

Distr.
GENERAL

CES/AC.68/2000/14
10 February 2000

Original: ENGLISH

STATISTICAL COMMISSION and
ECONOMIC COMMISSION FOR EUROPE
(OECD)

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

CONFERENCE OF EUROPEAN STATISTICIANS

COMMISSION OF THE EUROPEAN
COMMUNITIES (EUROSTAT)

Joint ECE/Eurostat/OECD
Meeting on National Accounts
(Geneva, 26-28 April 2000)

A NEW SURVEY OF FIXED ASSETS IN THE UNITED KINGDOM

Invited Paper submitted by the Office for National Statistics,
United Kingdom*

INTRODUCTION

1. The purpose of this paper is to explain why the UK Office for National Statistics decided to start collecting capital stock data directly from industry; to give an account of the survey methodology; to describe the problems encountered so far, and their possible solutions, and finally to say how we plan to use the data as a supplement to the Perpetual Inventory Method (PIM).

THE REASONS FOR A SURVEY

The Problems of the Perpetual Inventory Method

2. In most countries, as in the UK, the Perpetual Inventory Method (PIM) is the sole source of estimates of capital stock. In theory PIM should provide accurate results. In simple terms it is a model which adds new capital investment to what exists already, subtracts assets which have reached

* Prepared by Mr. Paul West.

the end of their lives, and places the results onto a common price basis. In practice however, it is, as with any model-based approach, only as accurate as the data which it uses. To produce accurate results PIM requires good quality investment data, and good quality information about asset life lengths. It has always been possible to collect reasonably accurate figures of capital expenditure from industry, but it is not so easy to obtain and keep up to date information on the life span of different classes of asset. In the UK we have only anecdotal evidence for asset lives, and research has shown that it would not be possible to conduct a survey of life lengths, because most businesses could not provide the information. In practice actual asset lives change over time, and sometimes they change very suddenly. We have to keep up to date.

3. There can be many reasons for sudden changes in asset life lengths, but two have been relevant to recent experience in the UK:

a) Firstly a downturn in the economy early in 1992 led to both voluntary and compulsory company liquidations. When a company is liquidated, it is likely that some, if not all, of its fixed assets will be prematurely scrapped. Obviously creditors try to obtain the best price for the assets of a company, but in practice this may often mean selling as scrap an asset which had many years of life left in it. In 1975, when the revised PIM model was introduced, there were 1275 voluntary and compulsory liquidations in manufacturing industry in the UK; in 1992 the figure was 5449, and in that year the total number of liquidations for all industry was more than 24,000, compared with around 5,400 in 1975. In addition to this many large companies, during periods of economic difficulty, close individual plants, and this too often leads to the wholesale scrapping of assets. The assumptions of asset lives which underlie PIM do not allow for such premature asset death.

b) The second phenomenon which undermined the reliability of PIM was rapid technological change. This is also unpredictable and leads to the scrapping of fixed assets earlier than would otherwise have been the case. It is much harder to quantify this, but there is no doubt that increasing and accelerating automation has occurred over recent years, and that this is likely to continue at an unpredictable rate. It has led to the purchase of ever more sophisticated plant and equipment by industry, leading once again to unexpectedly early asset disposal.

4. The result of these changes has been, as far as we can tell, for PIM to overestimate the level of capital stock, possibly by as much as 10 percent for some industries. The scale of the error varies between asset types, but PIM appears to be most accurate in measuring capital stock in buildings, and most prone to error in measuring capital stock in plant and equipment, with computer technology probably the greatest problem area.

Research by the National Institute for Economic and Social Research

5. Because of these doubts about the reliability of the estimates, and the lack of obvious data sources to correct them, we asked the National Institute for Economic and Social Research (NIESR) to investigate the problem, and to suggest solutions. A paper¹ in the National Institute Economic Review summarised their findings. In brief, they confirmed the likely inaccuracy of recent PIM estimates. Their principal recommendation was that a feasibility study should be conducted to determine whether it was possible to collect capital stock data direct from industry; subject to the results of this there should be a full benchmark survey designed to establish both the value and the age of capital stock. They suggested that the benchmark should be supplemented annually by information on the capital stock that has been scrapped.

