Computer Assisted Data Collection
Production test in the Labour Force Surveys
August 1989-January 1990

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Preface

This report describes a production test during the period August 1989 - January 1990 involving computer-assisted data collection (CADAC) in the labour force surveys (LFS) carried out by Statistics Sweden. The test was a part of a Statistics Sweden project whose purpose is to develop a general system for computer-assisted data collection and to bring this system into regular operation in the majority of Statistics Sweden's surveys.

The report has been compiled by a group consisting of Evert Blom (head of the project), Lars Bergman, Karl-Erik Kristiansson, Anita Olofsson, Åke Pettersson, Margaretha Säfström and Solveig Thudin.

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0 SUMMARY

0.1 Purpose and design

This report describes a production test with computer-assisted data collection (CADAC) in the monthly labour force surveys (LFS) carried out by Statistics Sweden during the period August 1989 to January 1990, inclusive (and in part during February too). These monthly surveys are conducted chiefly by way of the telephone, and they are the largest surveys undertaken by Statistics Sweden, involving a sample of some 18,000 persons every month. Since the LFS production routines are efficient and well-established, CADAC has to be of a very high standard if it is to replace the traditional system. Furthermore the monthly surveys come in for close attention, and any changes due to the adoption of a new method of data collection have to be accounted for. Important estimates in this connection are for instance those regarding the number of the employed and the number of the unemployed. Since the surveys are of the panel type and also involve estimation of the flows, it is of interest to estimate both bias and the error of the individual measurement.

The main purpose has been to obtain a basis for deciding whether CADAC can be implemented in the monthly surveys. The decision-making situation has been interpreted as being such that CADAC shall indeed become standard unless the production test shows it to have some essential drawback. The chief considerations are quality, economy and dependability.

The LFS sample was divided into two parts: one part for interview by the CADAC method, the other for interview by the paper and pencil method (PAPI). During the six months of the test the CADAC sample came to comprise some 19,000 persons, and the PAPI sample some 89,000.

A total of 49 interviewers carried out the CADAC interviews. It was not a random selection: the aim was to obtain - through geographical dispersal and through consideration of length of service and age - as representative a selection as possible of the entire range of interviewers (which comprises some 200 in the field and 20 in the central telephone group). The training was half a day of general ADP and introduction to the computer, followed by individual practice and then a two-day course on CADAC.

The test was the concluding stage of a series of experiments the purpose of which was to achieve a production system suitable for the majority of the surveys undertaken by Statistics Sweden.

The system and the software are principally of Statistics Sweden's own design. A general program in the field computer (the INT program) sees to the interview itself. A central computer in Örebro is in contact with the field computers during the night, sending interview forms, information about the sample, etc., and receiving response data, etc. Special supervisory programs handle the process control, generate production statistics, and log and steer the flow of administrative information and tasks. Unauthorised access to the interviewers' computers is prevented at several stages by special security software. The method and level of protection was chosen after contact with the National Data Inspection Board, who have closely followed the experiments.

An important function of the test was to indicate whether the system and the software had attained such a technical and functional level as to be ready to be put into regular operation.

The field interviewers used portable Toshiba 1200 computers, and the telephone interviewers used stationary computers (IBM PS/2 mod 50).

Every month a number of reinterviews were conducted in order to obtain a "real" value. These involved 1800 persons from the CADAC sample and the same number from the PAPI sample. Specially trained interviewers were used, and the method was that of "delayed reconciliation".

To obtain a deeper understanding of the CADAC process out in the field, observations were made on the spot, on the one hand in connection with the tracing and other preparatory work, and on the other in connection with the interviews. In all, 18 interviewers were observed on one or on two occasions.

Furthermore the old and the new method have been compared from the economic point of view. For this, information was required concerning interview time, tracing time, non-response rate and a host of other things to do with the way each method functioned. Especially important was to study the parts of the process on which the change of method was bound to have the greatest impact, i.e. data registration and editing - which in fact in the case of CADAC cease to be separate parts of the process and are integrated with the work of the interviewers.

Of great importance is the difference estimates regarding central variables that can be observed between CADAC and PAPI. We have proceeded on the following basis:

CADAC produces more accurate estimates - >	CADAC is to be brought into use, but the linking procedure requires consideration
PAPI produces more accurate estimates - >	CADAC cannot be brought into use until the fault has been detected and rectified

The test was incorporated in the ordinary LFS in order that there should be realistic conditions, proper production requirements and a sufficiently large sample. The fulfilment of these prerequisites outside the framework of the ordinary surveys was neither economically feasible nor practicable.

