that such divergences do is to give rise to confusion in the user's mind, because there is no obvious reason why the original ratios could not have been used instead.

So much for the encouraging part of the process - the remainder of the exercise does little more than reveal an entirely inexplicable (at least, to an outsider like myself) set of differences between what are taken to be actual basic data, and the data implicit in the CSS's calculations. Earlier on in the analysis (Step 6), it was observed that the discrepancies between the official benchmarked PVMPs and the DIY calendar year output indices (pseudo benchmarked PVMPS) estimated from the financial year Real Output indices (based on the 'Old' data) in Step 3 were an indication of problems ahead. It is those problems which must now be confronted.

The process commences in **Step 14.ii**. Three pieces of information are to hand, or may readily be estimated from published data. There are official benchmarked PVMPs by industry, PPIs for most industries, and estimates from the manufacturing census of the value of gross output. Naturally, the PVMPs and PPIs extracted must be for financial years. Abstracting from the fact that actual benchmarking is somewhat more complex than the procedure used in this appendix, it is clear that since the benchmarked PVMPs are derived from the other two variables, the only way in which differences can arise is through these two variables. As far as the latter is concerned, the question of the vintage of the estimates of the gross output data has already been raised. It was argued (in the discussion of Steps 7 and 8) that the published benchmarked CSS results are all apparently based on the unrevised census figures. The clues provided to date on which set of gross output estimates are being deflated (chiefly the CSS letter of 3 July 1992) point strongly to the unrevised ('Old'), published manufacturing census estimates. The tests below therefore make use of these, and not the 'Revised' figures, and certainly not the 'New' figures.

The test in Step 14.ii is based on the rudimentary proposition that for individual industries, the official benchmarked financial year PVMPs in the census years should be equal (or at least approximately equal) to Real Output (the value of gross output measured in the manufacturing census deflated by the appropriate PPI). If this condition does not hold, it is difficult to imagine what else might be implied by the notion of the 'correspondence' which the CSS induces during the benchmarking process. Table A2-6.S14ii gives the results of this test. The differences between the two sets of figures are given in the 5th and 6th Columns of the table. Other Chemicals performs poorly when the Petroleum PPI is used, and several other industries do badly, especially for the year 1981/82. As may be seen, not many industries return the expected zero difference between the two estimates - looking at the 1984/85 results, the closest are the Clothing and the Basic Iron and Steel and Non-ferrous Metals industries. This must raise a question as to whether or not the test is appropriate - certainly, zero differences in three industries could not be held to constitute sufficient evidence for believing that it is valid. Yet it seems unthinkable that the PVMPs do not relate to the Real Output indices in the manner suggested.

Somewhat surprisingly, considering the fact that it seemed to be possible to replicate the 1981/82 results, the differences between the CSS PVMPs and Real Output indices for that year are apparently more extreme than those revealed in the 1984/85 results. Most importantly, though, in the case of the 1984/85 results, in only 6 of the 27 industries is the CSS financial year PVMP larger than the estimate of Real Gross Output. The smaller aggregate PVMP reported by the CSS flows directly from this. The question is, why do most of the CSS PVMPs differ so substantially from the estimates of Real Gross Output? And, in the case of the three industries identified above, why do they not? If the correct values of gross output in current prices have been used in the test (unrevised gross output figures taken from the manufacturing censuses) then the only other possibility is that different deflators (PPIs) have been used by the CSS.

Having established that substantial differences exist between the expected and the actual PVMPs, a search for the origin of the difference should be undertaken. Unfortunately, given the available information, a proper analysis is not possible. All that can be done is to highlight certain apparent divergences between the implicit values of one of the independent variables, the PPIs, and the actual published figures. This is done in **Step 14.iii**, where the implicit deflators underlying the CSS benchmarked estimates are compared with the published PPIs for each industry (insofar as individual PPIs are or were available). Unless the CSS has reason to believe that some of the PPIs are unreliable, and has chosen to use PPIs from elsewhere to deflate gross output in any particular industry, there should be no differences between the PPIs and the implicit deflators. Given an index of output and an estimate of the value of output in current prices for the same period, calculating the implicit deflator in any industry is simplicity itself. Table A2-6.S14iii shows how far the CSS implicit deflators depart from this expectation. In the case of the 1981/82 figures, in 8 of 27 observations, the difference between the two deflators is less than 1 percentage point, but some of the remaining divergences are very large. When the implicit deflator is larger than the PPI, the CSS benchmarked output estimates will naturally be smaller than the deflated values of gross output and *vice-versa.*

There are two industries for which the PPIs are almost certainly garbage - Other Manufactured Products and Scientific, Optical and Related Products (Professional). No index for the latter is available before July 1989, so the index for the former has been used. The values appearing in Table A2-6.S14iii are inconsistent with the other indices, but they have been checked, and are correctly reproduced in the table. Fortunately, these two industries make a relatively small contribution to total output. This is not the case with another important instance where the implicit deflators are larger than the PPIs, ie, in the important Other Chemicals industry. If the divergence between the OC PPI and the implicit deflator for 1984/85 of 7,3 percentage points (Row 1533) was thought to be high, that between the implicit deflator and the Petroleum PPI is huge - a stunning 35 percentage points! (Row 1532). This variation on the way in which the data is manipulated provides yet another piece of evidence against the use of the Petroleum PPI.

A decomposition exercise could be performed on every CSS result that differs from the expected value to ascertain the effects of the delinquent deflation reported on above. The merits of such an undertaking are not obvious - probably the best way to tackle the problems of non-correspondence unearthed above is to spend some time at the CSS head office, working through each individual estimate separately. Until such time as every divergence can be explained satisfactorily, the balance of the evidence favours the conclusion that if it had been appropriate to use indirect volume estimates prepared from gross output figures, then the revised set of output estimates offered above are a better reflection of the reality of manufacturing sector performance than the CSS figures. Of course, the net output-based figures show quite clearly that output levels were, in fact, much higher.

APPENDIX 2-6: Do-it-yourself benchmarking

LOAD BASIC DATA - Tables A2-6.D1 to A2-6.D11, Rows 57-406

STAGE I - PSEUDO BENCHMARKING

Row	Step	
410	1	Convert PPIs (Financial years) to 1984/85=100.
443	2	Estimate qtpo (qtpo = qtpt x po/pt) (3 sets of estimates)
481	3	Divide qtpo by qopo for each industry.
517	4	Compare with unbenchmarked PVMPs.
587	5	Compare with benchmarked PVMPs.
657	6	Check benchmkd PVMPs against 'new' Real Output
793	7	Divide total qtpo by total qopo.
805	8	Compare result with that obtained by deflating total qtpt by total PPI.
822	9(i)	Estimate calendar year real gross output: Sum of Components
842	9(ii)	Estimate calendar year real gross output: Total

STAGE II - INDUSTRY BENCHMARKING

851 STAGE II - ESTIMATE AGGREGATE PVMPs

Estimate financial year PVMPs by adding up sub-sectoral PVMPs using various datasets

872	10(i)	Unbenchmarked PVMPs, 1978/79 weights.
943	10(ii)	Unbenchmarked PVMPs, 1984/85 weights.
981	11(i)	Benchmarked PVMPs & 'Old' gross output data, 1978/79 weights.
1092	11(ii)	Benchmarked PVMPs & 'Old' gross output data, 1984/85 weights.
1173	12(i)	Benchmarked PVMPs & 'New' gross output data, 1978/79 weights.
1210	12(ii)	Benchmarked PVMPs & 'New' gross output data, 1984/85 weights.
1252	13(i)	Calendar year PVMPs from Step 12ii results (bnchmkd ratio)
1293	13(ii)	Calendar year PVMPs from Step 12ii results (unbnchmkd ratio)

1358 14 Investigate the differences in the 10 (iii) and (iv) estimates.

1363	14(i)	Compare ratios of calendar to financial year indices for b'mkd and unb'mkd CSS figures
1467	14(ii)	Compare CSS financial year PVMP (benchmarked) with with value of deflated non-revd gross output
1507	14(iii)	Check implicit deflators and compare with PPIs with PPIs

LOAD BASIC DATA

TABLE A2-6.D1

Jan-Dec values Production Price Index (1985=100)

	1979	1982	1985	1988
FOOD	44.3	71.5	100.0	153.2
BEVERAGES	58.5	77.7	100.0	146.6
TOBACCO	53.9	73.4	100.0	134.5
TEXTILES	53.2	73.3	100.0	168.2
CLOTHING	54.5	73.9	100.0	151.7
LEATHER	63.3	66.6	100.0	180.1
FOOTWEAR	49.9	73.6	100.0	159.6
WOOD	43.6	72.7	100.0	158.4
FURNITURE	48.2	76.0	100.0	149.1
PAPER	48.1	73.0	100.0	165.8
PRINTING	48.1	73.0	100.0	165.8
INDUSTRIAL CHEMICA	48.1	72.7	100.0	154.4
OTH CHEMICALS(Pet)	48.1	71.0	100.0	104.5
OTH CHEMICALS(OC)	48.1	72.7	100.0	154.4
RUBBER	51.8	73.1	100.0	133.7
PLASTIC	51.8	73.1	100.0	133.7
POTTERY	44.7	69.7	100.0	157.4
GLASS	44.7	69.7	100.0	157.4
OTHER NON-M MIN PR	44.7	69.7	100.0	157.4
BASIC IRON & STEEL	48.2	72.8	100.0	153.3
BASIC NON-FERR MET	47.0	64.8	100.0	146.1
METAL PRODUCTS	48.3	74.9	100.0	167.6
MACHINERY	48.5	72.6	100.0	154.7
ELECTRICAL MACHINE	49.5	71.0	100.0	148.4
MOTOR VEHICLES	45.0	67.2	100.0	193.9
TRANSPORT EQUIPMEN	45.0	67.2	100.0	193.9
PROFESSIONAL	71.5	87.5	100.0	111.6
OTHER MANUF PROD	71.5	87.5	100.0	111.6

Source: File SUMMARY.WK1

TABLE A2-6.D2

July-June values Production Price Index (1985=100)

	1978/79	1981/82	1984/85	1987/88
FOOD	41.4	69.5	93.0	143.7
BEVERAGES	56.9	71.3	96.6	137.8
TOBACCO	52.6	70.0	95.7	128.1
TEXTILES	50.7	69.4	91.5	153.9
CLOTHING	52.7	69.3	93.3	142.0
LEATHER	53.9	62.3	90.0	166.4
FOOTWEAR	44.5	70.4	91.1	151.9
WOOD	40.7	68.9	95.2	143.6
FURNITURE	46.7	71.9	95.8	139.8
PAPER	45.7	68.8	92.1	153.1
PRINTING	45.7	68.8	92.1	153.1
INDUSTRIAL CHEMICA	45.0	67.5	91.8	144.4
OTH CHEMICALS(Pet)	34.5	68.7	84.8	101.3
OTH CHEMICALS(OC)	45.0	67.5	91.8	144.4
RUBBER	48.4	68.8	89.4	123.2
PLASTIC	48.4	68.8	89.4	123.2
POTTERY	42.0	64.5	94.6	146.4
GLASS	42.0	64.5	[illegible]	[illegible]

OTHER NON-M MIN PR	42.0	64.5	94.6	146.4
BASIC IRON & STEEL	44.1	67.1	94.2	145.0
BASIC NON-FERR MET	43.2	60.8	89.9	133.0
METAL PRODUCTS	44.4	69.4	94.7	155.7
MACHINERY	45.9	66.8	92.9	144.6
ELECTRICAL MACHINE	46.1	66.5	90.2	137.2
MOTOR VEHICLES	42.6	61.7	90.8	177.8
TRANSPORT EQUIPMEN	42.6	61.7	90.8	177.8
PROFESSIONAL	66.2	84.8	99.0	109.7
OTHER MANUF PROD	66.2	84.8	99.0	109.7

Source: File SUMMARY.WK1

TABLE A2-6.D3 Unbenchmarked (pre-census)
Jan-Dec average Calendar Year PVMPs (1985=100)

	1979	1982	1985	1988
FOOD	86.2	96.6	100.0	108.9
BEVERAGES	70.6	92.2	100.0	117.4
TOBACCO	88.6	105.2	100.0	129.2
TEXTILES	100.9	126.9	100.0	110.0
CLOTHING	103.4	134.0	100.0	99.3
LEATHER	120.2	112.1	100.0	106.2
FOOTWEAR	95.0	100.0	100.0	100.3
WOOD	105.5	127.6	100.0	102.0
FURNITURE	119.0	140.6	100.0	107.9
PAPER	89.5	86.1	100.0	121.4
PRINTING	76.0	94.9	100.0	96.2
INDUSTRIAL CHEMICA	95.8	110.4	100.0	101.2
OTHER CHEMICALS	92.4	97.4	100.0	114.6
RUBBER	112.1	117.0	100.0	118.3
PLASTIC	73.5	86.7	100.0	104.7
POTTERY	155.1	130.1	100.0	119.2
GLASS	87.3	110.4	100.0	114.2
OTHER NON-M MIN PR	102.8	112.9	100.0	110.9
BASIC IRON & STEEL	100.1	91.2	100.0	104.8
BASIC NON-FERR MET	85.8	92.7	100.0	120.0
METAL PRODUCTS	105.4	115.9	100.0	96.0
MACHINERY	120.2	133.2	100.0	89.8
ELECTRICAL MACHINE	96.2	121.3	100.0	117.4
MOTOR VEHICLES	117.1	173.8	100.0	126.8
TRANSPORT EQUIPMEN	157.0	175.5	100.0	83.1
PROFESSIONAL	92.2	109.1	100.0	115.5
OTHER MANUF PROD	85.9	100.5	100.0	131.3

Source: File SUMMARY.WK1

TABLE A2-6.D4 Unbenchmarked (pre-census)
July-June average Financial Year PVMPs (1985=100)

	1978/79	1981/82	1984/85	1987/88
FOOD	81.4	94.8	99.6	106.4
BEVERAGES	69.4	92.2	102.2	112.7
TOBACCO	84.5	101.2	100.8	129.4
TEXTILES	95.2	135.2	98.6	109.1
CLOTHING	97.5	141.3	108.1	100.6
LEATHER	116.1	113.7	105.2	103.7
FOOTWEAR	94.5	109.6	103.4	93.7
WOOD	93.5	129.9	103.7	102.1
FURNITURE	109.3	144.3	101.0	101.[illegible]

PAPER	83.8	89.1	97.5	114.2
PRINTING	73.1	93.5	109.5	93.2
INDUSTRIAL CHEMICA	93.5	116.0	101.4	100.0
OTHER CHEMICALS	90.0	101.6	102.4	105.0
RUBBER	113.5	130.8	101.3	110.4
PLASTIC	67.2	87.1	91.9	98.0
POTTERY	140.7	163.1	102.6	117.8
GLASS	88.1	117.7	110.0	114.7
OTHER NON-M MIN PR	96.1	118.3	107.9	102.8
BASIC IRON & STEEL	92.2	100.6	95.3	106.2
BASIC NON-FERR MET	76.9	93.9	102.6	112.2
METAL PRODUCTS	107.3	121.5	99.5	92.8
MACHINERY	105.7	135.5	110.8	85.1
ELECTRICAL MACHINE	94.4	124.3	106.5	111.3
MOTOR VEHICLES	121.2	190.1	117.6	118.7
TRANSPORT EQUIPMEN	152.7	176.4	110.9	79.2
PROFESSIONAL	89.8	110.5	95.0	112.3
OTHER MANUF PROD	79.6	107.1	96.2	132.7

Source: File SUMMARY.WK1

TABLE A2-6.D5 Benchmarked Calendar Year PVMPs
Jan-Dec average non-revised data (1985=100)

	1979	1982	1985	1988
FOOD	89.8	95.2	100.0	107.1
BEVERAGES	58.1	87.5	100.0	117.4
TOBACCO	75.1	95.1	100.0	112.6
TEXTILES	98.3	113.0	100.0	105.4
CLOTHING	83.1	119.8	100.0	99.3
LEATHER	87.2	109.2	100.0	102.8
FOOTWEAR	95.0	100.0	100.0	106.5
WOOD	91.2	105.1	100.0	102.0
FURNITURE	72.5	120.4	100.0	107.9
PAPER	76.7	82.5	100.0	121.4
PRINTING	76.0	94.9	100.0	96.2
INDUSTRIAL CHEMICA	96.1	109.8	100.0	101.2
OTHER CHEMICALS	70.6	88.6	100.0	115.2
RUBBER	92.6	114.0	100.0	118.3
PLASTIC	64.2	86.7	100.0	118.3
POTTERY	78.6	94.2	100.0	119.2
GLASS	88.4	110.3	100.0	114.2
OTHER NON-M MIN PR	99.9	106.6	100.0	110.9
BASIC IRON & STEEL	107.3	98.8	100.0	104.9
BASIC NON-FERR MET	95.9	99.1	100.0	125.7
METAL PRODUCTS	95.0	114.7	100.0	95.0
MACHINERY	102.0	133.1	100.0	88.4
ELECTRICAL MACHINE	87.4	112.1	100.0	117.4
MOTOR VEHICLES	88.2	133.2	100.0	126.8
TRANSPORT EQUIPMEN	153.0	151.2	100.0	87.9
PROFESSIONAL	63.9	87.9	100.0	115.5
OTHER MANUF PROD	115.8	116.0	100.0	121.8

Source: File SUMMARY.WK1

TABLE A2-6.D6 Benchmarked Financial Year PVMPs
July-June average non-revised data (1985=100)

	1978/79	1981/82	1984/85	1987/88
FOOD	95.1	93.7	[illegible]	[illegible]

BEVERAGES	56.8	86.8	103.2	112.7
TOBACCO	71.4	90.9	100.8	112.9
TEXTILES	94.7	119.9	99.4	103.8
CLOTHING	78.7	124.8	108.0	100.6
LEATHER	82.4	108.4	109.3	98.8
FOOTWEAR	94.5	109.6	103.4	96.4
WOOD	83.6	102.2	104.6	102.1
FURNITURE	65.6	118.0	101.0	101.9
PAPER	72.2	85.7	102.5	114.2
PRINTING	73.1	93.5	109.5	93.2
INDUSTRIAL CHEMICA	94.6	116.7	101.6	100.0
OTHER CHEMICALS	71.1	89.9	105.3	107.7
RUBBER	92.4	121.3	103.6	110.4
PLASTIC	58.2	87.1	91.9	113.3
POTTERY	69.3	116.0	102.6	117.8
GLASS	86.1	117.7	110.0	114.7
OTHER NON-M MIN PR	93.7	111.9	106.6	102.8
BASIC IRON & STEEL	99.4	108.8	95.0	106.3
BASIC NON-FERR MET	86.2	100.8	102.9	117.5
METAL PRODUCTS	97.2	119.2	101.0	92.6
MACHINERY	91.0	133.4	109.8	84.1
ELECTRICAL MACHINE	83.9	114.8	107.5	111.3
MOTOR VEHICLES	92.4	145.0	114.4	118.7
TRANSPORT EQUIPMEN	153.6	161.9	107.9	84.2
PROFESSIONAL	61.7	82.6	100.6	112.3
OTHER MANUF PROD	118.0	129.1	104.6	121.3

Source: File SUMMARY.WK1

TABLE A2-6.D7 Published Manufacturing Census Output Estimates (old data)

	1978/79 Gross Output R mill	1978/79 Net Output R mill	1981/82 Gross Output R mill	1981/82 Net Output R mill	1984/85 Gross Output R mill	1984/85 Net Output R mill
Food	4451.0	1307.5	7750.5	2317.9	11576.3	3587.5
Beverage	891.7	299.0	1750.1	638.3	2715.6	847.6
Tobacco	188.4	67.4	319.6	53.5	502.5	168.5
Textiles	1581.9	601.3	2546.4	985.3	2958.9	1152.5
Clothing	796.7	333.9	1499.6	656.9	1933.8	915.2
Leather	145.4	48.6	219.9	77.1	358.4	123.0
Footwear	283.4	126.0	521.3	252.0	646.5	309.1
Wood	414.9	181.4	845.7	398.5	1225.9	575.9
Furniture	279.5	135.0	662.9	324.5	913.7	447.9
Paper	1024.4	422.8	1618.3	657.4	2988.8	1286.6
Printing	707.2	414.8	1366.9	798.3	2030.4	1191.7
Industrial Chemica	1732.6	554.2	3083.9	971.3	3761.9	1302.4
Other Chemicals	3030.4	974.0	5891.6	1975.0	9479.0	4832.6
Rubber	420.6	200.0	769.0	404.6	904.9	444.0
Plastic	485.7	205.3	1183.6	502.3	1438.5	653.4
Pottery	30.2	18.1	77.3	52.3	103.3	62.9
Glass	178.4	94.0	382.4	216.5	501.8	270.0
Other Non-metal Mi	883.5	449.1	1644.6	839.9	2312.9	1264.7
Basic iron	2782.8	1172.6	4624.0	1929.1	5684.1	2391.2
Basic non-ferrous	945.3	354.8	1553.1	580.3	2346.6	939.4
Metal Products	2522.0	997.1	5009.8	2134.6	5820.1	2394.4
Machinery	1658.3	743.0	3740.4	1758.1	4352.4	1974.2
Electrical machine	1398.2	592.6	2776.5	[illegible]	[illegible]	[illegible]

Motor vehicles	1916.6	558.7	4265.5	1335.2	5113.9	1541.5
Transport equipmen	551.9	241.7	724.5	296.0	730.8	432.7
Professional	78.6	35.6	157.7	74.3	308.1	151.8
Other manufacturin	546.8	159.3	750.3	260.8	811.2	349.6
TOTAL	29926.6	11287.6	55735.6	21653.6	75092.2	31143.5
Check	29926.4	11287.8	55735.4	21653.5	75092.2	31143.1

Source: SAS 90, pp12.19-12.21. (File SUMMARY.WK1)

TABLE A2-6.D8 (Revised data)
Insert Revised Manufacturing Census Output Estimates
as per FAX from Herman Riekert of 6 November 1992
and estimate net output assuming ratio of net to
gross output does not change from original value.