The Decision to Conduct a Survey

6. Although NIESR also provided us with some information to help us estimate the corrections due to past inaccuracies in asset life lengths, we felt that the more radical approach of direct collection could well be the best long term solution. This was because similar changes were likely to occur in the future, and it seemed inevitable that we would only be able to catch up with them retrospectively. We therefore decided to go ahead with the feasibility study.

The Feasibility Study - Objectives

7. The study was carried out in the full knowledge that we were exploring new ground, and that the conduct of the survey and the questions asked would be likely to evolve as the study continued. The purpose of the study was defined as follows:

a) To determine whether asset registers contained the following information in readily accessible form:

A description of each asset sufficiently detailed to enable it to be placed into its broad asset category.

The Historic cost (at acquisition) of each asset

The date of capitalisation.

Service lives of different classes of asset

¹ David Mayes and Garry Young "Improving the Estimates of Capital Stock" *National Institute Economic Review*, London, February 1994

- b) To establish whether industry would be prepared to supply this information on a voluntary basis, or whether a full inquiry would need to be statutory.
- c) To estimate the likely compliance cost for industry
- d) To gain an insight into industry's policy on capitalisation -ie what was included and what excluded from its registers.
- f) To see whether there was any information available to enable new estimates of true asset lives to be made.

The Feasibility Study - Results

8. 212 companies were visited over a period of six months The main findings of the study were as follows:

- a) There is sufficient information available from enough businesses to make a full sample survey possible. This information is usually available in the form of a computerised asset register, which shows each current asset currently held, the date of acquisition, and the historic cost.
- b) There is a direct relationship between the size of a business, measured by the number of employees, and the availability of information. As a result of this finding, businesses consisting of a single unit with fewer than 100 employees would need to be excluded from any full survey undertaken, and businesses with between 101 and 300 employees would be sampled separately and less intensively. It follows that certain sectors of industry which consist mainly of large numbers of small businesses would also be excluded. This last consideration applies mainly to industries in the service sector such as advertising.
- c) Only 15 companies retained data of disposed assets for any length of time. This means that it is not possible to obtain sufficient information directly from industry, other than anecdotal information, to judge the true service lives of assets. The period over which businesses depreciate assets to zero is not a useful indicator because it is tax related rather than a true pointer to the expected life of an asset.
- e) With a few unimportant exceptions, there is little difference between companies as far as capitalisation policy is concerned.

The Feasibility Study - Problems Uncovered

9. The main problem that the study revealed was not that there was too little information available, but that there was too much. On average the registers inspected contained between 7000 and 10000 separate records, but many were much larger. Registers of over 20000 records were not uncommon, and the largest we encountered contained 1.6 million records with a total value

of £26 billion. It was obvious that the task of personally inspecting such a huge bulk of material, extracting a sample, and processing the results would be prohibitively expensive, and that unless some way could be found to solve this problem no further progress could be made.

The Decision to Consider a Postal Survey

10. In some cases the feasibility study found that businesses, particularly those with very large numbers of assets, stored their records in summary form. These summaries showed, by year of acquisition, the total historic cost of each class of asset. This fact led us to a possible solution to the problem of too much data. If businesses were able to supply us with information in this form on disk, it would provide all the information necessary to produce estimates of capital stock at historic cost. Price indices could then be used to convert to current replacement cost, or replacement cost at any base year.

11. This procedure would avoid the costly process of selecting and processing a sample from a complete asset register, and the information could be sought postally, without involving visits to respondents. In addition, should a business be unable to supply the information in the desired form, they might be willing to supply their complete asset register on disk which could be processed by us to produce the information in the summary form .

12. Before taking any further action we confirmed with the companies who produce the most commonly used packages of asset register software that their systems were able to produce the required report. This was confirmed both by the software companies, and by a number of their users. It was therefore decided to design a questionnaire, and conduct a small pilot survey to test it.