A new method of data collection cannot be introduced without the active co-operation and backing of the interviewers. For this reason the interviewers were asked to answer questionnaires concerning their attitudes to the use of ADP in their work, and concerning their experiences of the various functions of the CADAC system (including the ergonomic side). Further information of this type was collected from the interviewers by way of running contact during the course of the test.

0.2 Outline of results

This section offers a very concise account of the most important results, arranged in line with the chapters of the report.

Technical functioning of the CADAC system

The overall judgment is that the system worked well and fulfilled the highest expectations. From first to last there was stable functioning in the field computers and in connection with communication; in the central handling there were at first certain defects, but they were soon got rid of.

The interviewing itself went smoothly, but certain difficulties were experienced in the handling of the sample in connection with tracing, etc., and furthermore it was sometimes felt that the answering time was too long.

There were a limited number of faults to do with field computers, modems and the central power unit. On five occasions the computer had to be changed, though in fact in two of these cases no real fault was detected. On several occasions the wrong date in a field computer caused trouble in the night-time communication; it was perhaps due to battery malfunction.

The security system functioned excellently during the entire test, and there has been no report of unauthorised access.

Both a description of the CADAC system and an account of the experiences of it are to be found in Chapter 4.

Carrying out of the test

The test was carried out during the period August 1989 - January 1990, in accordance with the plan given in outline in Chapter 2 of this report, except that the reinterviews went on into February.

Field-work results

The proportion of interviews carried out is much the same in both CADAC (87.9%) and PAPI (88.6%). The difference can be explained principally by the difference in the test situation for each method. Details are to be found in Chapter 5.

Editing/coding

Most of the types of error that occur in PAPI have one by one been got rid of and do not occur in CADAC. The latter system provides greater degree of matching in the automatic coding of occupation and trade-union affiliation.

A special study shows that the interviewers have no great difficulty in writing down, via CADAC, the information required for the coding of occupation and branch of industry. The proportion of incorrect or missing descriptions is low in the case of both methods; it is slightly higher in CADAC than in PAPI. An account of the editing and coding is to be found in Chapter 5.

Observations in the field

The observations furnish a rounded picture of the interviewer's work situation and capacity to handle CADAC. Improvements are needed in the handling of the sampling form, and certain passages of the interview are felt by the interviewers to be too slow. The observations will influence the design of the training, and they provide a basis for improving the field-work procedure and the CADAC program. An account of the field observations is to be found in Chapter 6.

Questionnaires

According to the questionnaire that concluded the tests, most of the interviewers thought that CADAC was predominantly a good thing, and more than half thought that it made the work more efficient. 38% had no ergonomic trouble at all, whilst others reported one or more types of such trouble. In this respect the production test was more or less on a par with the 1988 technical test. The most commonly reported trouble in connection with CADAC was to do with the eyes. An account of both the August questionnaire and the one directly after the test is to be found in Chapter 7.

Comparison of estimates

What is most decisive is that the estimates of degree of attachment to the labour market and labour force status should be correct.

No significant difference has been found between CADAC and PAPI with regard to the estimate of the main LFS parameters (in the labour force, employed, at work, absent from work, and unemployed) or in respect of labour force status.

When it comes, on the other hand, to the three-part division according to degree of attachment to the labour market, there are significant differences. About 1 % more were firmly attached according to CADAC than according to PAPI, about 2% fewer were loosely attached according to CADAC than according to PAPI, and about 1% more were not attached. It would seem that this can be explained by the difference in layout between the CADAC and PAPI forms.

There was according to CADAC a somewhat broader distribution of number of hours worked than there was according to PAPI, which no doubt can be explained by the difference in method.

In sum, the judgment is that there is little difference between CADAC and PAPI when it comes to the estimates regarding the principal LFS variables, for which reason it is deemed feasible to bring CADAC into use at the planned rate without need for any special method of estimation. The estimates, which include February 1990, are to be found in Chapter 8.

Reinterviews

The gross proportion of error for the two principal variables degree of attachment to the labour market and labour force status was around 5%, with no more than slight differences between the methods.