	1978/79 Gross Output R mill	1978/79 Net Output R mill	1981/82 Gross Output R mill	1981/82 Net Output R mill	1984/85 Gross Output R mill	1984/85 Net Output R mill
Food	4451.0	1307.5	7750.5	2317.9	11576.3	3587.5
Beverage	891.7	299.0	1750.1	638.3	2715.6	847.6
Tobacco	188.4	67.4	319.6	53.5	502.5	168.5
Textiles	1581.9	601.3	2546.4	985.3	2958.9	1152.5
Clothing	796.7	333.9	1499.6	656.9	1933.8	915.2
Leather	145.4	48.6	219.9	77.1	335.9	115.3
Footwear	283.4	126.0	521.3	252.0	646.5	309.1
Wood	414.9	181.4	845.7	398.5	1225.9	575.9
Furniture	279.5	135.0	686.0	335.8	913.7	447.9
Paper	1024.4	422.8	1835.4	745.6	2988.8	1286.6
Printing	707.2	414.8	1366.9	798.3	2030.4	1191.7
Industrial Chemica	1732.6	554.2	3304.4	1040.8	3895.0	1348.5
Other Chemicals	2862.9	920.2	6912.9	2317.4	10095.9	5147.1
Rubber	420.6	200.0	769.0	404.6	904.9	444.0
Plastic	485.7	205.3	963.1	408.7	1438.5	653.4
Pottery	30.2	18.1	77.3	52.3	103.3	62.9
Glass	178.4	94.0	382.4	216.5	501.8	270.0
Other Non-metal Mi	883.5	449.1	1644.6	839.9	2312.9	1264.7
Basic iron	2782.8	1172.6	4624.0	1929.1	5684.1	2391.2
Basic non-ferrous	759.6	285.1	1263.6	472.1	1883.0	753.8
Metal Products	2522.0	997.1	4962.8	2114.6	5796.0	2384.5
Machinery	1658.3	743.0	3740.4	1758.1	4307.0	1953.6
Electrical machine	1398.2	592.6	2729.8	1143.9	3504.1	1503.7
Motor vehicles	1916.6	558.7	4265.5	1335.2	5020.2	1513.3
Transport equipmen	551.9	241.7	724.5	296.0	730.8	432.7
Professional	78.6	35.6	157.7	74.3	264.8	130.5
Other manufacturin	546.8	159.3	706.5	245.6	750.1	323.3
TOTAL	29573.2	11164.3	56569.8	21908.2	75020.8	31174.9
Check old total	29926.6	11287.8	55735.6	21653.5	75092.2	31143.1

TABLE A2-6.D9 Published Manufacturing Census Output Estimates (new data)

	1978/79 Gross Output R mill	1978/79 Net Output R mill	1981/82 Gross Output R mill	1981/82 Net Output R mill	1984/85 Gross Output R mill	1984/85 Net Output R mill	1987/88 Gross Output R mill	1987/88 Net Output R mill
Food	4451.0	1307.5	7815.6	2365.0	11576.3	3587.5	17835.4	5864.8
Beverage	908.2	315.5	1690.3	593.0	2867.5	891.8	4748.6	1760.2
Tobacco	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Textiles	1505.1	567.1	2530.6	981.9	2998.4	1169.3	4940.0	2078.4
Clothing	791.2	332.6	1529.5	671.3	1933.8	915.2	3064.9	1347.7
Leather	145.4	48.6	219.9	77.1	335.9	115.2	588.1	216.9
Footwear	283.4	126.0	521.3	252.0	646.5	309.1	1153.7	539.5
Wood	430.8	192.3	876.3	413.4	1225.9	575.9	1970.2	975.4
Furniture	279.5	135.0	686.0	334.6	913.7	448.0	1632.7	727.1
Paper	1016.9	413.5	1851.2	844.4	3047.5	1311.8	5660.1	2358.1
Printing	707.2	414.8	1366.9	798.3	2030.4	1191.7	3286.6	1828.0
Industrial Chemica	1818.1	591.6	3304.4	1046.1	4237.3	1469.3	6363.6	2290.2
Other Chemicals	3030.4	974.0	5938.7	1992.3	9728.8	4956.9	13307.8	5972.4
Rubber	420.6	200.0	769.0	404.6	904.9	444.0	1521.8	736.4
Plastic	485.7	205.3	953.7	420.6	1438.5	653.4	2802.5	1189.0
Pottery	30.2	18.1	77.3	52.3	103.3	63.0	152.1	103.3
Glass	178.4	94.0	382.4	216.5	501.8	270.0	934.4	525.9
Other Non-metal Mi	883.5	449.1	1644.6	839.9	2312.9	1264.8	3410.2	1775.0
Basic iron	2782.8	1172.6	4624.0	1929.1	5684.1	2391.2	9111.5	3506.8
Basic non-ferrous	759.6	285.1	1263.6	472.2	1883.0	754.7	2833.1	1081.4
Metal Products	2522.0	997.1	4962.8	2110.8	5953.9	2506.9	7938.0	3522.4
Machinery	1731.8	775.2	3740.4	1758.1	4149.1	1880.5	6638.8	2660.5
Electrical machine	1398.2	592.6	2729.8	1144.8	3504.1	1502.4	5857.5	2364.1
Motor vehicles	1916.6	558.7	4265.5	1335.2	5020.2	1515.0	8641.8	2667.2
Transport equipmen	478.4	209.4	724.5	296.0	730.8	432.7	1287.4	752.8
Professional	78.6	35.6	157.7	74.3	264.8	136.6	476.0	223.2
Other manufacturin	546.8	159.3	706.5	240.6	812.5	328.2	1355.2	450.9
TOTAL	29768.9	11237.9	55651.9	21717.9	75351.1	31296.5	118242.8	47783.1
Check	29768.9	11237.9	55651.9	21717.8	75351.1	31296.5	118242.8	47783.1

Source: SNR P3001, 28 June 1993. (File SUMMARY.WK1)

Table A2-6.D10 - Financial and Calendar Year PVMPs, Total Manufacturing

Summary:	1978/79	1979	1981/82	1982	1984/85	1985	1987/88	1988
Benchmarked	87.9	91.3	110.5	106.6	103.3	100.0	104.4	108.5
Unbenchmarked	90.9	95.5	113.0	108.7	102.3	100.0	104.3	108.7
Ratios of Calendar to Financial Year PVMPs								
Benchmarked		1.0393		0.9641		0.9682		1.0393
Unbenchmarked		1.0510		0.9619		0.9778		1.0423

Source: File OUT85-6.WK1

TABLE A2-6.D11 Check validity of assumption on net to gross output
used to derive Net Output values in Table A2-6.D8 above

	Net to Gross Output ratios 'Old' data (TA2-6.D8)			Net to Gross Output ratios 'New' data in TA2-6.D9			'Old' minus 'New'		
	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85
Food	29.4	29.9	31.0	29.4	30.3	31.0	-0.0	-0.4	-0.0
Beverage	33.5	36.5	31.2	34.7	35.1	31.1	-1.2	1.4	0.1
Tobacco	35.8	16.7	33.5	35.8	16.7	38.7	-0.0	0.0	-5.2
Textiles	38.0	38.7	39.0	37.7	38.8	39.0	0.3	-0.1	-0.0
Clothing	41.9	43.8	47.3	42.0	43.9	47.3	-0.1	-0.1	-0.0
Leather	33.4	35.1	34.3	33.4	35.1	34.3	0.0	-0.0	0.0
Footwear	44.5	48.3	47.8	44.5	48.3	47.8	0.0	0.0	-0.0
Wood	43.7	47.1	47.0	44.6	47.2	47.0	-0.9	-0.1	-0.0
Furniture	48.3	49.0	49.0	48.3	48.8	49.0	-0.0	0.2	-0.0
Paper	41.3	40.6	43.0	40.7	45.6	43.0	0.6	-5.0	0.0
Printing	58.7	58.4	58.7	58.6	58.4	58.7	0.0	0.0	-0.0
Industrial Chemica	32.0	31.5	34.6	32.5	31.7	34.7	-0.6	-0.2	-0.1
Other Chemicals	32.1	33.5	51.0	32.1	33.5	51.0	-0.0	-0.0	0.0
Rubber	47.6	52.6	49.1	47.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Plastic	42.3	42.4	45.4	42.3	44.1	45.4	0.0	-1.7	-0.0
Pottery	59.9	67.7	60.9	59.9	67.6	61.0	0.0	0.1	-0.1
Glass	52.7	56.6	53.8	52.7	56.6	53.8	0.0	-0.0	0.0
Other Non-metal Mi	50.8	51.1	54.7	50.8	51.1	54.7	0.0	-0.0	-0.0
Basic iron	42.1	41.7	42.1	42.1	41.7	42.1	-0.0	-0.0	-0.0
Basic non-ferrous	37.5	37.4	40.0	37.5	37.4	40.1	0.0	-0.0	-0.0
Metal Products	39.5	42.6	41.1	39.5	42.5	42.1	0.0	0.1	-1.0
Machinery	44.8	47.0	45.4	44.8	47.0	45.3	0.0	-0.0	0.0
Electrical machine	42.4	41.9	42.9	42.4	41.9	42.9	0.0	-0.0	0.0
Motor vehicles	29.2	31.3	30.1	29.1	31.3	30.2	0.0	-0.0	-0.0
Transport equipmen	43.8	40.9	59.2	43.8	40.8	59.2	0.0	0.0	-0.0
Professional	45.3	47.1	49.3	45.3	47.1	51.6	0.0	-0.0	-2.3
Other manufacturin	29.1	34.8	43.1	29.1	34.0	40.4	0.0	0.7	2.7
TOTAL	37.7	38.9	41.5	37.8	39.0	41.5	-0.0	-0.2	-0.1

STAGE I - PSEUDO BENCHMARKING

STEP 1. Convert PPIs with base 1985=100 in Table A2-6.D2 to base 1984/85=100

TABLE A2-6.S1 Financial years

Additional PPIs from P3041.3 12 November 1993, p37. 1990=100

TABLE A2-6.S1	1978/79	1981/82	1984/85	1987/88		1978/79	1981/82	1984/85	1987/88
Food	44.6	74.7	100.0	154.5					
Beverage	58.8	73.8	100.0	142.6					
Tobacco	55.0	73.2	100.0	133.9					
Textiles	55.4	75.8	100.0	168.2					
Clothing	56.5	74.2	100.0	152.3					
Leather	59.9	69.2	100.0	185.0					
Footwear	48.8	77.2	100.0	166.7					
Wood	42.8	72.3	100.0	150.9					
Furniture	48.8	75.0	100.0	145.8					
Paper	49.6	74.7	100.0	166.3					
Printing	49.6	74.7	100.0	166.3		23.0	45.8	56.4	67.4
Industrial Chemica	49.1	73.5	100.0	157.3	PET&COAL	40.8	81.2	100.0	119.5
Oth Chemicals(Pet)	40.7	81.1	100.0	119.5					
Oth Chemicals(OC)	49.1	73.5	100.0	157.3					
Rubber	54.1	77.0	100.0	137.8		22.1	33.4	45.5	71.2
Plastic	54.1	77.0	100.0	137.8	PLASTIC	48.6	73.4	100.0	156.5
Pottery	44.4	68.2	100.0	154.8					
Glass	44.4	68.2	100.0	154.8					
Other Non-metal Mi	44.4	68.2	100.0	154.8					
Basic iron	46.9	71.3	100.0	154.0					
Basic non-ferrous	48.1	67.6	100.0	147.8					
Metal Products	46.9	73.3	100.0	164.4					
Machinery	49.4	71.9	100.0	155.6					
Electrical machine	51.1	73.8	100.0	152.1					
Motor vehicles	47.0	68.0	100.0	195.8					
Transport equipmen	47.0	68.0	100.0	195.8		22.1	33.4	45.5	71.2
Professional	66.9	85.7	100.0	110.8	PROF	48.6	73.4	100.0	156.5
Other manufacturin	66.9	85.7	100.0	110.8	OTHER	48.6	73.4	100.0	156.5

STEP 2. Estimate qtpo for 1978/79, 81/82, 84/85 & 87/88 (qtpo = qtpt x po/pt)
Nominal value of gross output multiplied by price in base year
divided by price in year "t" = Real Gross Output in year "t".
base year = 1984/85

'Old' data (T A2-6.D7) 'Revised' data (T A2-6.D8) 'New' data (T A2-6.D9)

TABLE A2-6.S2 qtpo qtpo qopo qtpo qtpo qopo qtpo qtpo

	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1987/88
Food	9986.0	10372.0	11576.3	9986.0	10372.0	11576.3	9986.0	10459.1	11576.3	11540.9
Beverage	1515.6	2372.5	2715.6	1515.6	2372.5	2715.6	1543.6	2291.4	2867.5	3330.6
Tobacco	342.7	436.7	502.5	342.7	436.7	502.5	342.7	436.7	545.2	545.7
Textiles	2855.9	3357.9	2958.9	2855.9	3357.9	2958.9	2717.2	3337.0	2998.4	2936.3
Clothing	1409.9	2020.0	1933.8	1409.9	2020.0	1933.8	1400.2	2060.2	1933.8	2013.0
Leather	242.6	317.6	358.4	242.6	317.6	335.9	242.6	317.6	335.9	318.0
Footwear	580.7	675.1	646.5	580.7	675.1	646.5	580.7	675.1	646.5	692.2
Wood	970.2	1169.1	1225.9	970.2	1169.1	1225.9	1007.3	1211.4	1225.9	1305.8
Furniture	573.1	883.6	913.7	573.1	914.4	913.7	573.1	914.4	913.7	1119.5
Paper	2065.0	2166.3	2988.8	2065.0	2456.8	2988.8	2049.9	2478.0	3047.5	3404.6
Printing	1425.6	1829.7	2030.4	1425.6	1829.7	2030.4	1425.6	1829.8	2030.4	1976.9
Industrial Chemica	3530.4	4193.9	3761.9	3530.4	4493.8	3895.0	3704.7	4493.8	4237.3	4044.5
Oth Chemicals(Pet)	7452.8	7267.1	9479.0	7040.8	8526.9	10095.9	7452.7	7325.2	9728.8	11140.0
Oth Chemicals(OC)	6174.9	8012.2	9479.0	5833.6	9401.2	10095.9	6174.9	8076.3	9728.8	8458.1
Rubber	777.2	999.2	904.9	777.2	999.2	904.9	777.3	999.2	904.9	1104.4
Plastic	897.5	1537.9	1438.5	897.5	1251.4	1438.5	897.6	1239.2	1438.5	2033.8
Pottery	68.0	113.3	103.3	68.0	113.3	103.3	67.9	113.4	103.3	98.3
Glass	401.6	560.7	501.8	401.6	560.7	501.8	401.7	560.6	501.8	603.8
Other Non-metal Mi	1989.0	2411.2	2312.9	1989.0	2411.2	2312.9	1989.0	2411.2	2312.9	2203.5
Basic iron	5935.7	6485.7	5684.1	5935.7	6485.7	5684.1	5935.8	6485.7	5684.1	5915.2
Basic non-ferrous	1966.4	2297.9	2346.6	1580.0	1869.5	1883.0	1580.0	1869.5	1883.0	1916.4
Metal Products	5380.8	6835.3	5820.1	5380.8	6771.2	5796.0	5380.8	6771.2	5953.9	4828.9
Machinery	3355.0	5200.3	4352.4	3355.0	5200.3	4307.0	3503.8	5200.3	4149.1	4266.0
Electrical machine	2737.2	3763.1	3571.9	2737.2	3699.8	3504.1	2737.2	3699.8	3504.1	3850.0
Motor vehicles	4080.8	6273.2	5113.9	4080.8	6273.2	5020.2	4080.8	6273.1	5020.2	4412.6
Transport equipmen	1175.1	1065.5	730.8	1175.1	1065.5	730.8	1018.6	1065.5	730.8	657.3
Professional	117.5	184.1	308.1	117.5	184.1	264.8	117.5	184.1	264.8	429.5
Other manufacturin	817.3	875.8	811.2	817.3	824.7	750.1	817.3	824.7	812.5	1222.8
Total Eqtpo (Pet)	62649.6	75664.8	75092.2	61851.3	76652.2	75020.8	62331.6	75527.2	75351.1	77910.4
Total Eqtpo (OC)	61371.7	76409.9	75092.2	60644.1	77526.5	75020.8	61053.8	76278.3	75351.1	75228.6

STEP 3. Divide qtpo by qopo for each industry.
Value of Real Gross Output in year "t" divided by value of output in base year x 100.

TABLE A2-6.S3	'Old' data (T A2-6.D7)			'Revised' data (T A2-6.D8)			'New' data (T A2-6.D9)			
	qtpo/qopo	qtpo/qopo	qopo/qopo	qtpo/qopo	qtpo/qopo	qopo/qopo	qtpo/qopo	qtpo/qopo	qopo/qopo	qtpo/qopo
	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1987/88
Food	86.3	89.6	100.0	86.3	89.6	100.0	86.3	90.3	100.0	99.7
Beverage	55.8	87.4	100.0	55.8	87.4	100.0	53.8	79.9	100.0	116.1
Tobacco	68.2	86.9	100.0	68.2	86.9	100.0	62.9	80.1	100.0	100.1
Textiles	96.5	113.5	100.0	96.5	113.5	100.0	90.6	111.3	100.0	97.9
Clothing	72.9	104.5	100.0	72.9	104.5	100.0	72.4	106.5	100.0	104.1
Leather	67.7	88.6	100.0	72.2	94.6	100.0	72.2	94.6	100.0	94.7
Footwear	89.8	104.4	100.0	89.8	104.4	100.0	89.8	104.4	100.0	107.1
Wood	79.1	95.4	100.0	79.1	95.4	100.0	82.2	98.8	100.0	106.5
Furniture	62.7	96.7	100.0	62.7	100.1	100.0	62.7	100.1	100.0	122.5
Paper	69.1	72.5	100.0	69.1	82.2	100.0	67.3	81.3	100.0	111.7
Printing	70.2	90.1	100.0	70.2	90.1	100.0	70.2	90.1	100.0	97.4
Industrial Chemica	93.8	111.5	100.0	90.6	115.4	100.0	87.4	106.1	100.0	95.4
Oth Chemicals(Pet)	78.6	76.7	100.0	69.7	84.5	100.0	76.6	75.3	100.0	114.5
Oth Chemicals(OC)	65.1	84.5	100.0	57.8	93.1	100.0	63.5	83.0	100.0	86.9
Rubber	85.9	110.4	100.0	85.9	110.4	100.0	85.9	110.4	100.0	122.0
Plastic	62.4	106.9	100.0	62.4	87.0	100.0	62.4	86.1	100.0	141.4
Pottery	65.8	109.7	100.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Glass	80.0	111.7	100.0	80.0	111.7	100.0	80.0	111.7	100.0	120.3
Other Non-metal Mi	86.0	104.3	100.0	86.0	104.3	100.0	86.0	104.2	100.0	95.3
Basic iron	104.4	114.1	100.0	104.4	114.1	100.0	104.4	114.1	100.0	104.1
Basic non-ferrous	83.8	97.9	100.0	83.9	99.3	100.0	83.9	99.3	100.0	101.8
Metal Products	92.5	117.4	100.0	92.8	116.8	100.0	90.4	113.7	100.0	81.1
Machinery	77.1	119.5	100.0	77.9	120.7	100.0	84.4	125.3	100.0	102.8
Electrical machine	76.6	105.4	100.0	78.1	105.6	100.0	78.1	105.6	100.0	109.9
Motor vehicles	79.8	122.7	100.0	81.3	125.0	100.0	81.3	125.0	100.0	87.9
Transport equipmen	160.8	145.8	100.0	160.8	145.8	100.0	139.4	145.8	100.0	90.0
Professional	38.1	59.7	100.0	44.4	69.5	100.0	44.4	69.5	100.0	162.2
Other manufacturin	100.8	108.0	100.0	109.0	109.9	100.0	100.6	101.5	100.0	150.5

STEP 4. Compare indices of Real Gross Output in Table A2-6.S3 for each industry in STEP 3 with corresponding unbenchmarked PVMPs.

i) Convert unbenchmarked financial year PVMPs in Table A2-6.D4 from base 1985=100 to 1984/85=100