The Pilot

13. The aims of the pilot (September to December 1995) were:

- a) To confirm the Feasibility Study findings
- b) To test the form design, and its acceptability across relevant industries
- c) To assess resource needs and compliance costs
- d) To assess response rate
- e) To compare results from a specified industry with results obtained by PIM
- f) To identify problems.

14. The total sample of 65 companies included 45 from SIC 80 Class 34 (electrical and electronic engineering); this was to enable a comparison to be made with a corresponding PIM estimate. The remainder of the sample covered retailing, insurance, banking, insurance, transport and telecommunications; this was to identify any problems specific to service industries and utilities. The survey was voluntary, and achieved a 44.6% response.

15. The conclusions from the pilot were positive, and confirmed the findings of the feasibility study. It appeared that in most cases businesses would be able to aggregate costs of asset types by year and download the information into a useable computerised format. Both compliance costs, and our own resource costs were shown to be acceptable. The amount of data collected was insufficient for detailed analysis, but showed reasonable agreement with our expectations. However, the low response rate did point to the need for a statutory survey.

16. The decision was therefore made to move to a full survey which would create a rolling benchmark. It would collect historic cost data industry by industry over a period of four years, and would then start the process again. Other priorities did however mean that it was some time before we could start, and in fact the survey only commenced in July 1999.

THE FORM OF THE SURVEY

Who is Being Surveyed and Why

17. We wished to select industry sectors with significant capital stock holdings. The pilot survey and data from the quarterly Capital Expenditure (Capex) survey indicated that there is significant expenditure on capital goods within the manufacturing sector compared to the service sector. Our preference was initially to survey industries within the manufacturing sector.

18. Employment was chosen as the auxiliary variable for estimation purposes as opposed to 'turnover' because Capex data indicates a stronger relationship between employment and capital expenditure. This is especially so in the case of some service sectors where businesses may have low employment and low capital expenditure but extremely high turnover, such as information technology companies, which further reinforced our preference for manufacturing businesses.

19. The next considerations were logistical. The inquiry form questions may be slightly different depending on the industry sectors being surveyed. It seemed far simpler therefore to approach a limited group of industries each time with a common questionnaire. Our decision was therefore to commence our rolling survey at the start of the manufacturing sector according to the

Standard Industry Classification (SIC) 1992, equivalent to NACE Rev1. Consequently divisions 15 and 16, Food Processing & Manufacturing and Tobacco were chosen as the starting point.

Sample Design

20. Anecdotal evidence suggested that for a survey of this type, sampling businesses with employment below a certain figure is not worthwhile. Businesses were visited as part of the feasibility study and it appeared that the smaller businesses often did not maintain electronic fixed asset registers, making compliance with this survey impossible. It was decided therefore that to start with there would be a cut-off based on employment, below which we would not sample. After considering several cut-off figures we opted for a level of 100 employment. For our chosen industries this resulted in a sampling frame of 792 businesses, comprising 10% of the population, but 85% of the capital expenditure for the industry.

21. Next we needed to decide on a manageable sample size and design taking account of available resources. With this in mind our design needed to approximate to the following to provide a sample of roughly 250 businesses:

1000+	1 in 1
500 - 999	1 in 3
100- 499	1 in 5

Neymann allocation was then used to refine the design, providing a sample of 254 businesses, manageable within our resource and timescale constraints.

Form Design

22. The pilot survey form was used as a basis for the live survey form, but a few minor modifications were made. The form is essentially an explanatory notes sheet as the return should be in the form of an electronic report on a diskette provided. It was agreed to keep the form as simple as possible and to give the respondent flexibility in preparing the report. A covering letter, explaining the purpose of the survey was sent with the form. A copy of the form is annexed.

Estimation and Imputation

23. It has been necessary to develop estimation and imputation methodologies to deal with both unsampled units, and with partial or total non-response.