There are definite systematic measurement errors in CADAC both for loose attachment to the labour market and for no attachment, which confirms the corresponding differences in estimate as above. Here too, the difference in layout comes in as an explanatory factor.

There is an account of the reinterview study in Chapter 9, and there are further comments in Chapter 10.

Economics

The costs exceeded the estimated figure by approximately SEK 200,000, chiefly because the interview time at the beginning of the test was longer than expected.

Laying aside the differences in method and the effect of the supplementary questions, CADAC presents a lower total working-time than PAPI. Certainly the relevant data are difficult to interpret with any precision, nevertheless there seems reason to conclude that the CADAC interviews take less time than the PAPI ones.

The test has made it possible to update the basis for assessing future production costs for CADAC, and an estimate taking into account costs and receipts over a three-year period indicates a surplus, which means that it would pay to bring CADAC into use.

The economic questions are taken up in Chapter 11.

Evaluation and discussion

In Chapter 12, finally, the various experiences from the test are weighed together and interpreted with regard to the major aims.

The material from the test is extensive and provides a good basis for evaluation. We have found that the CADAC and PAPI estimates are very much alike where the central LFS variables are concerned, and in the light of this it should be possible to bring CADAC into use at a rate of about 20% per quarter without recourse to a special technique of estimation.

Used in the right way, the new method can mean a raising of the quality of the work of data collection, better process control and a better economy. But great care needs to go into the implementation. The degree of ultimate success in realising the method's potential depends to a large extent on how the Interview Unit does the work.

1 INTRODUCTION

In many parts of the world there is work going on for the development of systems for computer-assisted data collection (CADAC) in conjunction with interviewing. Especially in the case of the central type of system with telephone interviews where the interviewer reads out the questions from a display unit and enters the answers on a terminal (CATI), great advances have been made, and there are many instances of this type of system replacing the paper and pencil system (PAPI). At present the main thrust of development is towards the conducting of telephone and face-to-face interviews in a decentralised environment (the face-to-face interview being in the respondent's home). This calls for portable equipment, data communication special software and supervision that are suited to the requirements of this type of interview design.

Statistics Sweden has hitherto conducted computer-assisted telephone interviews on a limited scale through the central telephone group in Örebro. But most of our interviewers are in other parts of the country, for which reason a distributed and more general system of interviewing has been developed. With this system both the telephone interviews and the face-to-face interviews can be done with the aid of a computer. The interviewers out in the field use portable computers which at night are in connection with a central computer in Örebro, from where the work of the interviewers is administered. The central interviewer group use stationary computers.

This report describes a production test with computer-assisted data collection (CADAC) in the monthly labour force surveys (LFS) carried out by Statistics Sweden during the period August 1989 to January 1990, inclusive (though in fact the reinterviews extended into February). The ordinary LFS sample was divided into two parts: one part for interview by the CADAC method, the other for interview by the PAPI method. During the six months of the test the CADAC sample came to comprise some 19,000 persons, and the PAPI sample some 89,000.

A total of 49 interviewers carried out the CADAC interviews, 43 in the field and 6 in the central telephone group. The training consisted of half a day of introduction to the computer and ADP, followed by individual practice and then a two-day course on CADAC.

To make possible a qualitative comparison of the two methods, observations in the field and reinterviews were carried out. Furthermore there were coding studies and cost comparisons.

The test was the concluding stage of a series of experiments the purpose of which was to achieve a production system suitable for the majority of the surveys undertaken by Statistics Sweden. But special extra tests may be needed if new surveys are undertaken. The first experiments involved the testing of various prototypes that had been proposed, then in June 1988 technical tests were carried out in order to ascertain how the various parts of CADAC functioned in practice. There is an account of these technical tests in"Computer-Assisted Data Collection in the Labour Force Surveys. Report of Technical Tests" (CADAC project report, Statistics Sweden, 1989).

1.1 The purpose of the production test

The main purpose of the test was to provide a basis for deciding whether CADAC should become standard in the monthly surveys. Other important requirements were that the test should

* indicate whether CADAC leads to different estimates from PAPI with regard to central LFS variables,

* over an appreciable period and in realistic conditions make trial of CADAC's operational organisation and technical functioning,

* indicate whether CADAC involves any savings as compared with PAPI, and whether earlier profitability analyses remain valid,

* make trial of the design of the interviewers' training, and map out their attitudes to the use of CADAC.