TABLE A2-6.S4i

	1978/79	1981/82	1984/85	1987/88
Food	81.7	95.2	100.0	106.9
Beverage	67.9	90.2	100.0	110.3
Tobacco	83.9	100.4	100.0	128.4
Textiles	96.6	137.2	100.0	110.7
Clothing	90.1	130.7	100.0	93.0
Leather	110.4	108.1	100.0	98.5
Footwear	91.4	106.0	100.0	90.7
Wood	90.1	125.2	100.0	98.5
Furniture	108.3	142.9	100.0	100.9
Paper	86.0	91.4	100.0	117.2
Printing	66.7	85.5	100.0	85.1
Industrial Chemica	92.2	114.4	100.0	98.7
Other Chemicals	87.8	99.2	100.0	102.6
Rubber	112.1	129.2	100.0	109.0
Plastic	73.1	94.8	100.0	106.7
Pottery	137.1	159.0	100.0	114.8
Glass	80.2	107.1	100.0	104.3
Other Non-metal Mi	89.1	109.6	100.0	95.3
Basic iron	96.8	105.6	100.0	111.5
Basic non-ferrous	75.0	91.6	100.0	109.5
Metal Products	107.9	122.1	100.0	93.3
Machinery	95.4	122.3	100.0	76.8
Electrical machine	88.6	116.7	100.0	104.5
Motor vehicles	103.1	161.7	100.0	101.0
Transport equipmen	137.6	159.0	100.0	71.4
Professional	94.6	116.4	100.0	118.3
Other manufacturin	82.8	111.4	100.0	138.0

ii) Difference between Real Gross Output and unbenchmarked PVMPs. (values in Table A2-6.S3 minus those in Table A2-6.S4i)

	'Old' data (T A2-6.D7)			'Revised' data (T A2-6.D8)			'New' data (T A2-6.D9)			
TABLE A2-6.S4ii	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1987/88
Food	4.6	0.9	0.0	4.6	-5.6	0.0	4.6	-4.8	0.0	-7.2
Beverage	-12.1	1.0	0.0	-12.1	-2.9	0.0	-14.1	-10.3	0.0	5.8
Tobacco	-15.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				

Textiles	-0.1	0.8	0.0	-0.1	-23.7	0.0	-6.0	-25.9	0.0	-12.8
Clothing	-17.2	0.8	0.0	-17.2	-26.2	0.0	-17.7	-24.2	0.0	11.0
Leather	-42.7	0.8	0.0	-38.1	-13.5	0.0	-38.1	-13.5	0.0	-3.9
Footwear	-1.6	1.0	0.0	-1.6	-1.6	0.0	-1.6	-1.6	0.0	16.4
Wood	-11.0	0.8	0.0	-11.0	-29.9	0.0	-8.0	-26.4	0.0	8.1
Furniture	-45.5	0.7	0.0	-45.5	-42.8	0.0	-45.5	-42.8	0.0	21.6
Paper	-16.9	0.8	0.0	-16.9	-9.2	0.0	-18.7	-10.1	0.0	-5.5
Printing	3.5	1.1	0.0	3.5	4.7	0.0	3.5	4.7	0.0	12.3
Industrial Chemica	1.6	1.0	0.0	-1.6	0.9	0.0	-4.8	-8.4	0.0	-3.2
Oth Chemicals(Pet)	-9.2	0.8	0.0	-18.1	-14.7	0.0	-11.2	-23.9	0.0	11.9
Oth Chemicals(OC)	-22.7	0.9	0.0	-30.1	-6.1	0.0	-24.4	-16.2	0.0	-15.6
Rubber	-26.2	0.9	0.0	-26.2	-18.8	0.0	-26.2	-18.8	0.0	13.1
Plastic	-10.7	1.1	0.0	-10.7	-7.8	0.0	-10.7	-8.6	0.0	34.7
Pottery	-71.3	0.7	0.0	-71.3	-49.2	0.0	-71.4	-49.2	0.0	-19.7
Glass	-0.1	1.0	0.0	-0.1	4.7	0.0	-0.1	4.7	0.0	16.0
Other Non-metal Mi	-3.1	1.0	0.0	-3.1	-5.3	0.0	-3.1	-5.3	0.0	-0.0
Basic iron	7.7	1.1	0.0	7.7	8.5	0.0	7.7	8.5	0.0	-7.5
Basic non-ferrous	8.8	1.1	0.0	8.9	7.7	0.0	8.9	7.7	0.0	-7.7
Metal Products	-15.5	1.0	0.0	-15.1	-5.3	0.0	-17.5	-8.4	0.0	-12.2
Machinery	-18.3	1.0	0.0	-17.5	-1.6	0.0	-11.0	3.0	0.0	26.0
Electrical machine	-12.0	0.9	0.0	-10.5	-11.1	0.0	-10.5	-11.1	0.0	5.4
Motor vehicles	-23.3	0.8	0.0	-21.8	-36.8	0.0	-21.8	-36.8	0.0	-13.1
Transport equipmen	23.2	0.9	0.0	23.2	-13.2	0.0	1.8	-13.2	0.0	18.5
Professional	-56.4	0.5	0.0	-50.2	-46.9	0.0	-50.2	-46.9	0.0	43.9
Other manufacturin	18.0	1.0	0.0	26.2	-1.5	0.0	17.8	-9.9	0.0	12.5

STEP 5. Compare indices of Real Gross Output in Table A2-6.S3 for each industry in STEP 3 with corresponding benchmarked PVMPs.

i) Convert benchmarked financial year PVMPs in Table A2-6.D6 from base 1985=100 to 1984/85=100

TABLE A2-6.S5i

	1978/79	1981/82	1984/85	1987/88
FOOD	85.6	94.2	100.0	105.9
BEVERAGES	55.0	84.1	100.0	109.2
TOBACCO	70.8	90.1	100.0	112.0
TEXTILES	95.2	120.6	100.0	104.4
CLOTHING	72.9	115.6	100.0	93.2
LEATHER	75.4	99.2	100.0	90.4
FOOTWEAR	91.4	106.0	100.0	93.3
WOOD	79.9	97.7	100.0	97.7
FURNITURE	65.0	116.8	100.0	100.9
PAPER	70.4	83.6	100.0	111.4
PRINTING	66.7	85.5	100.0	85.1
INDUSTRIAL CHEMICA	93.1	114.9	100.0	98.5
OTHER CHEMICALS	67.5	85.3	100.0	102.3
RUBBER	89.2	117.0	100.0	106.5
PLASTIC	63.4	94.8	100.0	123.4
POTTERY	67.6	113.1	100.0	114.8
GLASS	78.3	107.0	100.0	104.3
OTHER NON-M MIN PR	87.9	105.0	100.0	96.5
BASIC IRON & STEEL	104.7	114.6	100.0	111.9
BASIC NON-FERR MET	83.8	98.0	100.0	114.2
METAL PRODUCTS	96.2	118.0	100.0	91.6
MACHINERY	82.9	121.5	100.0	[illegible]

ELECTRICAL MACHINE	78.1	106.8	100.0	103.5
MOTOR VEHICLES	80.8	126.7	100.0	103.7
TRANSPORT EQUIPMEN	142.4	150.1	100.0	78.0
PROFESSIONAL	61.4	82.1	100.0	111.6
OTHER MANUF PROD	112.9	123.4	100.0	116.0

ii) Difference between Real Gross Output and benchmarked PVMPs.
(values in Table A2-6.S3 minus those in Table A2-6.S5i)

	'Old' data (T A2-6.D7)			'Revised' data (T A2-6.D8)			'New' data (T A2-6.D9)			
TABLE A2-6.S5ii	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1987/88
Food	0.7	1.0	0.0	0.7	-4.6	0.0	0.7	-3.9	0.0	-6.2
Beverage	0.8	1.0	0.0	0.8	3.3	0.0	-1.2	-4.2	0.0	6.9
Tobacco	-2.6	1.0	0.0	-2.6	-3.2	0.0	-7.9	-10.0	0.0	-11.9
Textiles	1.3	0.9	0.0	1.3	-7.1	0.0	-4.6	-9.3	0.0	-6.5
Clothing	-0.0	0.9	0.0	-0.0	-11.2	0.0	-0.5	-9.1	0.0	10.9
Leather	-7.7	0.9	0.0	-3.1	-4.6	0.0	-3.1	-4.6	0.0	4.2
Footwear	-1.6	1.0	0.0	-1.6	-1.6	0.0	-1.6	-1.6	0.0	13.8
Wood	-0.8	1.0	0.0	-0.8	-2.4	0.0	2.2	1.1	0.0	8.8
Furniture	-2.2	0.8	0.0	-2.2	-16.7	0.0	-2.2	-16.7	0.0	21.6
Paper	-1.3	0.9	0.0	-1.3	-1.4	0.0	-3.1	-2.3	0.0	0.3
Printing	3.5	1.1	0.0	3.5	4.7	0.0	3.5	4.7	0.0	12.3
Industrial Chemica	0.7	1.0	0.0	-2.5	0.5	0.0	-5.7	-8.8	0.0	-3.1
Oth Chemicals(Pet)	11.1	0.9	0.0	2.3	-0.9	0.0	9.1	-10.1	0.0	12.2
Oth Chemicals(OC)	-2.3	1.0	0.0	-9.7	7.8	0.0	-4.0	-2.3	0.0	-15.3
Rubber	-3.3	0.9	0.0	-3.3	-6.6	0.0	-3.3	-6.6	0.0	15.5
Plastic	-1.0	1.1	0.0	-1.0	-7.8	0.0	-1.0	-8.6	0.0	18.0
Pottery	-1.8	1.0	0.0	-1.8	-3.3	0.0	-1.9	-3.3	0.0	-19.7
Glass	1.8	1.0	0.0	1.8	4.8	0.0	1.8	4.7	0.0	16.0
Other Non-metal Mi	-1.9	1.0	0.0	-1.9	-0.8	0.0	-1.9	-0.8	0.0	-1.2
Basic iron	-0.2	1.0	0.0	-0.2	-0.5	0.0	-0.2	-0.5	0.0	-7.9
Basic non-ferrous	0.0	1.0	0.0	0.1	1.3	0.0	0.1	1.3	0.0	-12.5
Metal Products	-3.8	1.0	0.0	-3.4	-1.1	0.0	-5.8	-4.2	0.0	-10.5
Machinery	-5.9	1.0	0.0	-5.0	-0.8	0.0	1.5	3.8	0.0	26.2
Electrical machine	-1.4	1.0	0.0	0.1	-1.2	0.0	0.1	-1.2	0.0	6.4
Motor vehicles	-1.0	1.0	0.0	0.5	-1.7	0.0	0.5	-1.7	0.0	-15.8
Transport equipmen	18.4	1.0	0.0	18.4	-4.3	0.0	-3.0	-4.3	0.0	11.9
Professional	-23.2	0.7	0.0	-17.0	-12.6	0.0	-17.0	-12.6	0.0	50.6
Other manufacturin	-12.1	0.9	0.0	-3.9	-13.5	0.0	-12.3	-21.9	0.0	34.5

STEP 6. Check industry benchmark estimates against Real Output indices

i) Estimate calendar year Real Gross Output indices (DIY pseudo PVMPs)
from financial year indices in Table A2-6.S3 above (1984/85=100)

TABLE A2-6.S6i	'Old' data			'Revised' data			'New' data			
	1979	1982	1985	1979	1982	1985	1979	1982	1985	1988
FOOD	91.4	91.3	100.4	91.4	91.3	100.4	91.4	92.1	100.4	102.0
BEVERAGES	56.8	87.3	97.9	56.8	87.3	97.9	54.8	79.9	97.9	121.0
TOBACCO	71.5	90.3	99.2	71.5	90.3	99.2	65.9	83.3	99.2	99.9
TEXTILES	102.3	106.6	101.5	102.3	106.6	101.5	96.0	104.5	101.5	98.8
CLOTHING	77.3	99.0	92.5	77.3	99.0	92.5	76.8	101.0	92.5	102.7
LEATHER	70.1	87.4	95.1	74.8	93.2	95.1	74.8	93.2	95.1	97.0
FOOTWEAR	90.3	95.2	96.8	90.3	95.2	96.8	90.3	95.2	96.8	114.6
WOOD	89.3	93.7	96.4	89.3	93.7	96.4	92.7	97.1	96.4	106.3
FURNITURE	68.3	94.2	99.0	68.3	97.5	99.0	[illegible]	[illegible]	[illegible]	[illegible]

PAPER	73.8	70.0	102.6	73.8	79.4	102.6	71.8	78.6	102.6	118.7
PRINTING	73.0	91.4	91.4	73.0	91.4	91.4	73.0	91.4	91.4	100.5
INDUSTRIAL CHEMICA	96.1	106.1	98.6	92.8	109.8	98.6	89.5	100.9	98.6	96.6
OTH CHEMICALS(Pet)	80.7	73.5	97.6	71.6	80.9	97.6	78.7	72.2	97.6	125.0
OTH CHEMICALS(OC)	66.9	81.0	97.6	59.3	89.2	97.6	65.2	79.6	97.6	94.9
RUBBER	84.8	98.7	98.7	84.8	98.7	98.7	84.8	98.7	98.7	130.7
PLASTIC	68.2	106.5	108.9	68.2	86.6	108.9	68.2	85.8	108.9	151.1
POTTERY	72.6	87.5	97.5	72.6	87.5	97.5	72.5	87.5	97.5	96.3
GLASS	79.3	104.7	91.0	79.3	104.7	91.0	79.3	104.7	91.0	119.7
OTHER NON-M MIN PR	92.0	99.6	92.7	92.0	99.6	92.7	92.0	99.5	92.7	102.8
BASIC IRON & STEEL	113.5	103.4	105.0	113.5	103.4	105.0	113.5	103.4	105.0	102.6
BASIC NON-FERR MET	93.5	96.6	97.5	93.6	98.0	97.5	93.6	98.0	97.5	108.8
METAL PRODUCTS	90.8	112.1	100.6	91.2	111.5	100.6	88.8	108.5	100.6	83.8
MACHINERY	87.6	117.5	90.3	88.6	118.7	90.3	96.0	123.2	90.3	108.5
ELECTRICAL MACHINE	78.1	102.9	93.9	79.6	103.1	93.9	79.6	103.1	93.9	115.9
MOTOR VEHICLES	77.1	112.2	85.1	78.5	114.2	85.1	78.5	114.2	85.1	93.9
TRANSPORT EQUIPMEN	165.4	145.1	90.2	165.4	145.1	90.2	143.4	145.1	90.2	94.3
PROFESSIONAL	39.1	58.9	105.3	45.5	68.6	105.3	45.5	68.6	105.3	166.8
OTHER MANUF PROD	108.7	101.3	104.0	117.5	103.1	104.0	108.5	95.2	104.0	148.9

ii) Convert to 1985=100

TABLE A2-6.S6ii	'Old' data			'Revised' data			'New' data			
	1979	1982	1985	1979	1982	1985	1979	1982	1985	1988
FOOD	91.0	90.9	100.0	91.0	90.9	100.0	91.0	91.7	100.0	101.6
BEVERAGES	58.0	89.2	100.0	58.0	89.2	100.0	56.0	81.6	100.0	123.6
TOBACCO	72.0	91.0	100.0	72.0	91.0	100.0	66.4	83.9	100.0	100.7
TEXTILES	100.8	105.0	100.0	100.8	105.0	100.0	94.6	103.0	100.0	97.4
CLOTHING	83.6	107.1	100.0	83.6	107.1	100.0	83.0	109.2	100.0	111.1
LEATHER	73.7	91.9	100.0	78.7	98.0	100.0	78.7	98.1	100.0	102.0
FOOTWEAR	93.3	98.4	100.0	93.3	98.4	100.0	93.3	98.4	100.0	118.4
WOOD	92.6	97.2	100.0	92.6	97.2	100.0	96.2	100.7	100.0	110.3
FURNITURE	68.9	95.1	100.0	68.9	98.4	100.0	68.9	98.4	100.0	131.0
PAPER	71.9	68.3	100.0	71.9	77.4	100.0	70.0	76.6	100.0	115.7
PRINTING	80.0	100.0	100.0	80.0	100.0	100.0	80.0	100.0	100.0	110.0
INDUSTRIAL CHEMICA	97.4	107.6	100.0	94.1	111.3	100.0	90.8	102.3	100.0	97.9
OTH CHEMICALS(Pet)	82.7	75.2	100.0	73.3	82.9	100.0	80.6	73.9	100.0	128.0
OTH CHEMICALS(Oc)	68.5	83.0	100.0	60.8	91.4	100.0	66.7	81.5	100.0	97.2
RUBBER	85.9	100.0	100.0	85.9	100.0	100.0	85.9	100.0	100.0	132.4
PLASTIC	62.7	97.8	100.0	62.7	79.6	100.0	62.7	78.8	100.0	138.8
POTTERY	74.4	89.8	100.0	74.4	89.8	100.0	74.3	89.8	100.0	98.7
GLASS	87.2	115.2	100.0	87.2	115.2	100.0	87.2	115.2	100.0	131.6
OTHER NON-M MIN PR	99.3	107.4	100.0	99.3	107.4	100.0	99.3	107.4	100.0	110.9
BASIC IRON & STEEL	108.0	98.5	100.0	108.0	98.5	100.0	108.0	98.5	100.0	97.7
BASIC NON-FERR MET	95.8	99.1	100.0	96.0	100.5	100.0	96.0	100.5	100.0	111.6
METAL PRODUCTS	90.3	111.4	100.0	90.7	110.9	100.0	88.3	107.9	100.0	83.4
MACHINERY	97.1	130.1	100.0	98.1	131.4	100.0	106.3	136.4	100.0	120.2
ELECTRICAL MACHINE	83.2	109.6	100.0	84.8	109.8	100.0	84.8	109.8	100.0	123.5
MOTOR VEHICLES	90.6	131.9	100.0	92.3	134.3	100.0	92.3	134.3	100.0	110.4
TRANSPORT EQUIPMEN	183.5	160.9	100.0	183.5	160.9	100.0	159.0	160.9	100.0	104.6
PROFESSIONAL	37.2	56.0	100.0	43.2	65.1	100.0	43.3	65.2	100.0	158.4
OTHER MANUF PROD	104.5	97.4	100.0	113.0	99.1	100.0	104.3	91.5	100.0	143.1

iii) Basic Data - Comparative values of PVMPs from
P3041.3, 9 March 1992 (1985=100) (Table A2-6.D5)

TABLE A2-6.S6iii

	1979	1982	1985	1988
FOOD	89.8	95.2	100.0	107.1
BEVERAGES	58.1	87.5	100.0	117.4
TOBACCO	75.1	95.1	100.0	112.6
TEXTILES	98.3	113.0	100.0	105.4
CLOTHING	83.1	119.8	100.0	99.3
LEATHER	87.2	109.2	100.0	102.8
FOOTWEAR	95.0	100.0	100.0	106.5
WOOD	91.2	105.1	100.0	102.0
FURNITURE	72.5	120.4	100.0	107.9
PAPER	76.7	82.5	100.0	121.4
PRINTING	76.0	94.9	100.0	96.2
INDUSTRIAL CHEMICA	96.1	109.8	100.0	101.2
OTHER CHEMICALS	70.6	88.6	100.0	115.2
RUBBER	92.6	114.0	100.0	118.3
PLASTIC	64.2	86.7	100.0	118.3
POTTERY	78.6	94.2	100.0	119.2
GLASS	88.4	110.3	100.0	114.2
OTHER NON-M MIN PR	99.9	106.6	100.0	110.9
BASIC IRON & STEEL	107.3	98.8	100.0	104.9
BASIC NON-FERR MET	95.9	99.1	100.0	125.7
METAL PRODUCTS	95.0	114.7	100.0	95.0
MACHINERY	102.0	133.1	100.0	88.4
ELECTRICAL MACHINE	87.4	112.1	100.0	117.4
MOTOR VEHICLES	88.2	133.2	100.0	126.8
TRANSPORT EQUIPMEN	153.0	151.2	100.0	87.9
PROFESSIONAL	63.9	87.9	100.0	115.5
OTHER MANUF PROD	115.8	116.0	100.0	121.8

iv) Estimate differences between DIY pseudo-benchmarked value
and Official benchmarked PVMPs

TABLE A2-6.S6iv	'Old' data			'Revised' data			'New' data			
	1979	1982	1985	1979	1982	1985	1979	1982	1985	1988
FOOD	1.3	-4.3	0.0	1.3	-4.3	0.0	1.3	-3.5	0.0	-5.5
BEVERAGES	-0.1	1.8	0.0	-0.1	1.8	0.0	-2.1	-5.8	0.0	6.2
TOBACCO	-3.0	-4.1	-0.0	-3.0	-4.1	-0.0	-8.7	-11.2	-0.0	-12.0
TEXTILES	2.5	-8.0	0.0	2.5	-8.0	0.0	-3.6	-10.0	0.0	-8.0
CLOTHING	0.5	-12.7	0.0	0.5	-12.7	0.0	-0.1	-10.5	0.0	11.8
LEATHER	-13.4	-17.4	-0.0	-8.5	-11.2	-0.0	-8.5	-11.2	-0.0	-0.8
FOOTWEAR	-1.7	-1.5	-0.0	-1.7	-1.5	-0.0	-1.7	-1.5	-0.0	11.9
WOOD	1.5	-7.8	0.0	1.5	-7.8	0.0	5.0	-4.3	0.0	8.4
FURNITURE	-3.6	-25.3	0.0	-3.6	-22.0	0.0	-3.6	-22.0	0.0	23.1
PAPER	-4.8	-14.2	-0.0	-4.8	-5.0	-0.0	-6.7	-5.9	-0.0	-5.7
PRINTING	4.0	5.2	0.0	4.0	5.2	0.0	4.0	5.2	0.0	13.9
INDUSTRIAL CHEMICA	1.3	-2.2	0.0	-2.0	1.6	0.0	-5.3	-7.4	0.0	-3.3
OTH CHEMICALS(Pet)	12.1	-13.4	0.0	2.7	-5.7	0.0	9.9	-14.7	0.0	12.8
OTH CHEMICALS(OC)	-2.1	-5.6	0.0	-9.9	2.8	0.0	-3.9	-7.1	0.0	-18.0
RUBBER	-6.7	-14.0	-0.0	-6.7	-14.0	-0.0	-6.7	-14.0	-0.0	14.1
PLASTIC	-1.5	11.1	0.0	-1.5	-7.1	0.0	-1.5	-7.9	0.0	20.5
POTTERY	-4.2	-4.4	-0.0	-4.2	-4.4	-0.0	-4.3	-4.4	-0.0	-20.4
GLASS	-1.2	4.8	0.0	-1.2	4.8	0.0	-1.2	4.8	0.0	17.5
OTHER NON-M MIN PR	-0.6	0.8	-0.0	-0.6	0.8	-0.0	-0.6	0.8	-0.0	-0.0
BASIC IRON & STEEL	0.7	-0.3	-0.0	0.7	-0.3	-0.0	0.7	-0.3	-0.0	-7.2
BASIC NON-FERR MET	-0.0	-0.0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

METAL PRODUCTS	-4.8	-3.2	0.0	-4.4	-3.8	0.0	-6.8	-6.7	0.0	-11.7
MACHINERY	-4.9	-3.1	-0.0	-3.9	-1.7	-0.0	4.3	3.3	-0.0	31.7
ELECTRICAL MACHINE	-4.1	-2.5	-0.0	-2.5	-2.3	-0.0	-2.5	-2.3	-0.0	6.1
MOTOR VEHICLES	2.5	-1.3	0.0	4.2	1.2	0.0	4.2	1.2	0.0	-16.4
TRANSPORT EQUIPMEN	30.5	9.7	0.0	30.5	9.7	0.0	6.1	9.7	0.0	16.7
PROFESSIONAL	-26.7	-31.9	-0.0	-20.7	-22.8	-0.0	-20.7	-22.7	-0.0	42.9
OTHER MANUF PROD	-11.4	-18.6	-0.0	-2.9	-16.8	-0.0	-11.5	-24.4	-0.0	21.3

STEP 7. Divide total qtpo by total qopo - ie, estimate sum of individually deflated components of output divided by base year total (Real Gross Output - Sum of Components).