24. We use a combined ratio estimation across the sampled strata, including the 0-99 sizeband. As already explained the employment cut off is due to the pilot study indicating lower availability of electronic registers in businesses with lower employment. Data from the Capital expenditure survey

show comparable capital expenditure in terms of employment across these strata, so estimating in this manner using employment as the auxiliary variable appears sensible. We will however, be testing these assumptions at a later date by selecting businesses in the 0-99 sizeband. The formula below combines all estimations including the non-sampled 0-99 sizeband.

$$\hat{T} = \frac{\sum_h \sum_k \frac{N_h}{n_h} y_k}{\sum_h \sum_k \frac{N_h}{n_h} x_k} \cdot \sum_{\substack{\text{sampling} \\ \text{strata}}} \sum_U X + \sum_{\text{lin1}} y_k$$

where:

y_k = item response

x_k = auxiliary variable for responded unit

N_h = number of units in population in cell h

n_h = number of units who responded to sample in cell h

$\sum_{\substack{\text{sampling} \\ \text{strata}}} \sum_U X$ = sum of auxiliary variable in population across all sampled strata including 0-99

Total = estimate from sampled units + sum of units in 1 in 1 strata
(including constructions)

25. Where unit non-response in the 1 in 1 strata needs to be constructed, we use the auxiliary variable as the link.

$$Link = \frac{1}{m} \sum \frac{y_k}{x_k}$$

Where m is the number of units with a returned value. Imputation is done, where possible, within cells.

PROBLEMS ENCOUNTERED

26. Most of the problems have arisen from businesses finding it difficult, or in some cases impossible to provide the information in the form requested. There are a variety of reasons:

- Computer systems. Some businesses find that their systems produce very flexible reports and find compliance with the survey straightforward. Unfortunately a significant number find that their systems have predefined reporting options which fail to report in the format we require. In order to comply with our request some of these companies have had to either send paper

asset registers, send complete computer dumps of their asset registers, commission their IT departments to produce bespoke reports, or exceptionally, have employed contract IT staff to interrogate their accountancy systems.

- Company structure. Our assumptions from the pilot are not always borne out with regard to company size. Where a larger company is reporting for several sites problems can be encountered pulling the data together (often from different systems) into a consolidated report.
- Some companies do not hold data in the way that we need, ie. some do not hold buildings and land separately, similarly computer software is sometimes recorded under plant & machinery
- Some companies do not have computerised asset registers or do not record acquisition years. It is not necessary for companies to keep records of individual acquisition years in order to compile their balance sheets and so some don't. They may have the information we need in paper form, through original invoices, but it is an unacceptable burden to ask them to spend weeks going through their paper records. There have been about 10 companies who have notified us of this problem.
- Item non-response (or partial returns) normally occurs when some sort of restructuring has taken place. Typically data is available in the form we require from a certain date, but prior to a business merger or installation of new computer system data is sometimes only available as a total with no breakdown by acquisition year. In such cases, a possible solution is to treat the earliest available data as a revaluation, in the same way as we do when buildings are revalued.

FINDINGS

27. The response rate at the end of 1999 was approximately 63%, but returns are still coming in. At the time of writing this paper no actual data was available, though it is hoped that by the time this paper is delivered we will be able to show how the results from direct collection differ from those produced through PIM.

28. We have learnt a number of lessons. Indeed, we have been treating this first group of industries as almost a pilot. We have discovered that we shall need to make some parts of the questionnaire form clearer. Some businesses include work in progress on their balance sheets, and we need to emphasise in future that it needs to be excluded. The position relating to long leaseholds of land and buildings also needs to be clarified if double counting is to be

avoided. The survey methodology and structure will be kept under continuous review, and changes may be made in the light of our experience.

HOW WILL THE DATA BE USED

29. Our plan is to use the data from the survey, not as a replacement to PIM, but as a supplement to it. Once the data at historic cost for each vintage is available, the first step will be to reduce it to a common (current or constant 1995) basis. For this we shall need to use the same price indices which are currently employed within our PIM model. These are based on implied Gross Fixed Capital Formation deflators for plant and machinery for each industry together with a building cost price index, and a separate price indices for vehicles.