The 1988 technical tests provided valuable experience and showed that CADAC functioned - both technically and as a system - in such a way as to warrant the planning in detail of a major production test (Bergman et al., 1989), and effort then went into the adaptation of CADAC to the LFS administrative routines.

But the technical tests differed in a number of respects from the ordinary monthly survey. For one thing there was not the same sample, and the results were not used in the ordinary survey. Then again, only a first interview was conducted, and there were no supplementary questions. Furthermore the short duration of these tests meant that no more than limited experience was gained regarding CADAC's long-term stability and reliability.

Above all, the technical tests provided no answer to the question whether the CADAC interviews were of high enough quality to become the standard LFS procedure.

The general experience of the transition to computer-assisted interviewing appears to have been good; no resistance was noted on the part of the respondents, and the majority of the interviewers have taken away a positive impression of the new method.

To answer the question whether CADAC can be put into regular operation calls for a host of detailed information that cannot be gone into here, but in Chapter 2 there is a list of the central requirements.

1.2 The CADAC project

The development of computer-assisted methods of data collection has been undertaken within the framework of the CADAC project, and from this has come what is known as the CADAC system. The software is principally of Statistics Sweden's own design.

Traditionally the interviewer works chiefly with the aid of paper and pencil, but in the CADAC system with the aid of a portable computer. Going with CADAC are the interview program and administrative programs for the interviewers' handling of the sample. There are programs, too, for the construction of the computerized questionnaire and the accompanying instructions and editing conditions. Furthermore, programs for the central field administration and process supervision are integral parts of CADAC. There is an account of the system in Chapter 4.

It was back in 1984 that tests with computer-assisted interviews were initiated by Statistics Sweden. Such interviews have been used in conjunction with the Survey of Household Purchasing Plans, the Consumer Price Index Inquiry, and the Survey of Political Preferences (see e.g. Näsholm 1985 and Andersson et al. 1986).

For several years the endeavour was to produce a special light portable computer in co-operation with a Swedish manufacturer, but this got no further than the production and testing of a small prototype series, and in the present test a Toshiba 1200 portable was used (see e.g. SCB, STU-report 1983 and Blom 1989).

The reason that such an effort has gone into the development of a system for computer-assisted interviewing is that there are inadequacies in PAPI. The aim has been to achieve better quality, greater speed and lower cost, whilst a further important goal has been to take advantage of the computer assistance in order to develop the interview organisation regionally, and in order to create opportunities for new tasks for the interviewers.

1.3 The labour force surveys (LFS)

The labour force surveys are carried out on a monthly basis. The purpose is to obtain a month-by-month picture of the state of the labour market, and this includes

- ascertaining data on employment, unemployment, non full-employment, absenteeism, education, etc.,

- bringing to light both short- and long-term changes, and

- bringing to light up-to-date information concerning population groups not gainfully employed and groups looking for work.

The surveys are concerned with everyone covered by the civil registration from 16 to 64, inclusive (plus during the fourth quarter those from 65 to 74).

Each monthly sample, stratified by county, sex, citizenship and employed/non-employed (according to the employment register), comprises about 18,000 persons. The overall design of inquiry is panel-type, whereby a person takes part once a quarter during a two-year period, i.e. eight times.

The interviews are standardised by way of special forms. The first interview involves the precise mapping out of the person's basic situation with regard to the labour market, and each of the subsequent ones involves ascertaining whether there has been any change since the one before. Furthermore on every occasion the interviewer asks questions concerning the person's situation with regard to the labour market during the current week.

As of the second interview, the questions concerning occupation and branch of industry are to be in part determined by the answers given in the first interview, therefore these answers have to remain available.

There are often supplementary questions of various types, directed sometimes towards the entire sample and sometimes merely towards parts (in the latter case depending on how this or that ordinary question has been answered).

The monthly labour force surveys make up by far the largest survey carried out by the Statistics Sweden Interview Unit, and are a major source of work for the interviewers. Very roughly, the annual cost comes to SEK 25 million. Much the greater part of the interviewing is done over the phone, but in a limited number of cases (first and foremost in order to trace and interview persons

that have no phone) the interviewer goes to the person's home. Normally the response rate is about 90%, with 5% refusers and 5% not reached.