	'Old' data (T A2-6.D7)			'Revised' data (T A2-6.D8)			'New' data (T A2-6.D9)			
	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1987/88
Σqtpo/Σqopo (Pet)	83.1	100.4	99.7	82.1	101.7	99.6	82.7	100.2	100.0	103.4
Set 1978/79=100	100.0	120.8	119.9	100.0	123.9	121.3	100.0	121.2	120.9	125.0
Σqtpo/Σqopo (OC)	81.4	101.4	99.7	80.5	102.9	99.6	81.0	101.2	100.0	99.8
Set 1978/79=100	100.0	124.5	122.4	100.0	127.8	123.7	100.0	124.9	123.4	123.2

STEP 8. Compare result with that obtained by deflating total qtpt by total PPI, ie, deflate revised estimate of total gross output by aggregate PPI (Real Gross Output - Total)

Basic data - take PPIs for financial year from CSS letter of 3 July 1992 with 1985=100 (78/79, 81/82 and 84/85) The 1987/88 PPI is from Y1988.WK1

	1978/79	1981/82	1984/85	1987/88
	45.2	68.2	92.7	145.3
Make 1984/85=100	48.7	73.5	100.0	156.8

	'Old' data (T A2-6.D7)			'Revised' data (T A2-6.D8)			'New' data (T A2-6.D9)			
	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1987/88
Estimate Σqtpt/PPI	61430.4	75813.5	75092.2	60704.9	76948.2	75020.8	61106.7	75699.7	75351.1	75420.6
Set 1984/85=100	81.8	101.0	100.0	80.9	102.6	100.0	81.1	100.5	100.0	100.1
Set 1978/79=100	100.0	123.4	122.2	100.0	126.8	123.6	100.0	123.9	123.3	123.4

STEP 9(i). Estimate calendar year Real Gross Output - Sum of Components, obtained in STEP 7 by ratio of unbenchmarked calendar and financial year PVMPs.

Basic data - Unbenchmarked PVMPs from Table A2-6.D10 - 1985=100

	1978/79	1979	1981/82	1982	1984/85	1985	1987/88	1988
	90.9	95.5	113.0	108.7	102.3	100.0	104.3	108.7
Set 1984/85=100	88.9	93.4	110.5	106.3	100.0	97.8	102.0	106.3

DIY Benchmarked calendar year indices - sum of components

	'Old' data (T A2-6.D7)			'Revised' data (T A2-6.D8)			'New' data (T A2-6.D9)			
	1979	1982	1985	1979	1982	1985	1979	1982	1985	1988
(Pet) 1984/85=100	87.4	96.6	97.4	86.3	97.8	97.4	86.9	96.4	97.8	107.8
Make 1979=100	100.0	110.5	111.5	100.0	113.4	112.9	100.0	110.9	112.5	124.0
Make 1985=100	89.7	99.1	100.0	88.6	100.5	100.0	88.9	98.6	100.0	110.2
(OC) 1984/85=100	85.6	97.5	97.4	84.6	99.0	97.4	85.2	97.4	97.8	104.1
Make 1979=100	100.0	113.9	113.8	100.0	117.0	115.1	100.0	114.3	114.8	122.2
Make 1985=100	87.8	100.1	100.0	86.9	101.7	100.0	[illegible]	[illegible]	[illegible]	[illegible]

STEP 9(ii). Estimate calendar year deflated totals obtained in STEP 8 by ratio of unbenchmarked calendar and financial year PVMPs.

Benchmarked calendar year indices - total

	1979	1982	1985	1988
1978/79=100	105.1	119.2	120.6	128.6
Make 1979=100	100.0	113.4	114.7	122.4
Make 1985=100	87.2	98.8	100.0	106.7

STAGE II - ESTIMATE AGGREGATE PVMPs

Estimate financial year PVMPs by adding up sub-sectoral PVMPs using various datasets

STEP 10	i	Unbenchmarked PVMPs, 1978/79 weights.
	ii	Unbenchmarked PVMPs, 1984/85 weights.
STEP 11	i	Benchmarked PVMPs & 'Old' gross output data, 1978/79 weights.
	ii	Benchmarked PVMPs & 'Old' gross output data, 1984/85 weights.
STEP 12	i	Benchmarked PVMPs & 'New' gross output data, 1978/79 weights.
	ii	Benchmarked PVMPs & 'New' gross output data, 1984/85 weights.
STEP 13	i	Calendar year PVMPs from Step 12ii results (bnchmkd ratio)
	ii	Calendar year PVMPs from Step 12ii results (unbnchmkd ratio)

STEPS 10ii and 11ii constitute a check of my understanding of the CSS method of benchmarking. If this has been correctly understood, then the totals obtained in this process should be roughly equal to the published figures. Note that 1978/79 weighted estimates are given for comparative purposes to show the effect of changing to the 1984/85 census weights. The latter were used to estimate the unbenchmarked PVMPs in SNR P3041.3 of 12 September 1990.

STEP 10i Unbenchmarked PVMPs, 1978/79 weights.

a) Convert unbenchmarked financial year PVMPs in Table A2-6.D4 from base 1985=100 to base 1978/79=100

TABLE A2-6.S10i(a)

	1978/79	1981/82	1984/85	1987/88
Food	100.0	116.5	122.4	130.8
Beverage	100.0	132.9	147.3	162.5
Tobacco	100.0	119.7	119.2	153.1
Textiles	100.0	142.0	103.5	114.6
Clothing	100.0	145.0	110.9	103.2
Leather	100.0	97.9	90.6	89.3
Footwear	100.0	116.0	109.4	99.2
Wood	100.0	138.9	110.9	109.2
Furniture	100.0	132.0	92.4	93.2
Paper	100.0	106.3	116.3	136.3
Printing	100.0	128.0	149.8	127.5
Industrial Chemica	100.0	124.1	108.4	107.0
Other Chemicals	100.0	112.9	113.8	116.7
Rubber	100.0	115.3	89.2	97.3
Plastic	100.0	129.6	136.8	145.9
Pottery	100.0	115.9	72.9	83.7
Glass	100.0	133.6	124.8	130.2
Other Non-metal Mi	100.0	123.1	112.3	107.0

Basic iron	100.0	109.2	103.4	115.3
Basic non-ferrous	100.0	122.0	133.3	145.9
Metal Products	100.0	113.2	92.7	86.5
Machinery	100.0	128.2	104.8	80.5
Electrical machine	100.0	131.7	112.9	117.9
Motor vehicles	100.0	156.9	97.0	98.0
Transport equipmen	100.0	115.5	72.7	51.9
Professional	100.0	123.1	105.8	125.1
Other manufacturin	100.0	134.5	120.8	166.7

Proportional contributions to total output using 1978/79 net output weights ('Old' estimates in Table A2-6.D7)

TABLE A2-6.S10i(b)

	1978/79	1981/82	1984/85	1987/88
FOOD	11.6	13.5	14.2	15.2
BEVERAGES	2.6	3.5	3.9	4.3
TOBACCO	0.6	0.7	0.7	0.9
TEXTILES	5.3	7.6	5.5	6.1
CLOTHING	3.0	4.3	3.3	3.1
LEATHER	0.4	0.4	0.4	0.4
FOOTWEAR	1.1	1.3	1.2	1.1
WOOD	1.6	2.2	1.8	1.8
FURNITURE	1.2	1.6	1.1	1.1
PAPER	3.7	4.0	4.4	5.1
PRINTING	3.7	4.7	5.5	4.7
INDUSTRIAL CHEMICA	4.9	6.1	5.3	5.3
OTHER CHEMICALS	8.6	9.7	9.8	10.1
RUBBER	1.8	2.0	1.6	1.7
PLASTIC	1.8	2.4	2.5	2.7
POTTERY	0.2	0.2	0.1	0.1
GLASS	0.8	1.1	1.0	1.1
OTHER NON-M MIN PR	4.0	4.9	4.5	4.3
BASIC IRON & STEEL	10.4	11.3	10.7	12.0
BASIC NON-FERR MET	3.1	3.8	4.2	4.6
METAL PRODUCTS	8.8	10.0	8.2	7.6
MACHINERY	6.6	8.4	6.9	5.3
ELECTRICAL MACHINE	5.3	6.9	5.9	6.2
MOTOR VEHICLES	4.9	7.8	4.8	4.8
TRANSPORT EQUIPMEN	2.1	2.5	1.6	1.1
PROFESSIONAL	0.3	0.4	0.3	0.4
OTHER MANUF PROD	1.4	1.9	1.7	2.4
	100.0	123.3	111.1	113.3
Compare estimates in letter of 3 July 1992				
	100.0	124.2	112.5	-

ii) Unbenchmarked financial year PVMPs with 1984/85=100 (Table A2-6.S4i)
Proportional contributions to total output using 1984/85 net output weights ('Old' estimates in Table A2-6.D7) except 87/88 values which use 'New' weights.

TABLE A2-6.S10ii

	1978/79	1981/82	1984/85	1987/88
FOOD	9.4	11.0	11.5	12.2
BEVERAGES	1.8	2.5	2.7	3.1
TOBACCO	0.5	0.5	0.5	0.9
TEXTILES	3.6	5.1	3.7	4.1

CLOTHING	2.6	3.8	2.9	2.7
LEATHER	0.4	0.4	0.4	0.4
FOOTWEAR	0.9	1.1	1.0	0.9
WOOD	1.7	2.3	1.8	1.8
FURNITURE	1.6	2.1	1.4	1.4
PAPER	3.6	3.8	4.1	4.9
PRINTING	2.6	3.3	3.8	3.2
INDUSTRIAL CHEMICA	3.9	4.8	4.2	4.6
OTHER CHEMICALS	13.6	15.4	15.5	16.2
RUBBER	1.6	1.8	1.4	1.5
PLASTIC	1.5	2.0	2.1	2.2
POTTERY	0.3	0.3	0.2	0.2
GLASS	0.7	0.9	0.9	0.9
OTHER NON-M MIN PR	3.6	4.5	4.1	3.9
BASIC IRON & STEEL	7.4	8.1	7.7	8.5
BASIC NON-FERR MET	2.3	2.8	3.0	2.6
METAL PRODUCTS	8.3	9.4	7.7	7.5
MACHINERY	6.0	7.8	6.3	4.6
ELECTRICAL MACHINE	4.4	5.7	4.9	5.0
MOTOR VEHICLES	5.1	8.0	4.9	4.9
TRANSPORT EQUIPMEN	1.9	2.2	1.4	1.0
PROFESSIONAL	0.5	0.6	0.5	0.5
OTHER MANUF PROD	0.9	1.3	1.1	1.4
Total	90.6	111.3	100.0	101.5
Set 1978/79=100	100.0	122.8	110.4	112.0
Compare estimates in letter of 3 July 92				
	100.0	124.2	112.5	-

STEP 11i Benchmarked PVMPs & 'Old' (non-revised) gross output data, 1978/79 weights.

Estimate aggregate PVMPs & compare the results of adding net output weighted estimates of the deflated value of gross output (qtpt) in each industry with the weighted sum of the benchmarked PVMPs. Differences SHOULD be minimal.

Initial step - convert benchmarked financial year PVMPs in Table A2-6.D6 from 1985=100 to 1978/79=100

TABLE A2-6.S11i(a)

	Benchmarked Financial Year PVMPs			
	1978/79	1981/82	1984/85	1987/88
FOOD	100.0	110.1	116.9	123.8
BEVERAGES	100.0	152.8	181.8	198.5
TOBACCO	100.0	127.3	141.3	158.2
TEXTILES	100.0	126.6	105.0	109.6
CLOTHING	100.0	158.6	137.1	127.8
LEATHER	100.0	131.6	132.7	120.0
FOOTWEAR	100.0	116.0	109.4	102.0
WOOD	100.0	122.3	125.1	122.2
FURNITURE	100.0	179.8	153.9	155.3
PAPER	100.0	118.7	142.0	158.3
PRINTING	100.0	128.0	149.8	127.5
INDUSTRIAL CHEMICA	100.0	123.4	107.4	105.8
OTHER CHEMICALS	100.0	126.5	148.2	151.6
RUBBER	100.0	131.2	112.1	119.4
PLASTIC	100.0	149.6	157.8	194.7
POTTERY	100.0	167.3	148.0	[illegible]

GLASS	100.0	136.7	127.8	133.3
OTHER NON-M MIN PR	100.0	119.5	113.8	109.8
BASIC IRON & STEEL	100.0	109.5	95.5	106.9
BASIC NON-FERR MET	100.0	117.0	119.4	136.4
METAL PRODUCTS	100.0	122.6	103.9	95.2
MACHINERY	100.0	146.5	120.6	92.4
ELECTRICAL MACHINE	100.0	136.8	128.1	132.6
MOTOR VEHICLES	100.0	156.8	123.8	128.4
TRANSPORT EQUIPMEN	100.0	105.4	70.2	54.8
PROFESSIONAL	100.0	133.8	163.0	181.9
OTHER MANUF PROD	100.0	109.4	88.6	102.8

Also, convert financial year PPIs in Table A2-6.D2
from 1985=100 to 1978/79=100

TABLE A2-6.S11i(b)

	1978/79	1981/82	1984/85	1987/88
FOOD	100.0	167.6	224.4	346.7
BEVERAGES	100.0	125.4	170.0	242.3
TOBACCO	100.0	133.1	181.9	243.6
TEXTILES	100.0	136.9	180.5	303.7
CLOTHING	100.0	131.4	177.0	269.4
LEATHER	100.0	115.5	166.8	308.6
FOOTWEAR	100.0	158.2	204.9	341.5
WOOD	100.0	169.1	233.8	352.8
FURNITURE	100.0	153.8	205.0	299.0
PAPER	100.0	150.6	201.6	335.1
PRINTING	100.0	150.6	201.6	335.1
INDUSTRIAL CHEMICA	100.0	149.8	203.8	320.6
OTH CHEMICALS(Pet)	100.0	199.4	245.9	293.8
OTH CHEMICALS(OC)	100.0	149.8	203.8	320.6
RUBBER	100.0	142.2	184.8	254.6
PLASTIC	100.0	142.2	184.8	254.6
POTTERY	100.0	153.5	225.1	348.4
GLASS	100.0	153.5	225.1	348.4
OTHER NON-M MIN PR	100.0	153.5	225.1	348.4
BASIC IRON & STEEL	100.0	152.1	213.3	328.6
BASIC NON-FERR MET	100.0	140.6	208.0	307.5
METAL PRODUCTS	100.0	156.4	213.4	350.7
MACHINERY	100.0	145.5	202.3	314.8
ELECTRICAL MACHINE	100.0	144.4	195.8	297.8
MOTOR VEHICLES	100.0	144.8	212.9	417.0
TRANSPORT EQUIPMEN	100.0	144.8	212.9	417.0
PROFESSIONAL	100.0	128.0	149.5	165.6
OTHER MANUF PROD	100.0	128.0	149.5	165.6

TABLE A2-6.S11i(c) Benchmarked PVMPs & 'Old' (non-revised) gross output data (1978/79 weights)

	Weighted qtpo minus weighted PVMP						Differences: Gross Output - PVMP		
	Benchmarked PVMPs			Gross output data					
	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85
FOOD	11.6	12.8	13.5	11.6	12.0	13.4	0.0	-0.7	-0.1
BEVERAGES	2.6	4.0	4.8	2.6	4.1	4.7	0.0	0.1	-0.1
TOBACCO	0.6	0.8	0.8	0.6	0.8	0.9	0.0	0.0	0.0
TEXTILES	5.3	6.7	5.6	5.3	6.3	5.5	0.0	-0.5	-0.1
CLOTHING	3.0	4.7	4.1	3.0	4.2	4.1	0.0	-0.5	0.0
LEATHER	0.4	0.6	0.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FOOTWEAR	1.1	1.3	1.2	1.1	1.3	1.2	0.0	0.0	0.0
WOOD	1.6	2.0	2.0	1.6	1.9	2.0	0.0	-0.0	0.0
FURNITURE	1.2	2.2	1.8	1.2	1.8	1.9	0.0	-0.3	0.1
PAPER	3.7	4.4	5.3	3.7	3.9	5.4	0.0	-0.5	0.1
PRINTING	3.7	4.7	5.5	3.7	4.7	5.2	0.0	0.0	-0.3
INDUSTRIAL CHEMICA	4.9	6.1	5.3	4.9	5.8	5.2	0.0	-0.2	-0.0
OTH CHEMICALS(Pet)	8.6	10.9	12.8	8.6	8.4	11.0	0.0	-2.5	-1.8
OTH CHEMICALS (OC)	8.6	10.9	12.8	8.6	11.2	13.2	0.0	0.3	0.5
RUBBER	1.8	2.3	2.0	1.8	2.3	2.1	0.0	-0.0	0.1
PLASTIC	1.8	2.7	2.9	1.8	3.1	2.9	0.0	0.4	0.0
POTTERY	0.2	0.3	0.2	0.2	0.3	0.2	0.0	-0.0	0.0
GLASS	0.8	1.1	1.1	0.8	1.2	1.0	0.0	0.0	-0.0
OTHER NON-M MIN PR	4.0	4.8	4.5	4.0	4.8	4.6	0.0	0.1	0.1
BASIC IRON & STEEL	10.4	11.4	9.9	10.4	11.4	9.9	0.0	-0.0	0.0
BASIC NON-FERR MET	3.1	3.7	3.8	3.1	3.7	3.8	0.0	-0.0	-0.0
METAL PRODUCTS	8.8	10.8	9.2	8.8	11.2	9.6	0.0	0.4	0.4
MACHINERY	6.6	9.6	7.9	6.6	10.2	8.5	0.0	0.6	0.6
ELECTRICAL MACHINE	5.3	7.2	6.7	5.3	7.2	6.9	0.0	0.0	0.1
MOTOR VEHICLES	4.9	7.8	6.1	4.9	7.6	6.2	0.0	-0.2	0.1
TRANSPORT EQUIPMEN	2.1	2.3	1.5	2.1	1.9	1.3	0.0	-0.3	-0.2
PROFESSIONAL	0.3	0.4	0.5	0.3	0.5	0.8	0.0	0.1	0.3
OTHER MANUF PROD	1.4	1.5	1.3	1.4	1.5	1.4	0.0	-0.0	0.2
Total (Pet)	100.0	127.0	121.0	100.0	122.8	120.6			
Total (OC)	100.0	127.0	121.0	100.0	125.6	122.9			
Compare estimates in letter of 3 July 92									
	100.0	125.8	117.6						

STEP 11ii To perform a similar operation using 1984/85 as base year, first convert financial year PVMPs in Table A2-6.D6 to 1984/85=100, and use PPIs with 1984/85=100 from Table A2-6.S1.