30. Once this has been done we propose to use the new data for each industry as it becomes available not only as the best estimate of capital stock for that industry, but also to adjust the life length assumptions for that industry's plant and machinery. These new assumptions will remain in place until the industry is next sampled, and PIM will be used to produce in the intervening years. In adjusting life lengths it will be assumed that these are the only variable requiring change, and that the investment data is sound. We are currently in the process of modernising the software used in the PIM model, and as part of this process we are introducing a mechanism which will make the calculations possible.

CONCLUSION

31. So far we are pleased with the way the project has gone. We are still learning, and many changes will be made to the questionnaire form as we gain experience. We are always concerned with the compliance cost to industry. So far this has ranged from 1 minute to several weeks. We are not happy with a situation where a business needs to bring in outside consultants to interrogate its database. Dialogue between ourselves and the software producers is one possible way to help.

32. Finally, if any other country is interested in starting out on this road, they would be very welcome to come and see us at the ONS. We believe that what we have found is a practical, and above all affordable means of collecting accurate capital stock data.

ANNEX**Fixed Assets Survey**

We require details of your level of fixed assets as at 31 December 1998 for the following categories:

- Land
- Buildings
- Capital plant and equipment
- Vehicles
- Computer software

Details of these assets will be contained in your fixed asset register. All assets remaining on your asset register should be included in your return, even if they have been fully depreciated.

What We Need To Know

Their date of purchase. If the assets have been re-valued, their date of revaluation.

The original cost, or, if re-valued, the value allocated to them at the date of revaluation. Values should include non-deductible VAT but exclude deductible VAT.

(**Note:** it is important that you do not supply any depreciated values; we are interested only in historic costs or revalued amounts)

How to Send Us Your Data

We have enclosed a diskette for your reply which has been virus checked. Data should be supplied in ASCII format where possible.

If you have any technical difficulties with meeting this requirement, please contact the person named on the front of this form.

Format In Which Your Information Should Be Sent

Options are listed below. Please note that the first option is our preference, but if this is difficult for you then one of the other two options is acceptable.

Option 1

Your report should be arranged by acquisition (purchase) year within asset class. Within each asset class the historic cost (or price at revaluation) of assets should be sub-totalled by acquisition (or revaluation) year. If your asset register system has a suitable report facility, you do not need to send us a report showing each individual entry - just the subtotals for each year. An illustration is given below

E.g.

BUILDINGS	SUBTOTAL FOR 1982	£400000
	SUBTOTAL FOR 1983	£600000
	etc.	
PLANT & MACHINERY	SUBTOTAL FOR 1982	£80000
	SUBTOTAL FOR 1983	£60000
	etc.	
VEHICLES	SUBTOTAL FOR 1991	£3000
	SUBTOTAL FOR 1992	£4000
	etc.	
COMPUTER SOFTWARE	SUBTOTAL FOR 1995	£2000
	SUBTOTAL FOR 1996	£2500
	etc.	

Option 2

As option 1, but with each entry printed, as illustrated below.

E.g.

BUILDINGS	DESCRIPTION	DATE PURCHASED	PURCHASE COST
	BUILDING 1	1/1/82	£100000
	BUILDING 2	1/7/82	£200000
	BUILDING 3	1/10/82	£100000
	etc.		
		SUBTOTAL FOR 1982	£400000
		etc.	

Option 3

If your asset register system is not capable of producing either of the above, the register should be sorted by asset class, and if possible sent to us in its entirety on diskette. If this is not possible please contact us.

Assets to Include

Within the asset classes listed above you should include the following:

1. Any assets held under **finance** leases or hire purchase agreements.
2. Under computer software you should include only those major purchases of software which you would normally capitalise, together with the costs of any major in-house software development. If you do not capitalise your computer software (either purchases or in-house development) you should inform us by telephone.
3. Property investments; if these are not held in your main asset register, but recorded separately, you should include these in an additional report which specifies the historic cost and year of acquisition.

Assets to Exclude

1. Exclude assets held overseas.
2. Exclude assets held under operating leases.

Additional Information

1. What is the name of your asset register software system?
2. How long did it take to complete this request?
3. Please add any further comments you may have in the box provided below