Generally half of those in the sample are interviewed in a first session (measuring week 1), and the other half in a second session (measuring week 2). In each case it is a seven-day session of field work with a few days of central telephone follow-up.

Everything about the labour force surveys has been thoroughly tried and tested. Detailed and gradually improved procedures and instructions have been developed over a long period. The production time is short. The results are published three weeks after the last measuring week.

Current and more detailed information concerning the surveys is to be found in a separate Statistics Sweden publication, SCB 1990:1 (though this is in Swedish).

The LFS interview form in its entirety is extremely comprehensive, because it comes in different versions depending on the situation of the respondent. The basic version which is used for the first interview is attached as Appendix 1.

2 DESIGN OF THE TEST

2.1 Starting-point and restrictions

Whilst only parts of the CADAC system had previously been tried out, the production test was designed to reflect its total functioning during a sufficiently long period for there to be a firm basis on which to decide whether or not to bring it into regular use.

There are two special problems with regard to making CADAC standard in the labour force surveys:

(1) The surveys are the largest of Statistics Sweden's surveys, involving some 18,000 interviews a month. They have been going on for a long time, so the method has been thoroughly tried and tested. The data collection procedure comprises the following: distribution of the sample among the various interviewers, face-to-face and telephone interviewing with the aid of a questionnaire (not the same one for interviews 2-8 as for the first interview; special procedure if "changers" are detected; certain months special supplementary questions), data registration, editing, coding of occupation and branch of industry, and in the case of error being discovered the repetition of the entire procedure. The training of the interviewers has to a large extent been specially geared to LFS requirements, and the detailed instructions and procedures have been refined over a long period. Thus the CADAC procedure has to be of a very high standard if it is to function at least as well - both from the point of view of quality and from the economic point of view - as the traditional procedure.

(2) The LFS results come in for a lot of attention. There are many who use them who want to follow them over a long period and to be able to interpret even quite small changes in e.g. unemployment from one month to another, and there was a certain amount of friction when a new questionnaire - with a new technique of questioning - was introduced in connection with a project concerning the revision of LFS content and definitions, because this change led to small differences in certain estimates. From the point of view of the users it is thus very important that the CADAC method should not cause any such differences to arise. Should, though, differences nevertheless arise, then we must be able to demonstrate that the CADAC estimates are the better ones, at the same time as there must be a comprehensive linking procedure to accompany the step-by-step introduction of the new method.

2.2 What information must the production test provide?

Production test is to provide:

(1) We must have a relatively precise notion of the magnitude of any differences between CADAC and PAPI estimates, especially concerning such important matters as the proportion who are employed and who are unemployed. Certain interviewers may have difficulty in coding occupation and branch of industry by way of a computer, and one must be on the watch for any effect of this on the estimates. If palpable differences do occur, it is of crucial importance that there be sufficiently reliable information as to enable one to see which of the two methods provides the more correct estimates - which is to say that one needs to be able to perceive the bias differences.

(2) The surveys constitute a panel inquiry, and the users require both longitudinal studies and an account of gross changes on the labour market. It is therefore important to detect and explain any differences between CADAC and PAPI regarding the estimation of flows, and in this connection it is of interest to attempt to determine both bias and individual measurement errors.

(3) Information is required concerning such field-work parameters as interview time, tracing time and non-response level, so that one can get some idea of the costs - though the test cannot be expected to provide the basis for a fully realistic cost estimate.

(4) The interpretation of the results is greatly facilitated if there is information about the detailed functioning of the data collection process in the case of each method, and about how errors arise; such information is of course also useful when it comes to e.g. proposing how the procedure can be improved. This means that both observations in the field and reinterviews are indispensable.

(5) Somewhat less important but very helpful is the acquisition of information about the proportion of indirect interviews and of face-to-face ones, about the way in which the interview situation is experienced both by the interviewers and by those being interviewed, about the production time for the estimates, and about certain other cost parameters.

2.3 The decision-making situation

We have construed the general decision-making situation as being such that CADAC shall become standard unless the production test shows it to have some essential drawback - one important reason for this being that CADAC is assessed as having fine development potential. The chief considerations are quality, dependability and economy, though in fact the last of these is no more than a subsidiary object of attention in the test. We offer now a brief discussion of the decision-making situation from the quality point of view.