Table A2-6.S11ii(a)

	Benchmarked Financial Year PVMPs			
	1978/79	1981/82	1984/85	1987/88
FOOD	85.6	94.2	100.0	105.9
BEVERAGES	55.0	84.1	100.0	109.2
TOBACCO	70.8	90.1	100.0	112.0
TEXTILES	95.2	120.6	100.0	104.4
CLOTHING	72.9	115.6	100.0	93.2
LEATHER	75.4	99.2	100.0	90.4
FOOTWEAR	91.4	106.0	100.0	93.3
WOOD	79.9	97.7	100.0	97.7
FURNITURE	65.0	116.8	100.0	100.9
PAPER	70.4	83.6	100.0	111.4
PRINTING	66.7	85.5	100.0	85.1
INDUSTRIAL CHEMICA	93.1	114.9	100.0	98.5
OTHER CHEMICALS	67.5	85.3	100.0	102.3
RUBBER	89.2	117.0	100.0	106.5
PLASTIC	63.4	94.8	100.0	123.4
POTTERY	67.6	113.1	100.0	114.8
GLASS	78.3	107.0	100.0	104.3
OTHER NON-M MIN PR	87.9	105.0	100.0	96.5
BASIC IRON & STEEL	104.7	114.6	100.0	111.9
BASIC NON-FERR MET	83.8	98.0	100.0	114.2
METAL PRODUCTS	96.2	118.0	100.0	91.6
MACHINERY	82.9	121.5	100.0	76.6

ELECTRICAL MACHINE	78.1	106.8	100.0	103.5
MOTOR VEHICLES	80.8	126.7	100.0	103.7
TRANSPORT EQUIPMEN	142.4	150.1	100.0	78.0
PROFESSIONAL	61.4	82.1	100.0	111.6
OTHER MANUF PROD	112.9	123.4	100.0	116.0

Table A2-6.S11ii(b) Benchmarked PVMPs & 'Old' (non-revised) gross output data(1984/85 weights)

	Weighted qtpo minus weighted PVMP						Differences: Gross		
	Benchmarked PVMPs			Gross output data (non-rev)			Output - PVMP		
	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85	1978/79	1981/82	1984/85
FOOD	9.9	10.9	11.5	9.9	10.3	11.5	0.1	-0.5	0.0
BEVERAGES	1.5	2.3	2.7	1.5	2.4	2.7	0.0	0.1	0.0
TOBACCO	0.4	0.5	0.5	0.4	0.5	0.5	-0.0	-0.0	0.0
TEXTILES	3.5	4.5	3.7	3.6	4.2	3.7	0.0	-0.3	0.0
CLOTHING	2.1	3.4	2.9	2.1	3.1	2.9	-0.0	-0.3	0.0
LEATHER	0.3	0.4	0.4	0.3	0.3	0.4	-0.0	-0.0	0.0
FOOTWEAR	0.9	1.1	1.0	0.9	1.0	1.0	-0.0	-0.0	0.0
WOOD	1.5	1.8	1.8	1.5	1.8	1.8	-0.0	-0.0	0.0
FURNITURE	0.9	1.7	1.4	0.9	1.4	1.4	-0.0	-0.3	0.0
PAPER	2.9	3.5	4.1	2.9	3.0	4.1	-0.1	-0.5	0.0
PRINTING	2.6	3.3	3.8	2.7	3.4	3.8	0.1	0.2	0.0
INDUSTRIAL CHEMICA	3.9	4.8	4.2	3.9	4.7	4.2	0.0	-0.1	0.0
OTH CHEMICALS(Pet)	10.5	13.2	15.5	12.2	11.9	15.5	1.7	-1.3	0.0
OTH CHEMICALS(OC)	10.5	13.2	15.5	10.1	13.1	15.5	-0.4	-0.1	0.0
RUBBER	1.3	1.7	1.4	1.2	1.6	1.4	-0.0	-0.1	0.0
PLASTIC	1.3	2.0	2.1	1.3	2.2	2.1	-0.0	0.3	0.0
POTTERY	0.1	0.2	0.2	0.1	0.2	0.2	-0.0	-0.0	0.0
GLASS	0.7	0.9	0.9	0.7	1.0	0.9	0.0	0.0	0.0
OTHER NON-M MIN PR	3.6	4.3	4.1	3.5	4.2	4.1	-0.1	-0.0	0.0
BASIC IRON & STEEL	8.0	8.8	7.7	8.0	8.8	7.7	-0.0	-0.0	0.0
BASIC NON-FERR MET	2.5	3.0	3.0	2.5	3.0	3.0	0.0	-0.0	0.0
METAL PRODUCTS	7.4	9.1	7.7	7.1	9.0	7.7	-0.3	-0.0	0.0
MACHINERY	5.3	7.7	6.3	4.9	7.6	6.3	-0.4	-0.1	0.0
ELECTRICAL MACHINE	3.8	5.3	4.9	3.8	5.2	4.9	-0.1	-0.1	0.0
MOTOR VEHICLES	4.0	6.3	4.9	3.9	6.1	4.9	-0.0	-0.2	0.0
TRANSPORT EQUIPMEN	2.0	2.1	1.4	2.2	2.0	1.4	0.3	-0.1	0.0
PROFESSIONAL	0.3	0.4	0.5	0.2	0.3	0.5	-0.1	-0.1	0.0
OTHER MANUF PROD	1.3	1.4	1.1	1.1	1.2	1.1	-0.1	-0.2	0.0
Total (Pet)	82.4	104.2	100.0	83.4	100.3	100.0			
Set 1978/79=100	100.0	126.4	121.3	100.0	120.3	119.9			
Total (OC)	82.4	104.2	100.0	81.3	101.5	100.0			
Set 1978/79=100	100.0	126.4	121.3	100.0	124.9	123.0			
Compare estimates in letter of 3 July 92									
	100.0	125.8	117.6						

Note: According to P3041.3, 9 March 1992, weighting factors used to obtain aggregate benchmarked PVMPs were obtained from the 1985 Manufacturing Census

STEP 12. A similar process to STEPS 11i and 11ii above except that the 'New' gross output estimates (qtpt) from SNR P3001 of 28 June 1993 are used

STEP 12i 'New' data, 1978/79 weights.

TABLE A2-6.S12i Benchmarked PVMPs & 'New' gross output data

Weighted qtpo minus weighted PVMP (1978/79 weights)

	Benchmarked PVMPs				Gross output data (new)				Output - PVMP	
	1978/79	1981/82	1984/85	1987/88	1978/79	1981/82	1984/85	1987/88	1981/82	1984/85
FOOD	11.6	12.8	13.6	14.4	11.6	12.2	13.5	13.4	-0.6	-0.1
BEVERAGES	2.8	4.3	5.1	5.6	2.8	4.2	5.2	6.1	-0.1	0.1
TOBACCO	0.6	0.8	0.8	0.9	0.6	0.8	1.0	1.0	0.0	0.1
TEXTILES	5.0	6.4	5.3	5.5	5.0	6.2	5.6	5.5	-0.2	0.3
CLOTHING	3.0	4.7	4.1	3.8	3.0	4.4	4.1	4.3	-0.3	0.0
LEATHER	0.4	0.6	0.6	0.5	0.4	0.6	0.6	0.6	-0.0	0.0
FOOTWEAR	1.1	1.3	1.2	1.1	1.1	1.3	1.2	1.3	0.0	0.0
WOOD	1.7	2.1	2.1	2.1	1.7	2.1	2.1	2.2	-0.0	-0.1
FURNITURE	1.2	2.2	1.8	1.9	1.2	1.9	1.9	2.3	-0.2	0.1
PAPER	3.7	4.4	5.2	5.8	3.7	4.4	5.5	6.1	0.1	0.2
PRINTING	3.7	4.7	5.5	4.7	3.7	4.7	5.3	5.1	0.0	-0.3
INDUSTRIAL CHEMICA	5.3	6.5	5.7	5.6	5.3	6.4	6.0	5.7	-0.1	0.4
OTH CHEMICALS(Pet)	8.7	11.0	12.8	13.1	8.7	8.5	11.3	13.0	-2.4	-1.5
OTH CHEMICALS(OC)	8.7	11.0	12.8	13.1	8.7	11.3	13.7	11.9	0.4	0.8
RUBBER	1.8	2.3	2.0	2.1	1.8	2.3	2.1	2.5	-0.0	0.1
PLASTIC	1.8	2.7	2.9	3.6	1.8	2.5	2.9	4.1	-0.2	0.0
POTTERY	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.2	-0.0	0.0
GLASS	0.8	1.1	1.1	1.1	0.8	1.2	1.0	1.3	0.0	-0.0
OTHER NON-M MIN PR	4.0	4.8	4.5	4.4	4.0	4.8	4.6	4.4	0.1	0.1
BASIC IRON & STEEL	10.4	11.4	10.0	11.2	10.4	11.4	10.0	10.4	-0.0	0.0
BASIC NON-FERR MET	2.5	3.0	3.0	3.5	2.5	3.0	3.0	3.1	0.0	-0.0
METAL PRODUCTS	8.9	10.9	9.2	8.4	8.9	11.2	9.8	8.0	0.3	0.6
MACHINERY	6.9	10.1	8.3	6.4	6.9	10.2	8.2	8.4	0.1	-0.1
ELECTRICAL MACHINE	5.3	7.2	6.8	7.0	5.3	7.1	6.8	7.4	-0.1	-0.0
MOTOR VEHICLES	5.0	7.8	6.2	6.4	5.0	7.6	6.1	5.4	-0.2	-0.0
TRANSPORT EQUIPMEN	1.9	2.0	1.3	1.0	1.9	1.9	1.3	1.2	-0.0	0.0
PROFESSIONAL	0.3	0.4	0.5	0.6	0.3	0.5	0.7	1.2	0.1	0.2
OTHER MANUF PROD	1.4	1.6	1.3	1.5	1.4	1.4	1.4	2.1	-0.1	0.2
Total (Pet)	100.0	127.2	121.2	122.4	100.0	123.1	121.5	126.3		
Total (OC)	100.0	127.2	121.2	122.4	100.0	126.0	123.8	125.2		

STEP 12ii 'New' data, 1984/85 weights.

The new gross output figures (qtpt) have already been converted to constant prices (qtpo) with 1984/85=100, and expressed in index form (qtpo/qopo) in Table A2-6.S3. Benchmarked financial year PVMPs with 1984/85=100 are given directly in Table A2-6.S11ii(a)

TABLE A2-6.S12ii Weighted qtpo minus weighted PVMP (1984/85=100)

	Benchmarked PVMPs				Gross output data (new)				Differences: Gross Output - PVMP	
	1978/79	1981/82	1984/85	1987/88	1978/79	1981/82	1984/85	1987/88	1978/79	1981/82
FOOD	9.8	10.8	11.5	12.1	9.9	10.4	11.5	11.4	0.1	-0.4
BEVERAGES	1.6	2.4	2.8	3.1	1.5	2.3	2.8	3.3	-0.0	-0.1
TOBACCO	0.5	0.6	0.7	0.8	0.4	0.5	0.7	0.7	-0.1	-0.1
TEXTILES	3.6	4.5	3.7	3.9	3.4	4.2	3.7	3.7	-0.2	-0.3
CLOTHING	2.1	3.4	2.9	2.7	2.1	3.1	2.9	3.0	-0.0	-0.3
LEATHER	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.3	-0.0	-0.0
FOOTWEAR	0.9	1.0	1.0	0.9	0.9	1.0	1.0	1.1	-0.0	-0.0
WOOD	1.5	1.8	1.8	1.8	1.5	1.8	1.8	2.0	0.0	0.0
FURNITURE	0.9	1.7	1.4	1.4	0.9	1.4	1.4	1.8	-0.0	-0.2
PAPER	3.0	3.5	4.2	4.7	2.8	3.4	4.2	4.7	-0.1	-0.1
PRINTING	2.5	3.3	3.8	3.2	2.7	3.4	3.8	3.7	0.1	0.2
INDUSTRIAL CHEMICA	4.4	5.4	4.7	4.6	4.1	5.0	4.7	4.5	-0.3	-0.4
OTH CHEMICALS(Pet)	10.7	13.5	15.8	16.2	12.1	11.9	15.8	18.1	1.4	-1.6
OTH CHEMICALS(OC)	10.7	13.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

RUBBER	1.3	1.7	1.4	1.5	1.2	1.6	1.4	1.7	-0.0	-0.1
PLASTIC	1.3	2.0	2.1	2.6	1.3	1.8	2.1	3.0	-0.0	-0.2
POTTERY	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	-0.0	-0.0
GLASS	0.7	0.9	0.9	0.9	0.7	1.0	0.9	1.0	0.0	0.0
OTHER NON-M MIN PR	3.6	4.2	4.0	3.9	3.5	4.2	4.0	3.9	-0.1	-0.0
BASIC IRON & STEEL	8.0	8.8	7.6	8.6	8.0	8.7	7.6	8.0	-0.0	-0.0
BASIC NON-FERR MET	2.0	2.4	2.4	2.8	2.0	2.4	2.4	2.5	0.0	0.0
METAL PRODUCTS	7.7	9.4	8.0	7.3	7.2	9.1	8.0	6.5	-0.5	-0.3
MACHINERY	5.0	7.3	6.0	4.6	5.1	7.5	6.0	6.2	0.1	0.2
ELECTRICAL MACHINE	3.7	5.1	4.8	5.0	3.7	5.1	4.8	5.3	0.0	-0.1
MOTOR VEHICLES	3.9	6.1	4.8	5.0	3.9	6.0	4.8	4.3	0.0	-0.1
TRANSPORT EQUIPMEN	2.0	2.1	1.4	1.1	1.9	2.0	1.4	1.2	-0.0	-0.1
PROFESSIONAL	0.3	0.4	0.4	0.5	0.2	0.3	0.4	0.7	-0.1	-0.1
OTHER MANUF PROD	1.2	1.3	1.0	1.2	1.1	1.1	1.0	1.6	-0.1	-0.2
Total (Pet)	82.4	104.1	100.0	101.0	82.6	99.8	100.0	104.1		
Set 1978/79=100	100.0	126.3	121.3	122.6	100.0	120.8	121.0	126.0		
Total (OC)	82.4	104.1	100.0	101.0	80.6	101.1	100.0	99.8		
Set 1978/79=100	100.0	126.3	121.3	122.6	100.0	125.5	124.1	123.9		

STEP 13i Estimate benchmarked (calendar year) figures from the results in STEP 12ii. Use ratios of financial to calendar years given in Table A2-6.S14i(b) (benchmarked PVMPs).

TABLE A2-6.S13i Benchmarked Deflated Gross Output (1984/85 based data)

	1979	1982	1985	1988
FOOD	10.4	10.5	11.5	11.6
BEVERAGES	1.6	2.3	2.8	3.4
TOBACCO	0.4	0.6	0.7	0.7
TEXTILES	3.5	3.9	3.8	3.7
CLOTHING	2.2	3.0	2.7	3.0
LEATHER	0.3	0.4	0.3	0.4
FOOTWEAR	0.9	0.9	1.0	1.2
WOOD	1.6	1.9	1.8	2.0
FURNITURE	1.0	1.5	1.4	1.9
PAPER	3.0	3.3	4.1	5.0
PRINTING	2.8	3.5	3.5	3.8
INDUSTRIAL CHEMICA	4.2	4.7	4.6	4.5
OTH CHEMICALS(Pet)	12.1	11.8	15.0	19.4
OTH CHEMICALS(OC)	10.0	13.0	15.0	14.7
RUBBER	1.2	1.5	1.4	1.9
PLASTIC	1.4	1.8	2.3	3.1
POTTERY	0.1	0.2	0.2	0.2
GLASS	0.7	0.9	0.8	1.0
OTHER NON-M MIN PR	3.7	4.0	3.8	4.2
BASIC IRON & STEEL	8.6	7.9	8.0	7.8
BASIC NON-FERR MET	2.3	2.4	2.3	2.6
METAL PRODUCTS	7.1	8.8	7.9	6.7
MACHINERY	5.7	7.5	5.5	6.5
ELECTRICAL MACHINE	3.9	4.9	4.5	5.6
MOTOR VEHICLES	3.8	5.6	4.2	4.5
TRANSPORT EQUIPMEN	1.9	1.9	1.3	1.3
PROFESSIONAL	0.2	0.3	0.4	0.7
OTHER MANUF PROD	1.0	1.0	1.0	1.6
Tot(Pet) 84/85=100	85.7	96.7	96.7	108.2
Make 1979=100	100.0	112.9	112.9	126.3
Make 1985=100	88.6	99.9	100.0	111.9

Tot(OC) 84/85=100	83.6	97.9	96.7	103.5
Make 1979=100	100.0	117.1	115.7	123.8
Make 1985=100	86.4	101.2	100.0	107.0

STEP 13ii Estimate benchmarked (calendar year) figures from the results in Step 12ii. Use ratios of financial to calendar years given in Table A2-6.S14i(a) (unbenchmarked PVMPs).

TABLE A2-6.S13ii Benchmarked Deflated Gross Output (1984/85 based data)

	1979	1982	1985	1988
FOOD	10.5	10.6	11.5	11.7
BEVERAGES	1.6	2.3	2.8	3.4
TOBACCO	0.4	0.6	0.7	0.7
TEXTILES	3.6	3.9	3.8	3.7
CLOTHING	2.2	3.0	2.7	3.0
LEATHER	0.3	0.3	0.3	0.4
FOOTWEAR	0.9	0.9	1.0	1.1
WOOD	1.7	1.8	1.8	2.0
FURNITURE	1.0	1.4	1.4	1.9
PAPER	3.0	3.3	4.3	5.0
PRINTING	2.8	3.5	3.5	3.8
INDUSTRIAL CHEMICA	4.2	4.7	4.6	4.5
OTH CHEMICALS(Pet)	12.5	11.4	15.5	19.8
OTH CHEMICALS(OC)	10.3	12.6	15.5	15.0
RUBBER	1.2	1.4	1.4	1.9
PLASTIC	1.4	1.8	2.3	3.2
POTTERY	0.1	0.2	0.2	0.2
GLASS	0.7	0.9	0.8	1.0
OTHER NON-M MIN PR	3.7	4.0	3.7	4.2
BASIC IRON & STEEL	8.7	7.9	8.0	7.8
BASIC NON-FERR MET	2.3	2.4	2.4	2.6
METAL PRODUCTS	7.1	8.7	8.1	6.7
MACHINERY	5.8	7.4	5.4	6.5
ELECTRICAL MACHINE	3.8	4.9	4.5	5.6
MOTOR VEHICLES	3.8	5.5	4.1	4.5
TRANSPORT EQUIPMEN	2.0	2.0	1.2	1.3
PROFESSIONAL	0.2	0.3	0.5	0.7
OTHER MANUF PROD	1.1	1.0	1.1	1.6
Tot(Pet) 84/85=100	86.5	96.1	97.5	108.7
Set 1979=100	100.0	111.0	112.7	125.6
Set 1985=100	88.8	98.5	100.0	111.5
Tot(OC) 84/85=100	84.4	97.3	97.5	104.0
Set 1979=100	100.0	115.2	115.5	123.2
Set 1985=100	86.6	99.7	100.0	106.6

STEP 13iii Check against Real Output (Sum of Components) (New data) obtained in Table A2-6.S2. Ratios of financial to calendar year PVMPs for total manufacturing are from Table A2-6.D9. First step is to express those totals as indices with 1984/85=100. These are then converted to calendar year values.