Going over to CADAC means that the LFS data are collected and processed in a different way, and the question that especially interested us was whether the accuracy/bias of the estimates was affected by changes in measurement error and in processing error (and by any non-response error). We have therefore compared the two methods with regard to the following:

(a) differences in the levels of the estimates,

(b) the systematic error in the estimates (i.e. to what extent this or that estimate differs from the "true" value),

(c) the error in the individual measurement, sometimes referred to as the gross error (and important for e.g. the study of the flows).

Of great importance is the size of any difference in estimate between CADAC and PAPI with regard to central variables (first and foremost those regarding the proportion of the employed and of the unemployed); it corresponds to the size of the difference in systematic errors. Through comparison with the "true" values obtained by way of the reinterviews, one can determine which of the two methods provides the more correct estimate. If it is CADAC that does so, then of course CADAC must be implemented in spite of - or indeed because of - the difference, but a special linking procedure needs to be considered; if on the other hand it is PAPI that provides the better estimate,

then CADAC cannot be implemented until the cause of its inferiority in this respect has been elucidated and eliminated.

It is also important that there not be too much error in the individual measurements, because this can easily become misleading and for instance cause the flows to appear more irregular than they really are. It is difficult to be precise about what is "too much", but what can and should be done is to compare CADAC and PAPI with regard to such error.

Since the level of non-response was very much the same in the case of both methods, we were able to make use of our previous knowledge of the non-response error (otherwise it would have been necessary to supplement the analysis with a non-response study).

Nor must one, in the decision-making situation, leave out of account the knowledge one has acquired - through observations in the field, analysis of the reinterview results, etc. - concerning causes of error in the data collection process (both CADAC and PAPI). Such knowledge can in many cases provide a good basis for the improvement of procedures, etc. so as to eliminate or reduce error.

2.4 The incorporation of the test in the regular surveys

For the following two reasons it was considered best to incorporate the test in the ordinary monthly labour force surveys:

(1) Experience has shown that it is difficult to create realistic field-work conditions if the test lies outside the ordinary field work. There is a risk that in a situation where there is a heavy work-load the test will be assigned low priority by the field-work organisation, resulting in e.g. a higher level of non-response. Nor can one in such a case present the survey to the respondents as an ordinary labour force survey. But the incorporation of the test in the regular surveys both creates realistic field-work conditions and makes it possible to compare CADAC with PAPI.

(2) Since a high degree of precision is required of the estimates deriving from the test, there need to be very large samples - but this would call for large extra resources, and be very expensive, if the test lay outside the ordinary LFS framework. When the test is incorporated, on the other hand, only moderately increased resources are called for.

2.5 The parts of the test

The CADAC production test was incorporated in the monthly labour force surveys and was carried out during the six-month period August 1989 - January 1990 (with reinterviews in February too). During October, November and December there was a supplement concerning the work environment, and this was included in the test. The following are the parts of which the test was composed:

(1) Some of the ordinary LFS sample were interviewed as usual with PAPI, and some with CADAC. (The figures are given in the following section, 2.6.) In the case of the latter method, the interviews were carried out in all rotation groups. In groups 2-8 the interview was during the first three months carried out as a first-time interview (just as in group 1). The reason for this was to avoid having

the CADAC result coloured by an earlier PAPI interview - to avoid, that is, having to ask questions concerning changes, etc. against the background of a work situation brought to light by a PAPI interview.

The CADAC interviewers did only CADAC interviews. As far as possible the regional distribution was made to correspond to that of the body of interviewers as a whole; but since the CADAC interviewers had to cover larger geographical areas than normal, the PAPI interviewers assisted them with information to facilitate tracing. The CADAC face-to-face interviews (amounting to less than 1% of the total assignment) were carried out by the nearest interviewer (just as in the case of PAPI).

(2) The reinterviews were carried out for the purpose of obtaining the "true" values, and the interviewers were ones that had had especially thorough training. The work was centralised, the method was that of "delayed reconciliation", and the persons interviewed were principally from rotation group 8 (departing panel). (See further Chapter 9.)

(3) In order to obtain a deeper understanding of the CADAC process out in the field, observations were made of the interviewers in accordance with a special schedule. (See further Chapter 6.)

(4) During December and January a time-budget study was carried out, where all the CADAC interviewers and a comparable selection of PAPI interviewers noted down their time expenditure. Furthermore a cost comparison was made on the one hand between the two groups, and on the other hand between the CADAC interviewers and themselves as earlier PAPI interviewers. (See further Chapter 11.)