Table A2-6.S13iii

	1978/79	1981/82	1984/85	1987/88
Σqtpo/Σqopo (Pet)	82.7	100.2	100.0	103.4
Convert	1979	1982	1985	1988
i - bmkd PVMPs	86.0	96.6	96.8	107.5
ii - unbmkd PVMPs	86.9	96.4	97.8	107.8

Set 1979=100				
i - bmkd PVMPs	100.0	112.4	112.6	125.0
ii - unbmkd PVMPs	100.0	110.9	112.5	124.0

	1978/79	1981/82	1984/85	1987/88
Σqtpo/Σqopo (OC)	81.0	101.2	100.0	99.8
Convert	1979	1982	1985	1988
i - bmkd PVMPs	84.2	97.6	96.8	103.8
ii - unbmkd PVMPs	85.2	97.4	97.8	104.1
Set 1979=100				
i - bmkd PVMPs	100.0	115.9	115.0	123.2
ii - unbmkd PVMPs	100.0	114.3	114.8	122.2

STEP 14.
Investigate the differences between the estimates of sum of the separate benchmarked industry output figures generated in Steps 11i and 11ii above (120.6 [122.9] or 123.0 [119.9] vs 117.6 for 1984/85).

i) Compare the ratios of calendar to financial year indices for the benchmarked and non-benchmarked CSS figures. (The 1987/88 figures are not strictly relevant for this exercise since there is no non-revised CSS output estimate after 1984/85)

TABLE A2-6.S14i(a)Unbenchmarked

	1979 to 1978/79	1982 to 1981/82	1985 to 1984/85	1988 to 1987/88
FOOD	1.060	1.019	1.004	1.023
BEVERAGES	1.018	1.000	0.979	1.042
TOBACCO	1.048	1.040	0.992	0.998
TEXTILES	1.060	0.939	1.015	1.009
CLOTHING	1.060	0.948	0.925	0.987
LEATHER	1.036	0.986	0.951	1.024
FOOTWEAR	1.005	0.912	0.968	1.070
WOOD	1.129	0.983	0.964	0.998
FURNITURE	1.088	0.974	0.990	1.059
PAPER	1.067	0.966	1.026	1.063
PRINTING	1.040	1.014	0.914	1.032
INDUSTRIAL CHEMICA	1.024	0.952	0.986	1.012
OTHER CHEMICALS	1.027	0.958	0.976	1.092
RUBBER	0.987	0.894	0.987	1.071
PLASTIC	1.094	0.996	1.089	1.069
POTTERY	1.103	0.797	0.975	1.012
GLASS	0.991	0.937	0.910	0.995
OTHER NON-M MIN PR	1.070	0.955	0.927	1.079
BASIC IRON & STEEL	1.086	0.906	1.050	0.986
BASIC NON-FERR MET	1.115	0.987	0.975	1.069
METAL PRODUCTS	0.982	0.954	1.006	1.034
MACHINERY	1.137	0.983	0.903	1.055
ELECTRICAL MACHINE	1.019	0.976	0.939	1.055
MOTOR VEHICLES	0.966	0.914	0.851	1.068
TRANSPORT EQUIPMEN	1.029	0.995	0.902	1.048
PROFESSIONAL	1.026	0.987	1.053	1.028
OTHER MANUF PROD	1.079	0.938	1.040	0.989

TABLE A2-6.S14i(b)Benchmarked

	1979 to	1982 to	1985 to	1988 to

	1978/79	1981/82	1984/85	1987/88
FOOD	1.055	1.016	1.005	1.017
BEVERAGES	1.023	1.008	0.969	1.042
TOBACCO	1.052	1.047	0.992	0.998
TEXTILES	1.038	0.943	1.006	1.015
CLOTHING	1.056	0.959	0.926	0.987
LEATHER	1.058	1.008	0.915	1.040
FOOTWEAR	1.005	0.912	0.968	1.105
WOOD	1.091	1.028	0.956	0.998
FURNITURE	1.105	1.021	0.990	1.059
PAPER	1.062	0.962	0.976	1.063
PRINTING	1.040	1.014	0.914	1.032
INDUSTRIAL CHEMICA	1.016	0.941	0.985	1.012
OTHER CHEMICALS	0.994	0.986	0.949	1.069
RUBBER	1.002	0.940	0.965	1.071
PLASTIC	1.103	0.996	1.089	1.044
POTTERY	1.134	0.812	0.975	1.012
GLASS	1.027	0.938	0.909	0.995
OTHER NON-M MIN PR	1.067	0.953	0.938	1.079
BASIC IRON & STEEL	1.080	0.908	1.053	0.987
BASIC NON-FERR MET	1.112	0.983	0.972	1.069
METAL PRODUCTS	0.978	0.962	0.990	1.026
MACHINERY	1.121	0.998	0.911	1.052
ELECTRICAL MACHINE	1.041	0.976	0.930	1.055
MOTOR VEHICLES	0.954	0.919	0.874	1.068
TRANSPORT EQUIPMEN	0.996	0.934	0.927	1.044
PROFESSIONAL	1.035	1.064	0.994	1.028
OTHER MANUF PROD	0.982	0.898	0.956	1.005

TABLE A2-6.S14i(c)

Differences between these ratios:- Unbmkd - benchmarked

	1979 to 1978/79	1982 to 1981/82	1985 to 1984/85	1988 to 1987/88
FOOD	0.006	0.004	-0.001	0.007
BEVERAGES	-0.005	-0.008	0.010	0.000
TOBACCO	-0.004	-0.007	0.000	-0.000
TEXTILES	0.022	-0.004	0.009	-0.006
CLOTHING	0.004	-0.011	-0.001	0.000
LEATHER	-0.023	-0.022	0.036	-0.016
FOOTWEAR	0.000	0.000	0.000	-0.034
WOOD	0.038	-0.045	0.008	0.000
FURNITURE	-0.017	-0.047	0.000	0.000
PAPER	0.005	0.004	0.050	0.000
PRINTING	0.000	0.000	0.000	0.000
INDUSTRIAL CHEMICA	0.008	0.011	0.002	0.000
OTHER CHEMICALS	0.033	-0.027	0.027	0.022
RUBBER	-0.015	-0.046	0.022	0.000
PLASTIC	-0.009	0.000	0.000	0.025
POTTERY	-0.031	-0.015	0.000	0.000
GLASS	-0.036	-0.000	0.000	0.000
OTHER NON-M MIN PR	0.003	0.002	-0.012	0.000
BASIC IRON & STEEL	0.007	-0.001	-0.003	-0.000
BASIC NON-FERR MET	0.003	0.004	0.003	-0.000
METAL PRODUCTS	0.004	-0.008	0.016	0.007
MACHINERY	0.016	-0.015	-0.008	0.003
ELECTRICAL MACHINE	-0.021	-0.000	[illegible]	[illegible]

MOTOR VEHICLES	0.012	-0.004	-0.023	0.000
TRANSPORT EQUIPMEN	0.033	0.061	-0.026	0.004
PROFESSIONAL	-0.009	-0.077	0.059	0.000
OTHER MANUF PROD	0.097	0.040	0.084	-0.015

There is a sufficiently large number of very small differences or zeroes to make it appear that the ratio method as spelled out above is applied. Once again though, the large number of significantly different results requires explanation.

ii) Compare CSS financial year PVMP (benchmarked) with value of deflated non-revised ('Old') gross output - 1978/79=100

TABLE A2-6.S14ii	Benchmarked PVMPs		Deflated gross out		Differences:- Deflated gross out		Absolute averages		
	1981/82	1984/85	1981/82	1984/85	1981/82	1984/85	1981/82	1984/85	
FOOD	110.1	116.9	103.9	115.9	6.2	1.0	6.2	1.0	
BEVERAGES	152.8	181.8	156.5	179.2	-3.7	2.6	3.7	2.6	
TOBACCO	127.3	141.3	127.4	146.6	-0.1	-5.4	0.1	5.4	
TEXTILES	126.6	105.0	117.6	103.6	9.0	1.4	9.0	1.4	
CLOTHING	158.6	137.1	143.3	137.2	15.3	-0.0	15.3	0.0	
LEATHER	131.6	132.7	130.9	147.7	0.7	-15.1	0.7	15.1	
FOOTWEAR	116.0	109.4	116.2	111.3	-0.2	-1.9	0.2	1.9	
WOOD	122.3	125.1	120.5	126.4	1.8	-1.3	1.8	1.3	
FURNITURE	179.8	153.9	154.2	159.4	25.6	-5.5	25.6	5.5	
PAPER	118.7	142.0	104.9	144.7	13.8	-2.7	13.8	2.7	
PRINTING	128.0	149.8	128.3	142.4	-0.3	7.4	0.3	7.4	
INDUSTRIAL CHEMICA	123.4	107.4	118.8	106.6	4.6	0.8	4.6	0.8	
OTH CHEMICALS(Pet)	126.5	148.2	97.5	127.2	29.0	21.0	29.0	21.0	
OTH CHEMICALS(OC)	126.5	148.2	129.8	153.5	-3.3	-5.3	3.3	5.3	
RUBBER	131.2	112.1	128.6	116.4	2.6	-4.3	2.6	4.3	
PLASTIC	149.6	157.8	171.4	160.3	-21.8	-2.4	21.8	2.4	
POTTERY	167.3	148.0	166.7	151.9	0.6	-4.0	0.6	4.0	
GLASS	136.7	127.8	139.6	124.9	-2.9	2.8	2.9	2.8	
OTHER NON-M MIN PR	119.5	113.8	121.2	116.3	-1.7	-2.5	1.7	2.5	
BASIC IRON & STEEL	109.5	95.5	109.3	95.8	0.2	-0.2	0.2	0.2	
BASIC NON-FERR MET	117.0	119.4	116.9	119.3	0.1	0.0	0.1	0.0	
METAL PRODUCTS	122.6	103.9	127.0	108.2	-4.4	-4.2	4.4	4.2	
MACHINERY	146.5	120.6	155.0	129.7	-8.5	-9.2	8.5	9.2	
ELECTRICAL MACHINE	136.8	128.1	137.5	130.5	-0.7	-2.4	0.7	2.4	
MOTOR VEHICLES	156.8	123.8	153.7	125.3	3.1	-1.6	3.1	1.6	
TRANSPORT EQUIPMEN	105.4	70.2	90.7	62.2	14.7	8.0	14.7	8.0	
PROFESSIONAL	133.8	163.0	156.7	262.3	-22.9	-99.3	171.8	107.6	Abs Sum (Pet)
OTHER MANUF PROD	109.4	88.6	107.2	99.3	2.2	-10.7	146.1	92.0	Abs Sum (OC)
							6.6	4.1	Abs avg (Pet)
							5.6	3.5	Abs avg (OC)

There is not a sufficiently large number of deviations approximately equal to zero to confirm that this is a valid comparison. See especially the basic metal industries, ferrous and non-ferrous.
Why the substantial divergences observed above?

iii) Check the implicit deflators and compare these with the PPIs. (1978/79=100)

Check differences between implicit and actual deflators.
Where the implicit deflator is larger, the CSS benchmarked estimates will be lower than the deflated values of gross

output as estimated here, and vice-versa. The PVMPs are given in Table A2-6.S11i(a), and the PPIs in Table A2-6.S11i(b).

TABLE A2-6.S14iii Financial years

	Impl defs from CSS b'mkd ests.		PPIs from Table A2-6.S11i(b)		Differences:- Implicit Def - PPI	
	1981/82	1984/85	1981/82	1984/85	1981/82	1984/85
FOOD	158.2	222.5	167.6	224.4	-9.5	-1.8
BEVERAGES	128.4	167.5	125.4	170.0	3.0	-2.4
TOBACCO	133.2	188.8	133.1	181.9	0.1	6.9
TEXTILES	127.2	178.2	136.9	180.5	-9.7	-2.4
CLOTHING	118.7	177.0	131.4	177.0	-12.7	0.0
LEATHER	114.9	185.8	115.5	166.8	-0.6	18.9
FOOTWEAR	158.6	208.6	158.2	204.9	0.3	3.6
WOOD	166.7	236.2	169.1	233.8	-2.4	2.3
FURNITURE	131.9	212.4	153.8	205.0	-21.9	7.3
PAPER	133.0	205.4	150.6	201.6	-17.5	3.8
PRINTING	151.0	191.6	150.6	201.6	0.4	-10.0
INDUSTRIAL CHEMICA	144.3	202.2	149.8	203.8	-5.6	-1.6
OTH CHEMICALS(Pet)	153.7	211.1	199.4	245.9	-45.7	-34.9
OTH CHEMICALS(OC)	153.7	211.1	149.8	203.8	3.9	7.3
RUBBER	139.3	191.9	142.2	184.8	-2.9	7.1
PLASTIC	162.9	187.6	142.2	184.8	20.7	2.9
POTTERY	153.0	231.2	153.5	225.1	-0.5	6.0
GLASS	156.8	220.2	153.5	225.1	3.3	-5.0
OTHER NON-M MIN PR	155.8	230.1	153.5	225.1	2.2	4.9
BASIC IRON & STEEL	151.8	213.8	152.1	213.3	-0.3	0.5
BASIC NON-FERR MET	140.4	208.0	140.6	208.0	-0.2	-0.0
METAL PRODUCTS	162.0	222.0	156.4	213.4	5.6	8.7
MACHINERY	153.9	217.7	145.5	202.3	8.4	15.4
ELECTRICAL MACHINE	145.2	199.4	144.4	195.8	0.8	3.7
MOTOR VEHICLES	141.9	215.6	144.8	212.9	-2.8	2.7
TRANSPORT EQUIPMEN	124.5	188.5	144.8	212.9	-20.2	-24.4
PROFESSIONAL	149.9	240.5	128.0	149.5	21.9	91.0
OTHER MANUF PROD	125.5	167.4	128.0	149.5	-2.6	18.0

Apart from 2 zero differences, 8 1984/85 PPIs are smaller, only 2 by a significant amount. All of the other implicit deflators are larger, some substantially so. Critical differences exist in 'Other Chemicals (Pet)' and 'Machinery'. 'Professional' and 'Other Manufacturing' stand out as anomalous.

APPENDIX 2-7

Estimate Real Net Output

Rows 1-147 consist of basic data imported from Appendix 4 - Tables A2-6.D9; A2-6.S1; A2-6.S2 and A2-6.S14i(b).

Unlike the approach adopted for Appendix 2-6, the mechanics of the process of attempting to estimate real net output, and the results it generates are not discussed in this appendix. Instead, they are to be found towards the end of Chapter 2-7 of the study, along with the review of the theory which tries to justify their use.

Import the net output weights from file APP-4.WQ1
These estimates of net output have been made because the weights
given in P3041.2 of 12 November 1993, and used in APP-4.WQ1
are the only indications of the split in the Other Chemicals
between Other Chemicals & Prod of Petroleum and Coal

	1979	1982	1985	1988
FOOD	11.6	10.9	11.5	12.3
BEVERAGES	2.8	2.7	2.9	3.7
TOBACCO	0.6	0.3	0.7	0.6
TEXTILES	5.1	4.5	3.7	4.4
CLOTHING	3.0	3.1	2.9	2.8
LEATHER	0.4	0.4	0.4	0.5
FOOTWEAR	1.1	1.2	1.0	1.1
WOOD	1.7	1.9	1.8	2.0
FURNITURE	1.2	1.5	1.4	1.5
PAPER	3.7	3.9	4.2	4.9
PRINTING	3.7	3.7	3.8	3.8
INDUSTRIAL CHEMICALS	5.3	4.8	4.7	4.8
OTHER CHEMICALS	5.2	5.5	5.2	6.2
PETROL & COAL PROD	3.5	3.6	10.7	6.3
RUBBER	1.8	1.9	1.4	1.5
PLASTIC	1.8	1.9	2.1	2.5
POTTERY	0.2	0.2	0.2	0.2
GLASS	0.8	1.0	0.9	1.1
OTHER NON-M MIN PROD	4.0	3.9	4.0	3.7
BASIC IRON & STEEL	10.4	8.9	7.6	7.3
BASIC NON-FERR MET	2.5	2.2	2.4	2.3
METAL PRODUCTS	8.9	9.7	8.0	7.4
MACHINERY	6.9	8.1	6.0	5.6
ELECTRICAL MACHINERY	5.3	5.3	4.8	5.0
MOTOR VEHICLES	5.0	6.2	4.8	5.6
TRANSPORT EQUIPMENT	1.9	1.4	1.4	1.6
PROFESSIONAL	0.3	0.3	0.4	0.5
OTHER MANUF PROD	1.4	1.1	1.1	0.9

Reconstruct the PPIs in Table A2-6.S1. Nb. These are values.

	Financial years			
	1978/79	1981/82	1984/85	1987/88
Food	44.6	74.7	100.0	154.5
Beverage	58.8	73.8	100.0	142.6
Tobacco	55.0	73.2	100.0	133.9
Textiles	55.4	75.8	100.0	168.2
Clothing	56.5	74.2	100.0	152.3
Leather	59.9	69.2	100.0	185.0
Footwear	48.8	77.2	100.0	166.7
Wood	42.8	72.3	100.0	150.9
Furniture	48.8	75.0	100.0	145.8
Paper	49.6	74.7	100.0	166.3
Printing	49.6	74.7	100.0	166.3
Industrial Chemicals	49.1	73.5	100.0	157.3
Oth Chemicals(OC)	49.1	73.5	100.0	157.3
Petroleum & Coal	40.8	81.2	100.0	119.5
Rubber	54.1	77.0	100.0	137.8

Plastic	48.6	73.4	100.0	156.5
Pottery	44.4	68.2	100.0	154.8
Glass	44.4	68.2	100.0	154.8
Other Non-metal Min	44.4	68.2	100.0	154.8
Basic iron	46.9	71.3	100.0	154.0
Basic non-ferrous	48.1	67.6	100.0	147.8
Metal Products	46.9	73.3	100.0	164.4
Machinery	49.4	71.9	100.0	155.6
Electrical machinery	51.1	73.8	100.0	152.1
Motor vehicles	47.0	68.0	100.0	195.8
Transport equipment	47.0	68.0	100.0	195.8
Professional	48.6	73.4	100.0	156.5
Other manufacturing	48.6	73.4	100.0	156.5

STEP 1. Estimate calendar and financial year Real Net Output
Use revised data published in SHR P3001 of 28 June 1993.

i) Estimate Real Net Output using PPI in Table A2-6.S1 (1984/85=100) as deflator

TABLE A2-7.S1i	1978/79	1981/82	1984/85	1987/88
FOOD	2933.5	3164.9	3587.5	3795.0
BEVERAGES	536.3	803.9	891.8	1234.6
TOBACCO	122.7	73.1	211.2	198.4
TEXTILES	1023.8	1294.8	1169.3	1235.4
CLOTHING	588.6	904.3	915.2	885.2
LEATHER	81.0	111.4	115.2	117.3
FOOTWEAR	258.2	326.3	309.1	323.7
WOOD	449.7	571.5	575.9	646.4
FURNITURE	276.8	446.0	448.0	498.5
PAPER	833.5	1130.3	1311.8	1418.4
PRINTING	836.1	1068.5	1191.7	1099.5
INDUSTRIAL CHEMICALS	1205.6	1422.6	1469.3	1455.6
OTH CHEMICALS(Pet)	2395.5	2457.5	4956.9	4999.5
OTH CHEMICALS(OC)	1984.7	2709.5	4956.9	3795.9
RUBBER	369.5	525.7	444.0	534.4
PLASTIC	379.3	546.5	653.4	862.8
POTTERY	40.7	76.6	63.0	66.7
GLASS	211.6	317.4	270.0	339.8
OTHER NON-M MIN PROD	1011.0	1231.4	1264.8	1146.9
BASIC IRON & STEEL	2501.2	2705.8	2391.2	2276.6
BASIC NON-FERR MET	593.0	698.7	754.7	731.5
METAL PRODUCTS	2127.3	2880.0	2506.9	2142.8
MACHINERY	1568.4	2444.3	1880.5	1709.6
ELECTRICAL MACHINERY	1160.1	1551.6	1502.4	1553.8
MOTOR VEHICLES	1189.5	1963.6	1515.0	1361.9
TRANSPORT EQUIPMENT	445.9	435.3	432.7	384.4
PROFESSIONAL	53.2	86.8	136.6	201.4
OTHER MANUF PROD	238.1	280.8	328.2	406.9
TOTAL (Pet)	23430.0	29519.7	31296.5	31627.0
Σqtpo/Σqopo	74.9	94.3	100.0	101.1
Set 1978/79=100	100.0	126.0	133.6	135.0
TOTAL (OC)	23019.2	29771.7	31296.5	30423.5
Σqtpo/Σqopo	73.6	95.1	100.0	97.2
Set 1978/79=100	100.0	129.3	136.0	132.2

ii) Check differences between Real Net Output (Sum of Components) and Real Net Output (Total).
Deflate current price net output estimates in Table A2-6.D9 by aggregate PPIs from CSS letter of 3 July 1992. The 1987/88 figure is from Y1988.WK1

TABLE A2-7.S1ii	1978/79	1981/82	1984/85	1987/88
	45.2	68.2	92.7	145.3
Make 1984/85=100	48.7	73.5	100.0	156.8
Net Output (Σqtpt)	11237.9	21717.9	31296.5	47783.1
Σqtpo	23068.1	29541.4	31296.5	30478.3
Σqtpo/Σqopo	73.7	94.4	100.0	97.4
Set 1978/79=100	100.0	128.1	135.7	132.1

Largest differences between Real Net Output (Sum of Components) and Real Net Output (Total) occur where Petroleum PPI is used.
2.1 percentage points in 1981/82, 2.4 in 1984/85 and 2.9 in 1987/88.

iii) Convert Real Net Output values to Index Form and subtract Real Gross Output in Table A2-6.S2 for the year 1984/85 only from Real Net Output. For this exercise, 1978/79 must be used as base year.

TABLE A2-7.S1iii	Real Net Output				RealGross Output	Diff:- Net - Gross
	1978/79	1981/82	1984/85	1987/88	1984/85	1984/85
FOOD	100.0	107.9	122.3	129.4	115.9	6.4
BEVERAGES	100.0	149.9	166.3	230.2	185.8	-19.5
TOBACCO	100.0	59.5	172.1	161.7	159.1	13.0
TEXTILES	100.0	126.5	114.2	120.7	110.3	3.9
CLOTHING	100.0	153.6	155.5	150.4	138.1	17.4
LEATHER	100.0	137.5	142.2	144.8	138.5	3.7
FOOTWEAR	100.0	126.4	119.7	125.4	111.3	8.4
WOOD	100.0	127.1	128.1	143.7	121.7	6.4
FURNITURE	100.0	161.1	161.8	180.1	159.4	2.4
PAPER	100.0	135.6	157.4	170.2	148.7	8.7
PRINTING	100.0	127.8	142.5	131.5	142.4	0.1
INDUSTRIAL CHEMICALS	100.0	118.0	121.9	120.7	114.4	7.5
OTH CHEMICALS(Pet)	100.0	102.6	206.9	208.7	130.5	76.4
OTH CHEMICALS(OC)	100.0	136.5	249.8	191.3	157.6	92.2
RUBBER	100.0	142.3	120.2	144.6	116.4	3.7
PLASTIC	100.0	144.1	172.3	227.5	160.3	12.0
POTTERY	100.0	188.4	154.9	164.0	152.2	2.7
GLASS	100.0	150.0	127.6	160.6	124.9	2.7
OTHER NON-M MIN PROD	100.0	121.8	125.1	113.4	116.3	8.8
BASIC IRON & STEEL	100.0	108.2	95.6	91.0	95.8	-0.2
BASIC NON-FERR MET	100.0	117.8	127.3	123.3	119.2	8.1
METAL PRODUCTS	100.0	135.4	117.8	100.7	110.7	7.2
MACHINERY	100.0	155.8	119.9	109.0	118.4	1.5
ELECTRICAL MACHINERY	100.0	133.7	129.5	133.9	128.0	1.5
MOTOR VEHICLES	100.0	165.1	127.4	114.5	123.0	4.3
TRANSPORT EQUIPMENT	100.0	97.6	97.0	86.2	71.7	25.3
PROFESSIONAL	100.0	163.1	256.8	378.5	225.4	31.4
OTHER MANUF PROD	100.0	117.9	137.9	170.9	99.4	38.5

iv and v) Estimate aggregate 'pseudo' PVMPs by adding up weighted sub-sectoral 'pseudo' PVMPs obtained from Steps 1.i and 1.iii above. (qtpo/qopo * qt/Σqt)

iv) 1978/79 weights

TABLE A2-7.S1iv

	1978/79	1981/82	1984/85	1987/88
FOOD	11.6	12.6	14.2	15.1
BEVERAGES	2.8	4.2	4.7	6.5
TOBACCO	0.6	0.4	1.0	1.0
TEXTILES	5.0	6.4	5.8	6.1
CLOTHING	3.0	4.5	4.6	4.5
LEATHER	0.4	0.6	0.6	0.6
FOOTWEAR	1.1	1.4	1.3	1.4
WOOD	1.7	2.2	2.2	2.5
FURNITURE	1.2	1.9	1.9	2.2
PAPER	3.7	5.0	5.8	6.3
PRINTING	3.7	4.7	5.3	4.9
INDUSTRIAL CHEMICALS	5.3	6.2	6.4	6.4
OTH CHEMICALS(Pet)	8.7	8.9	17.9	18.1
OTH CHEMICALS(OC)	8.7	11.8	21.6	16.6
RUBBER	1.8	2.5	2.1	2.6
PLASTIC	1.8	2.6	3.1	4.2
POTTERY	0.2	0.3	0.2	0.3
GLASS	0.8	1.3	1.1	1.3
OTHER NON-M MIN PROD	4.0	4.9	5.0	4.5
BASIC IRON & STEEL	10.4	11.3	10.0	9.5
BASIC NON-FERR MET	2.5	3.0	3.2	3.1
METAL PRODUCTS	8.9	12.0	10.5	8.9
MACHINERY	6.9	10.8	8.3	7.5
ELECTRICAL MACHINERY	5.3	7.1	6.8	7.1
MOTOR VEHICLES	5.0	8.2	6.3	5.7
TRANSPORT EQUIPMENT	1.9	1.8	1.8	1.6
PROFESSIONAL	0.3	0.5	0.8	1.2
OTHER MANUF PROD	1.4	1.7	2.0	2.4
Total (Pet)	100.0	126.9	133.1	135.2
Total (OC)	100.0	129.8	136.8	133.7

v) 1984/85 weights.

TABLE A2-7.S1v

	1978/79	1981/82	1984/85	1987/88
FOOD	9.4	10.1	11.5	12.1
BEVERAGES	1.7	2.6	2.8	3.9
TOBACCO	0.4	0.2	0.7	0.6
TEXTILES	3.3	4.1	3.7	3.9
CLOTHING	1.9	2.9	2.9	2.8
LEATHER	0.3	0.4	0.4	0.4
FOOTWEAR	0.8	1.0	1.0	1.0
WOOD	1.4	1.8	1.8	2.1
FURNITURE	0.9	1.4	1.4	1.6
PAPER	2.7	3.6	4.2	4.5
PRINTING	2.7	3.4	3.8	3.5
INDUSTRIAL CHEMICALS	3.9	4.5	4.7	4.7
OTH CHEMICALS(Pet)	7.7	7.9	15.8	16.0
OTH CHEMICALS(OC)	6.3	8.7	15.8	12.1

RUBBER	1.2	1.7	1.4	1.7
PLASTIC	1.2	1.7	2.1	2.8
POTTERY	0.1	0.2	0.2	0.2
GLASS	0.7	1.0	0.9	1.1
OTHER NON-M MIN PROD	3.2	3.9	4.0	3.7
BASIC IRON & STEEL	8.0	8.6	7.6	7.3
BASIC NON-FERR MET	1.9	2.2	2.4	2.3
METAL PRODUCTS	6.8	9.2	8.0	6.8
MACHINERY	5.0	7.8	6.0	5.5
ELECTRICAL MACHINERY	3.7	5.0	4.8	5.0
MOTOR VEHICLES	3.8	6.3	4.8	4.4
TRANSPORT EQUIPMENT	1.4	1.4	1.4	1.2
PROFESSIONAL	0.2	0.3	0.4	0.6
OTHER MANUF PROD	0.8	0.9	1.0	1.3
Total (Pet)	74.9	94.3	100.0	101.1
Set 1978/79=100	100.0	126.0	133.6	135.0
Total (OC)	73.6	95.1	100.0	97.2
Set 1978/79=100	100.0	129.3	136.0	132.2

vi) Estimate calendar year output index from Table A2-6.S1iv (1978/79-weighted) results using ratios derived from the benchmarked results in Table A2-6.S14i(b)

TABLE A2-7.S1vi

	1979	1982	1985	1988
FOOD	12.3	12.7	14.3	15.3
BEVERAGES	2.9	4.2	4.5	6.7
TOBACCO	0.6	0.4	1.0	1.0
TEXTILES	5.2	6.0	5.8	6.2
CLOTHING	3.1	4.4	4.3	4.4
LEATHER	0.5	0.6	0.6	0.7
FOOTWEAR	1.1	1.3	1.3	1.6
WOOD	1.9	2.2	2.1	2.5
FURNITURE	1.3	2.0	1.9	2.3
PAPER	3.9	4.8	5.6	6.7
PRINTING	3.8	4.8	4.8	5.0
INDUSTRIAL CHEMICALS	5.3	5.8	6.3	6.4
OTH CHEMICALS(Pet)	8.6	8.8	17.0	19.3
OTH CHEMICALS(OC)	8.6	11.7	20.6	17.7
RUBBER	1.8	2.4	2.1	2.8
PLASTIC	2.0	2.6	3.4	4.3
POTTERY	0.2	0.2	0.2	0.3
GLASS	0.9	1.2	1.0	1.3
OTHER NON-M MIN PROD	4.3	4.6	4.7	4.9
BASIC IRON & STEEL	11.3	10.2	10.5	9.4
BASIC NON-FERR MET	2.8	2.9	3.1	3.3
METAL PRODUCTS	8.7	11.6	10.3	9.2
MACHINERY	7.7	10.7	7.5	7.9
ELECTRICAL MACHINERY	5.5	6.9	6.4	7.5
MOTOR VEHICLES	4.7	7.5	5.5	6.1
TRANSPORT EQUIPMENT	1.9	1.7	1.7	1.7
PROFESSIONAL	0.3	0.5	0.8	1.2
OTHER MANUF PROD	1.4	1.5	1.9	2.4
Total (Pet)	104.0	122.7	128.8	140.2
Set 1979=100	100.0	118.0	123.8	134.8
Total (OC)	104.0	125.6	132.3	138.6
Set 1979=100	100.0	120.8	127.2	133.3

vii) Estimate calendar year output indices from Table A2-6.S1v (1984/85-weighted) results using ratios derived from the benchmarked results in Table A2-6.S14i(b)

TABLE A2-7.S1vii

	1979	1982	1985	1988
FOOD	9.9	10.3	11.5	12.3
BEVERAGES	1.8	2.6	2.8	4.1
TOBACCO	0.4	0.2	0.7	0.6
TEXTILES	3.4	3.9	3.8	4.0
CLOTHING	2.0	2.8	2.7	2.8
LEATHER	0.3	0.4	0.3	0.4
FOOTWEAR	0.8	1.0	1.0	1.1
WOOD	1.6	1.9	1.8	2.1
FURNITURE	1.0	1.5	1.4	1.7
PAPER	2.8	3.5	4.1	4.8
PRINTING	2.8	3.5	3.5	3.6
INDUSTRIAL CHEMICALS	3.9	4.3	4.6	4.7
OTH CHEMICALS(Pet)	7.6	7.7	15.0	17.1
OTH CHEMICALS(OC)	6.3	8.5	15.0	13.0
RUBBER	1.2	1.6	1.4	1.8
PLASTIC	1.3	1.7	2.3	2.9
POTTERY	0.1	0.2	0.2	0.2
GLASS	0.7	1.0	0.8	1.1
OTHER NON-M MIN PROD	3.4	3.7	3.8	4.0
BASIC IRON & STEEL	8.6	7.8	8.0	7.2
BASIC NON-FERR MET	2.1	2.2	2.3	2.5
METAL PRODUCTS	6.6	8.9	7.9	7.0
MACHINERY	5.6	7.8	5.5	5.7
ELECTRICAL MACHINERY	3.9	4.8	4.5	5.2
MOTOR VEHICLES	3.6	5.8	4.2	4.6
TRANSPORT EQUIPMENT	1.4	1.3	1.3	1.3
PROFESSIONAL	0.2	0.3	0.4	0.7
OTHER MANUF PROD	0.7	0.8	1.0	1.3
Total (Pet)	77.8	91.3	96.7	104.9
Make 1979=100	100.0	117.3	124.3	134.8
Total (OC)	76.5	92.1	96.7	100.8
Make 1979=100	100.0	120.3	126.4	131.7

STEP 2 Examine the impact on these results of the publication of the P3041.3, 12 November 1993 estimates.

i) Estimate the value of net output in current prices

TABLE A2-7.S2i	1978/79	1981/82	1984/85	1987/88
Food	1307.0	2365.1	3586.6	5863.0
Beverage	315.8	592.9	891.9	1758.4
Tobacco	67.4	54.3	209.7	267.6
Textiles	567.5	981.6	1170.5	2078.6
Clothing	332.6	671.1	913.9	1347.5
Leather	48.3	78.2	115.8	215.0
Footwear	125.9	251.9	309.8	539.9
Wood	192.2	412.6	575.9	974.8
Furniture	134.9	334.5	447.5	726.3
Paper	413.6	844.8	1311.3	2355.7

Printing	414.7	799.2	1192.4	1830.1
Industrial Chemicals	591.1	1046.8	1467.8	2288.8
Oth Chemicals(OC)	582.1	1203.2	1621.2	2967.3
Petroleum & Coal	392.2	788.4	3336.2	3005.6
Rubber	200.0	404.0	444.4	735.9
Plastic	205.7	421.3	654.1	1189.8
Pottery	18.0	52.1	62.6	105.1
Glass	94.4	217.2	269.1	525.6
Other Non-metal Min	449.5	840.5	1264.4	1772.8
Basic iron	1173.2	1928.5	2391.1	3507.3
Basic non-ferrous	285.4	471.3	754.2	1079.9
Metal Products	996.8	2111.0	2506.8	3521.6
Machinery	775.4	1759.1	1880.9	2661.5
Electrical machinery	592.2	1144.5	1502.2	2365.3
Motor vehicles	558.5	1335.6	1514.7	2666.3
Transport equipment	209.0	295.4	431.9	755.0
Professional	36.0	73.8	137.7	224.6
Other manufacturing	159.6	241.1	328.6	449.2
	11239.0	21720.0	31293.3	47778.4

Check against total net output estimates from Table A2-6.D9

TOTAL	11237.9	21717.9	31296.5	47783.1

ii) Estimate value of real net output

TABLE A2-7.S2ii	1978/79	1981/82	1984/85	1987/88
Food	2932.3	3165.0	3586.6	3793.8
Beverage	536.7	803.8	891.9	1233.3
Tobacco	122.7	74.2	209.7	199.8
Textiles	1024.6	1294.5	1170.5	1235.5
Clothing	588.7	904.0	913.9	885.0
Leather	80.6	112.9	115.8	116.3
Footwear	257.9	326.2	309.8	324.0
Wood	449.3	570.5	575.9	646.0
Furniture	276.5	445.8	447.5	498.0
Paper	833.7	1130.9	1311.3	1417.0
Printing	835.9	1069.8	1192.4	1100.8
Industrial Chemicals	1204.5	1423.6	1467.8	1454.7
Oth Chemicals(OC)	1186.2	1636.2	1621.2	1886.0
Petroleum & Coal	961.7	970.8	3336.2	2515.0
Rubber	369.6	524.9	444.4	534.0
Plastic	423.4	574.0	654.1	760.3
Pottery	40.5	76.4	62.6	67.9
Glass	212.5	318.4	269.1	339.6
Other Non-metal Min	1012.0	1232.3	1264.4	1145.5
Basic iron	2502.5	2705.0	2391.1	2276.9
Basic non-ferrous	593.8	697.3	754.2	730.5
Metal Products	2126.7	2880.2	2506.8	2142.3
Machinery	1568.8	2445.7	1880.9	1710.3
Electrical machinery	1159.4	1551.2	1502.2	1554.6
Motor vehicles	1189.2	1964.3	1514.7	1361.5
Transport equipment	445.1	434.4	431.9	385.5
Professional	74.0	100.6	137.7	143.5
Other manufacturing	328.5	328.4	328.6	287.0
	23337.3	29761.3	31293.3	30744.7

iii) Convert to index form

TABLE A2-7.S2iii	1978/79	1981/82	1984/85	1987/88
Food	100.0	107.9	122.3	129.4
Beverage	100.0	149.8	166.2	229.8
Tobacco	100.0	60.5	170.9	162.9
Textiles	100.0	126.3	114.2	120.6
Clothing	100.0	153.6	155.2	150.3
Leather	100.0	140.1	143.6	144.2
Footwear	100.0	126.5	120.1	125.6
Wood	100.0	127.0	128.2	143.8
Furniture	100.0	161.2	161.9	180.1
Paper	100.0	135.7	157.3	170.0
Printing	100.0	128.0	142.6	131.7
Industrial Chemicals	100.0	118.2	121.9	120.8
Oth Chemicals(OC)	100.0	137.9	136.7	159.0
Petroleum & Coal	100.0	100.9	346.9	261.5
Rubber	100.0	142.0	120.2	144.5
Plastic	100.0	135.6	154.5	179.6
Pottery	100.0	188.8	154.6	167.8
Glass	100.0	149.8	126.6	159.8
Other Non-metal Min	100.0	121.8	124.9	113.2
Basic iron	100.0	108.1	95.5	91.0
Basic non-ferrous	100.0	117.4	127.0	123.0
Metal Products	100.0	135.4	117.9	100.7
Machinery	100.0	155.9	119.9	109.0
Electrical machinery	100.0	133.8	129.6	134.1
Motor vehicles	100.0	165.2	127.4	114.5
Transport equipment	100.0	97.6	97.0	86.6
Professional	100.0	135.9	186.0	193.8
Other manufacturing	100.0	100.0	100.0	87.4

iv) Rebase and link in the same manner as SNA (1992) Table XVI.1

Gross outputs - new data P85Q88

	1978/79			1981/82			1984/85			1987/88		
TABLE A2-7.S2iv(a)	P78	Q78	V78	P82	Q82	V82	P84	Q84	V84	P87	Q87	V87
Food	44.6	99.9	4451.0	74.7	104.6	7815.6	100.0	115.8	11576.3	154.5	115.4	17835.4
Beverage	58.8	15.4	908.2	73.8	22.9	1690.3	100.0	28.7	2867.5	142.6	33.3	4748.6
Tobacco	55.0	3.4	188.4	73.2	4.4	319.6	100.0	5.5	545.2	133.9	5.5	730.7
Textiles	55.4	27.2	1505.1	75.8	33.4	2530.6	100.0	30.0	2998.4	168.2	29.4	4940.0
Clothing	56.5	14.0	791.2	74.2	20.6	1529.5	100.0	19.3	1933.8	152.3	20.1	3064.9
Leather	59.9	2.4	145.4	69.2	3.2	219.9	100.0	3.4	335.9	185.0	3.2	588.1
Footwear	48.8	5.8	283.4	77.2	6.8	521.3	100.0	6.5	646.5	166.7	6.9	1153.7
Wood	42.8	10.1	430.8	72.3	12.1	876.3	100.0	12.3	1225.9	150.9	13.1	1970.2
Furniture	48.8	5.7	279.5	75.0	9.1	686.0	100.0	9.1	913.7	145.8	11.2	1632.7
Paper	49.6	20.5	1016.9	74.7	24.8	1851.2	100.0	30.5	3047.5	166.3	34.0	5660.1
Printing	49.6	14.3	707.2	74.7	18.3	1366.9	100.0	20.3	2030.4	166.3	19.8	3286.6
Industrial Chemicals	49.1	37.0	1818.1	73.5	44.9	3304.4	100.0	42.4	4237.3	157.3	40.4	6363.6
Oth Chemicals(OC)	49.1	28.8	1413.2	73.5	35.1	2578.1	100.0	35.5	3551.2	157.3	40.4	6363.6
Petroleum & Coal	40.8	39.7	1617.2	81.2	41.4	3360.7	100.0	61.8	6177.6	119.5	52.8	6313.7
Rubber	54.1	7.8	420.6	77.0	10.0	769.0	100.0	9.0	904.9	137.8	11.0	1521.8
Plastic	48.6	10.0	485.7	73.4	13.0	953.7	100.0	14.4	1438.5	156.5	17.9	2802.5
Pottery	44.4	0.7	30.2	68.2	1.1	77.3	100.0	1.0	103.3	154.8	1.0	152.1
Glass	44.4	4.0	178.4	68.2	5.6	382.4	100.0	5.0	501.8	154.8	6.0	934.4

Other Non-metal Min	44.4	19.9	883.5	68.2	24.1	1644.6	100.0	23.1	2312.9	154.8	22.0	3410.2
Basic iron	46.9	59.4	2782.8	71.3	64.9	4624.0	100.0	56.8	5684.1	154.0	59.2	9111.5
Basic non-ferrous	48.1	15.8	759.6	67.6	18.7	1263.6	100.0	18.8	1883.0	147.8	19.2	2833.1
Metal Products	46.9	53.8	2522.0	73.3	67.7	4962.8	100.0	59.5	5953.9	164.4	48.3	7938.0
Machinery	49.4	35.0	1731.8	71.9	52.0	3740.4	100.0	41.5	4149.1	155.6	42.7	6638.8
Electrical machinery	51.1	27.4	1398.2	73.8	37.0	2729.8	100.0	35.0	3504.1	152.1	38.5	5857.5
Motor vehicles	47.0	40.8	1916.6	68.0	62.7	4265.5	100.0	50.2	5020.2	195.8	44.1	8641.8
Transport equipment	47.0	10.2	478.4	68.0	10.7	724.5	100.0	7.3	730.8	195.8	6.6	1287.4
Professional	48.6	1.6	78.6	73.4	2.1	157.7	100.0	2.6	264.8	156.5	3.0	476.0
Other manufacturing	48.6	11.3	546.8	73.4	9.6	706.5	100.0	8.1	812.5	156.5	8.7	1355.2
	-	-	29768.9	-	-	55651.9	-	-	75351.1	-	-	117612.3

Gross outputs are given on p36 of SNR P3041.3, 12 Nov 93.
Net outputs estimated from weights in 12 Nov 1993 P30041.3