(5) A cost analysis was performed (see 11.4).

(6) How the interviewers experienced CADAC was recorded by way of two questionnaires that they answered, one during the first month of the test and one at its conclusion. To some extent the information thus acquired could be subjected to comparison with that similarly acquired in conjunction with the 1988 technical tests. (See further Chapter 7.)

2.6 Sample

The CADAC sample was like the ordinary LFS one in being a probability sample of the Swedish population. The dimensioning was as follows:

Table 2.1
The sample distributed on CADAC and PAPI, with reference to rotation groups and reinterviews

Month		Sample interviews		Sample reinterviews
		Rotation gp 1-7	Rotation gp 8	
Aug	CADAC	787	1137	304
	PAPI	15041	1143	307
Sep	CADAC	2327	1112	295
	PAPI	13457	1144	301
Oct	CADAC	2375	1130	297
	PAPI	13370	1134	283
Nov	CADAC	2360	1172	-
	PAPI	13428	1118	-
Dec	CADAC	2348	1127	-
	PAP	13423	1147	-
Jan	CADAC	2383	1111	451
	PAPI	13395	1131	465
Feb	CADAC	2379	1126	453
	PAPI	13451	1137	444

3 THE INTERVIEWERS

Statistics Sweden has a staff of approximately 200 interviewers throughout the country, and in addition there is in Örebro a central telephone group of 25 persons who do telephone follow-ups and small-scale telephone surveys. The basic training comprises a one-week course preceded by a correspondence course and followed six months later by a two-day extension course. There is special training in connection with the larger type of survey, and there is the opportunity for the interviewers to apply to go on courses in specific subjects. The average interviewer works about 65% of full time.

This chapter offers a presentation of the CADAC interviewers with reference to age, years of service and place of domicile, and also a presentation of the training they received so that they would be able to work with the computer.

3.1 Participant interviewers

As far as possible the same interviewers were asked to take part in the production test as had taken part in the 1988 technical tests.

For the technical tests the CADAC interviewers had been chosen in the following two stages.

Firstly certain counties were selected - subjectively - in order both to cover different types of region and to have the interviewers concentrated in a few areas (in the latter case for the purpose of keeping down the cost of training, etc.).

Secondly, from each of the selected counties either all the interviewers were taken, or a random sample. However, certain adjustments were necessary in view of the fact that not all of the interviewers in question could (or would) participate in the tests: the latter interviewers were replaced by others from the same (or a nearby) area, most of whom had been randomly selected as reserves right at the start.

By this two-stage process 30 interviewers were chosen for the field-work and five for the central telephone group. All the interviewers in the counties of Malmö and Norrbotten took part, and the rest were randomly chosen from the counties of Stockholm, Värmland and Örebro. There is a description of the selection process - where attention is given to its weaknesses - in the report on the technical tests (1988, in English 1989). It was in June 1988 that the tests were carried out. Then there was a week of practice every month from the autumn of 1988 to the spring of 1989, so that the interviewers would not lose the hang of working with the computer; it involved practice interviews and communication with the centre in Örebro.

For the production test there remained 25 of the original interviewers, the others either having quit or being on leave of absence or on the sick-list. A total of 18 interviewers were newly trained in June and August 1989. The nine in Gothenburg were at the same time participating in an experiment to do with changing the interviewers' forms of working; the other nine were in counties in Southern Sweden where there had not previously been any CADAC interviewers. It was a subjective selection, intended to create a group whose composition might be said to epitomise that of the body of interviewers of the 1990s. Furthermore three persons from the telephone group were newly trained for the production test.

A total of 43 interviewers took part in the test at least one of the months, of whom 39 took part at least five of the months. A total of six from the telephone group took part.