	1978/79			1981/82			1984/85			1987/88		
TABLE A2-7.S2iv(b)	P78	Q78	V78	P82	Q82	V82	P84	Q84	V84	P87	Q87	V87
Food	44.6	29.3	1307.0	74.7	31.7	2365.1	100.0	35.9	3586.6	154.5	37.9	5863.0
Beverage	58.8	5.4	315.8	73.8	8.0	592.9	100.0	8.9	891.9	142.6	12.3	1758.4
Tobacco	55.0	1.2	67.4	73.2	0.7	54.3	100.0	2.1	209.7	133.9	2.0	267.6
Textiles	55.4	10.2	567.5	75.8	12.9	981.6	100.0	11.7	1170.5	168.2	12.4	2078.6
Clothing	56.5	5.9	332.6	74.2	9.0	671.1	100.0	9.1	913.9	152.3	8.9	1347.5
Leather	59.9	0.8	48.3	69.2	1.1	78.2	100.0	1.2	115.8	185.0	1.2	215.0
Footwear	48.8	2.6	125.9	77.2	3.3	251.9	100.0	3.1	309.8	166.7	3.2	539.9
Wood	42.8	4.5	192.2	72.3	5.7	412.6	100.0	5.8	575.9	150.9	6.5	974.8
Furniture	48.8	2.8	134.9	75.0	4.5	334.5	100.0	4.5	447.5	145.8	5.0	726.3
Paper	49.6	8.3	413.6	74.7	11.3	844.8	100.0	13.1	1311.3	166.3	14.2	2355.7
Printing	49.6	8.4	414.7	74.7	10.7	799.2	100.0	11.9	1192.4	166.3	11.0	1830.1
Industrial Chemicals	49.1	12.0	591.1	73.5	14.2	1046.8	100.0	14.7	1467.8	157.3	14.5	2288.8
Oth Chemicals(OC)	49.1	11.9	582.1	73.5	16.4	1203.2	100.0	16.2	1621.2	157.3	18.9	2967.3
Petroleum & Coal	40.8	9.6	392.2	81.2	9.7	788.4	100.0	33.4	3336.2	119.5	25.2	3005.6
Rubber	54.1	3.7	200.0	77.0	5.2	404.0	100.0	4.4	444.4	137.8	5.3	735.9
Plastic	48.6	4.2	205.7	73.4	5.7	421.3	100.0	6.5	654.1	156.5	7.6	1189.8
Pottery	44.4	0.4	18.0	68.2	0.8	52.1	100.0	0.6	62.6	154.8	0.7	105.1
Glass	44.4	2.1	94.4	68.2	3.2	217.2	100.0	2.7	269.1	154.8	3.4	525.6
Other Non-metal Min	44.4	10.1	449.5	68.2	12.3	840.5	100.0	12.6	1264.4	154.8	11.5	1772.8
Basic iron	46.9	25.0	1173.2	71.3	27.1	1928.5	100.0	23.9	2391.1	154.0	22.8	3507.3
Basic non-ferrous	48.1	5.9	285.4	67.6	7.0	471.3	100.0	7.5	754.2	147.8	7.3	1079.9
Metal Products	46.9	21.3	996.8	73.3	28.8	2111.0	100.0	25.1	2506.8	164.4	21.4	3521.6
Machinery	49.4	15.7	775.4	71.9	24.5	1759.1	100.0	18.8	1880.9	155.6	17.1	2661.5
Electrical machinery	51.1	11.6	592.2	73.8	15.5	1144.5	100.0	15.0	1502.2	152.1	15.5	2365.3
Motor vehicles	47.0	11.9	558.5	68.0	19.6	1335.6	100.0	15.1	1514.7	195.8	13.6	2666.3
Transport equipment	47.0	4.5	209.0	68.0	4.3	295.4	100.0	4.3	431.9	195.8	3.9	755.0
Professional	48.6	0.7	36.0	73.4	1.0	73.8	100.0	1.4	137.7	156.5	1.4	224.6
Other manufacturing	48.6	3.3	159.6	73.4	3.3	241.1	100.0	3.3	328.6	156.5	2.9	449.2
	-	-	11239.0	-	-	21720.0	-	-	31293.3	-	-	47778.4

v) Extract volumes from these estimates

TABLE A2-7.S1v(a) Gross output

	1978/79	1981/82	1984/85	1987/88
Food	99.9	104.6	115.8	115.4
Beverage	15.4	22.9	28.7	33.3
Tobacco	3.4	4.4	5.5	5.5
Textiles	27.2	33.4	30.0	29.4
Clothing	14.0	20.6	19.3	20.1
Leather	2.4	3.2	3.4	3.2
Footwear	5.8	6.8	6.5	6.9
Wood	10.1	12.1	12.3	13.1
Furniture	5.7	9.1	9.1	11.2

TABLE A2-7.S2v(b) Net output

	1978/79	1981/82	1984/85	1987/88
Food	29.3	31.7	35.9	37.9
Beverage	5.4	8.0	8.9	12.3
Tobacco	1.2	0.7	2.1	2.0
Textiles	10.2	12.9	11.7	12.4
Clothing	5.9	9.0	9.1	8.9
Leather	0.8	1.1	1.2	1.2
Footwear	2.6	3.3	3.1	3.2
Wood	4.5	5.7	5.8	6.5
Furniture	2.8	4.5	4.5	5.0

Paper	20.5	24.8	30.5	34.0	Paper	8.3	11.3	13.1	14.2
Printing	14.3	18.3	20.3	19.8	Printing	8.4	10.7	11.9	11.0
Industrial Chemicals	37.0	44.9	42.4	40.4	Industria	12.0	14.2	14.7	14.5
Oth Chemicals(OC)	28.8	35.1	35.5	40.4	Oth Chemi	11.9	16.4	16.2	18.9
Petroleum & Coal	39.7	41.4	61.8	52.8	Petroleum	9.6	9.7	33.4	25.2
Rubber	7.8	10.0	9.0	11.0	Rubber	3.7	5.2	4.4	5.3
Plastic	10.0	13.0	14.4	17.9	Plastic	4.2	5.7	6.5	7.6
Pottery	0.7	1.1	1.0	1.0	Pottery	0.4	0.8	0.6	0.7
Glass	4.0	5.6	5.0	6.0	Glass	2.1	3.2	2.7	3.4
Other Non-metal Min	19.9	24.1	23.1	22.0	Other Non	10.1	12.3	12.6	11.5
Basic iron	59.4	64.9	56.8	59.2	Basic iro	25.0	27.1	23.9	22.8
Basic non-ferrous	15.8	18.7	18.8	19.2	Basic non	5.9	7.0	7.5	7.3
Metal Products	53.8	67.7	59.5	48.3	Metal Pro	21.3	28.8	25.1	21.4
Machinery	35.0	52.0	41.5	42.7	Machinery	15.7	24.5	18.8	17.1
Electrical machinery	27.4	37.0	35.0	38.5	Electrica	11.6	15.5	15.0	15.5
Motor vehicles	40.8	62.7	50.2	44.1	Motor veh	11.9	19.6	15.1	13.6
Transport equipment	10.2	10.7	7.3	6.6	Transport	4.5	4.3	4.3	3.9
Professional	1.6	2.1	2.6	3.0	Professio	0.7	1.0	1.4	1.4
Other manufacturing	11.3	9.6	8.1	8.7	Other man	3.3	3.3	3.3	2.9

vi) Convert to 1987/79=100

TABLE A2-7.S2vi(a)	Gross output				TABLE A2-7.S2vi(b)Net output				
	1978/79	1981/82	1984/85	1987/88		1978/79	1981/82	1984/85	1987/88
Food	100.0	104.7	115.9	115.6	Food	100.0	107.9	122.3	129.4
Beverage	100.0	148.4	185.8	215.8	Beverage	100.0	149.8	166.2	229.8
Tobacco	100.0	127.4	159.1	159.2	Tobacco	100.0	60.5	170.9	162.9
Textiles	100.0	122.8	110.3	108.1	Textiles	100.0	126.3	114.2	120.6
Clothing	100.0	147.1	138.1	143.8	Clothing	100.0	153.6	155.2	150.3
Leather	100.0	131.0	138.5	131.1	Leather	100.0	140.1	143.6	144.2
Footwear	100.0	116.2	111.3	119.2	Footwear	100.0	126.5	120.1	125.6
Wood	100.0	120.3	121.7	129.6	Wood	100.0	127.0	128.2	143.8
Furniture	100.0	159.6	159.4	195.4	Furniture	100.0	161.2	161.9	180.1
Paper	100.0	120.9	148.7	166.1	Paper	100.0	135.7	157.3	170.0
Printing	100.0	128.3	142.4	138.7	Printing	100.0	128.0	142.6	131.7
Industrial Chemicals	100.0	121.3	114.4	109.2	Industria	100.0	118.2	121.9	120.8
Oth Chemicals(OC)	100.0	121.8	123.3	140.5	Oth Chemi	100.0	137.9	136.7	159.0
Petroleum & Coal	100.0	104.4	155.8	133.2	Petroleum	100.0	100.9	346.9	261.5
Rubber	100.0	128.6	116.4	142.1	Rubber	100.0	142.0	120.2	144.5
Plastic	100.0	129.9	143.8	179.1	Plastic	100.0	135.6	154.5	179.6
Pottery	100.0	167.0	152.2	144.8	Pottery	100.0	188.8	154.6	167.8
Glass	100.0	139.6	124.9	150.3	Glass	100.0	149.8	126.6	159.8
Other Non-metal Min	100.0	121.2	116.3	110.8	Other Non	100.0	121.8	124.9	113.2
Basic iron	100.0	109.3	95.8	99.7	Basic iro	100.0	108.1	95.5	91.0
Basic non-ferrous	100.0	118.3	119.2	121.3	Basic non	100.0	117.4	127.0	123.0
Metal Products	100.0	125.8	110.7	89.7	Metal Pro	100.0	135.4	117.9	100.7
Machinery	100.0	148.4	118.4	121.8	Machinery	100.0	155.9	119.9	109.0
Electrical machinery	100.0	135.2	128.0	140.7	Electrica	100.0	133.8	129.6	134.1
Motor vehicles	100.0	153.7	123.0	108.1	Motor veh	100.0	165.2	127.4	114.5
Transport equipment	100.0	104.6	71.7	64.5	Transport	100.0	97.6	97.0	86.6
Professional	100.0	132.8	163.6	188.0	Professio	100.0	135.9	186.0	193.8
Other manufacturing	100.0	85.5	72.2	76.9	Other man	100.0	100.0	100.0	87.4

vii) Check differences between real gross and real net output

TABLE A2-7.S2vii(a)	1978/79	1981/82	1984/85	1987/88
Food	0.0	-3.2	-6.4	-13.8

Beverage	0.0	-1.3	19.6	-14.0
Tobacco	0.0	66.9	-11.9	-3.7
Textiles	0.0	-3.5	-3.9	-12.5
Clothing	0.0	-6.4	-17.1	-6.6
Leather	0.0	-9.1	-5.2	-13.1
Footwear	0.0	-10.2	-8.8	-6.4
Wood	0.0	-6.7	-6.5	-14.1
Furniture	0.0	-1.7	-2.4	15.2
Paper	0.0	-14.8	-8.6	-3.9
Printing	0.0	0.4	-0.2	7.0
Industrial Chemicals	0.0	3.1	-7.5	-11.6
Oth Chemicals(OC)	0.0	-16.2	-13.3	-18.5
Petroleum & Coal	0.0	3.4	-191.1	-128.3
Rubber	0.0	-13.4	-3.8	-2.4
Plastic	0.0	-5.6	-10.6	-0.5
Pottery	0.0	-21.8	-2.5	-23.0
Glass	0.0	-10.3	-1.7	-9.5
Other Non-metal Min	0.0	-0.5	-8.7	-2.4
Basic iron	0.0	1.2	0.2	8.7
Basic non-ferrous	0.0	0.9	-7.9	-1.7
Metal Products	0.0	-9.6	-7.2	-11.0
Machinery	0.0	-7.5	-1.5	12.7
Electrical machinery	0.0	1.4	-1.6	6.6
Motor vehicles	0.0	-11.5	-4.4	-6.4
Transport equipment	0.0	7.0	-25.3	-22.1
Professional	0.0	-3.1	-22.4	-5.9
Other manufacturing	0.0	-14.5	-27.9	-10.4

Test for influence of changing net to gross output ratios
Net output from TA2-7.S2i and gross from A2-6.D9

TABLE A2-7.S2vii(b)	1978/79	1981/82	1984/85	1987/88
Food	29.4	30.3	31.0	32.9
Beverage	34.8	35.1	31.1	37.0
Tobacco	35.8	17.0	38.5	36.6
Textiles	37.7	38.8	39.0	42.1
Clothing	42.0	43.9	47.3	44.0
Leather	33.2	35.5	34.5	36.6
Footwear	44.4	48.3	47.9	46.8
Wood	44.6	47.1	47.0	49.5
Furniture	48.3	48.8	49.0	44.5
Paper	40.7	45.6	43.0	41.6
Printing	58.6	58.5	58.7	55.7
Industrial Chemicals	32.5	31.7	34.6	36.0
Other Chemicals	41.2	46.7	45.7	46.6
Petroleum and Coal	24.3	23.5	54.0	47.6
Rubber	47.6	52.5	49.1	48.4
Plastic	42.3	44.2	45.5	42.5
Pottery	59.6	67.4	60.6	69.1
Glass	52.9	56.8	53.6	56.3
Other Non-metal Min	50.9	51.1	54.7	52.0
Basic iron	42.2	41.7	42.1	38.5
Basic non-ferrous	37.6	37.3	40.1	38.1
Metal Products	39.5	42.5	42.1	44.4
Machinery	44.8	47.0	45.3	40.1
Electrical machinery	42.4	41.9	42.9	40.4

Motor vehicles	29.1	31.3	30.2	30.9
Transport equipment	43.7	40.8	59.1	58.6
Professional	45.7	46.8	52.0	47.2
Other manufacturing	29.2	34.1	40.4	33.1

Change in Net to gross output ratios in TABLE A2-7.S2vii(b)

TABLE A2-7.S2vii(c)	78/79 to 1981/82	81/82 to 1984/85	84/85 to 1987/88
Food	-0.9	-0.7	-1.9
Beverage	-0.3	4.0	-5.9
Tobacco	18.8	-21.5	1.8
Textiles	-1.1	-0.2	-3.0
Clothing	-1.8	-3.4	3.3
Leather	-2.3	1.1	-2.1
Footwear	-3.9	0.4	1.1
Wood	-2.5	0.1	-2.5
Furniture	-0.5	-0.2	4.5
Paper	-5.0	2.6	1.4
Printing	0.2	-0.3	3.0
Industrial Chemicals	0.8	-3.0	-1.3
Other Chemicals	-5.5	1.0	-1.0
Petroleum and Coal	0.8	-30.5	6.4
Rubber	-5.0	3.4	0.8
Plastic	-1.8	-1.3	3.0
Pottery	-7.8	6.8	-8.5
Glass	-3.9	3.2	-2.6
Other Non-metal Min	-0.2	-3.6	2.7
Basic iron	0.5	-0.4	3.6
Basic non-ferrous	0.3	-2.8	1.9
Metal Products	-3.0	0.4	-2.3
Machinery	-2.3	1.7	5.2
Electrical machinery	0.4	-0.9	2.5
Motor vehicles	-2.2	1.1	-0.7
Transport equipment	2.9	-18.3	0.5
Professional	-1.1	-5.2	4.8
Other manufacturing	-4.9	-6.3	7.3

viii) Estimate aggregate PVMPs using 'real' net output values
from TABLE A2-7.S2iv(b) above.

Use linking technique from 1993 SNA.

Growth from 1978/79 to 1981/82 using 1978/79 weights
Growth from 1981/82 to 1984/85 using 1981/82 weights
Growth from 1984/85 to 1987/88 using 1984/85 weights

TABLE A2-7.S2viii	P79Q79	P79Q82	P82Q82	P82Q85	P85Q85	P85Q88
Food	1307.0	1410.7	2365.1	2680.1	3586.6	3793.8
Beverage	315.8	472.9	592.9	658.0	891.9	1233.3
Tobacco	67.4	40.8	54.3	153.5	209.7	199.8
Textiles	567.5	717.0	981.6	887.6	1170.5	1235.5
Clothing	332.6	510.8	671.1	678.4	913.9	885.0
Leather	48.3	67.7	78.2	80.2	115.8	116.3
Footwear	125.9	159.2	251.9	239.3	309.8	324.0

Wood	192.2	244.0	412.6	416.5	575.9	646.0
Furniture	134.9	217.4	334.5	335.8	447.5	498.0
Paper	413.6	561.0	844.8	979.6	1311.3	1417.0
Printing	414.7	530.7	799.2	890.8	1192.4	1100.8
Industrial Chemicals	591.1	698.6	1046.8	1079.3	1467.8	1454.7
Oth Chemicals(OC)	582.1	803.0	1203.2	1192.1	1621.2	1886.0
Petroleum & Coal	392.2	395.9	788.4	2709.2	3336.2	2515.0
Rubber	200.0	284.0	404.0	342.0	444.4	534.0
Plastic	205.7	278.8	421.3	480.1	654.1	760.3
Pottery	18.0	33.9	52.1	42.7	62.6	67.9
Glass	94.4	141.4	217.2	183.6	269.1	339.6
Other Non-metal Min	449.5	547.4	840.5	862.4	1264.4	1145.5
Basic iron	1173.2	1268.2	1928.5	1704.7	2391.1	2276.9
Basic non-ferrous	285.4	335.2	471.3	509.8	754.2	730.5
Metal Products	996.8	1350.0	2111.0	1837.3	2506.8	2142.3
Machinery	775.4	1208.9	1759.1	1352.9	1880.9	1710.3
Electrical machinery	592.2	792.4	1144.5	1108.4	1502.2	1554.6
Motor vehicles	558.5	922.6	1335.6	1030.0	1514.7	1361.5
Transport equipment	209.0	204.0	295.4	293.7	431.9	385.5
Professional	36.0	48.9	73.8	101.1	137.7	143.5
Other manufacturing	159.6	159.5	241.1	241.2	328.6	287.0
	11239.0	14404.9	21720.0	23070.1	31293.3	30744.7
	100.0	128.2	100.0	106.2	100.0	98.2
	P79Q79	P79Q82	P82Q82	P82Q85	P85Q85	P85Q88

	1978/79	1981/82	1984/85	1987/88
	100.0	128.2	136.1	133.7
Make 1979=100	95.1	122.0	129.5	127.3

Estimate calendar year values using ratio of reconstructed figures

in SLIDEX.WQ1	1979	1982	1985	1988
	105.1	123.3	133.1	139.4
Set 1979=100	100.0	117.3	126.7	132.6

DATA: PVMPS from Table A2-6.D10

Unbenchmarked PVMPs

78/79	90.9
1979	95.5
81/82	113.0
1982	108.7
84/85	102.3
1985	100.0
87/88	104.3
1988	108.7

ix) Estimate aggregate PVMPs using 'real' gross output values from TABLE A2-7.S2iv(a) above.

Growth from 1978/79 to 1981/82 using 1978/79 weights
Growth from 1981/82 to 1984/85 using 1981/82 weights
Growth from 1984/85 to 1987/88 using 1984/85 weights

TABLE A2-7.S2ix	P79Q79	P79Q82	P82Q82	P82Q85	P85Q85	P85Q88
Food	4451.0	4661.9	7815.6	8650.4	11576.3	11540.9
Beverage	908.2	1348.2	1690.3	2115.2	2867.5	3330.6
Tobacco	188.4	240.0	319.6	399.0	545.2	545.7
Textiles	1505.1	1848.4	2530.6	2273.8	2998.4	2936.3
Clothing	791.2	1164.2	1529.5	1435.6	1933.8	2013.0
Leather	145.4	190.4	219.9	232.6	335.9	318.0
Footwear	283.4	329.4	521.3	499.2	646.5	692.2
Wood	430.8	518.1	876.3	886.7	1225.9	1305.8
Furniture	279.5	445.9	686.0	685.5	913.7	1119.5
Paper	1016.9	1229.3	1851.2	2276.6	3047.5	3404.6
Printing	707.2	907.7	1366.9	1516.8	2030.4	1976.9
Industrial Chemicals	1818.1	2205.4	3304.4	3115.8	4237.3	4044.5
Oth Chemicals(OC)	1413.2	1720.6	2578.1	2611.3	3551.2	4044.5
Petroleum & Coal	1617.2	1687.7	3360.7	5016.6	6177.6	5283.3
Rubber	420.6	540.7	769.0	696.4	904.9	1104.4

Plastic	485.7	631.1	953.7	1055.9	1438.5	1790.9
Pottery	30.2	50.4	77.3	70.5	103.3	98.3
Glass	178.4	249.0	382.4	342.3	501.8	603.8
Other Non-metal Min	883.5	1071.0	1644.6	1577.5	2312.9	2203.5
Basic iron	2782.8	3040.6	4624.0	4052.4	5684.1	5915.2
Basic non-ferrous	759.6	898.7	1263.6	1272.7	1883.0	1916.4
Metal Products	2522.0	3173.7	4962.8	4363.8	5953.9	4828.9
Machinery	1731.8	2570.4	3740.4	2984.3	4149.1	4266.0
Electrical machinery	1398.2	1889.9	2729.8	2585.4	3504.1	3850.0
Motor vehicles	1916.6	2946.3	4265.5	3413.6	5020.2	4412.6
Transport equipment	478.4	500.4	724.5	496.9	730.8	657.3
Professional	78.6	104.4	157.7	194.4	264.8	304.2
Other manufacturing	546.8	467.5	706.5	596.4	812.5	866.0
	29768.9	36631.2	55651.9	55417.7	75351.1	75373.3
	100.0	123.1	100.0	99.6	100.0	100.0
	P79Q79	P79Q82	P82Q82	P82Q85	P85Q85	P85Q88
	1978/79	1981/82	1984/85	1987/88		
	100.0	123.1	122.5	122.6		