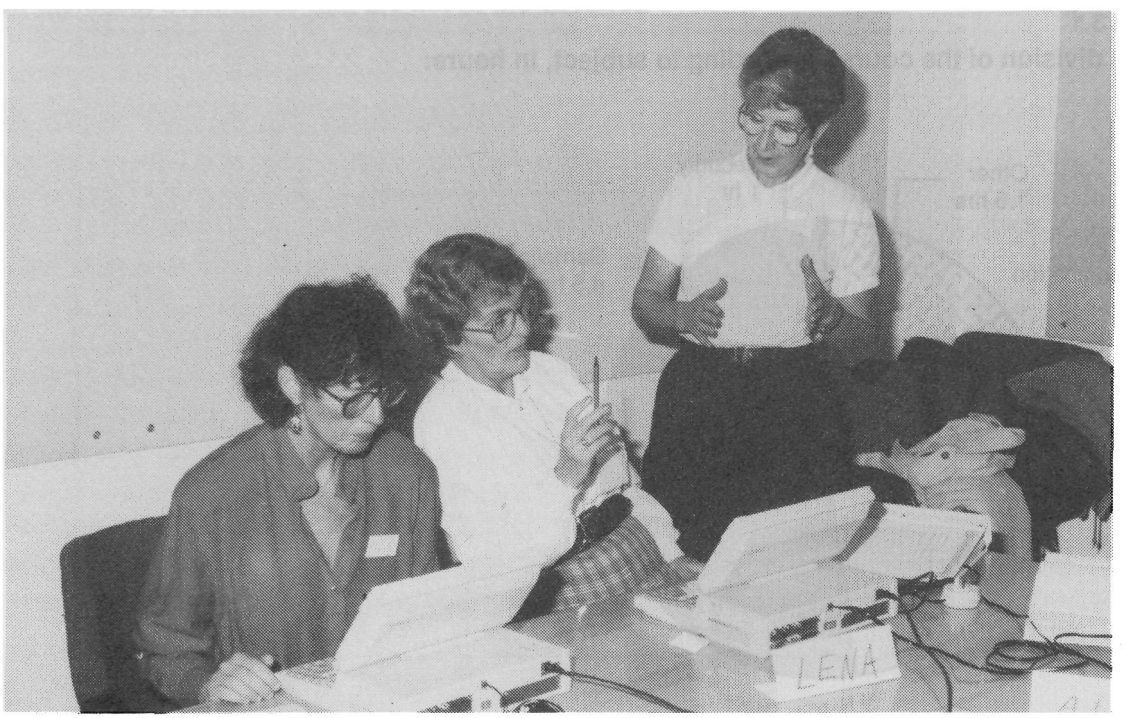
Table 3.1
The entire body of interviewers (N=182) compared with the CADAC group (n=39) with regard to age-group and years of service, %

Age	CADAC %	ALL %	Yrs of service	CADAC %	ALL %
- 39	18	12	< 2	23	23
40- 54	49	43	2-15	49	45
55-	33	45	> 15	28	32
Total	100	100	Total	100	100

It can be seen from the table that the average CADAC interviewer was somewhat younger than the average interviewer in general; it can be seen, too, that there was very little difference when it came to years of service. In the CADAC group two of the interviewers were men.

3.2 The CADAC training

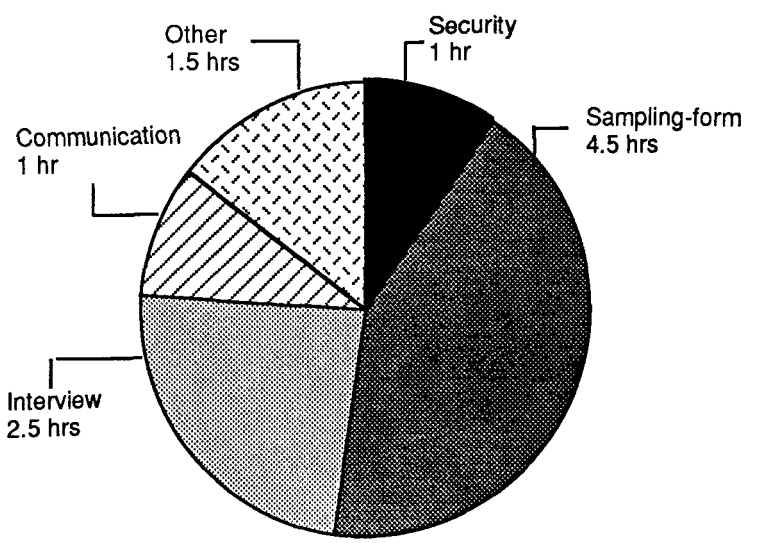
The four groups that were trained in the spring of 1988 got 12 hours of unified instruction spread out over two days. It was found, though, that the interviewers were being expected to learn too much at the same time - not merely about the computer, about how to communicate with the centre in Örebro, and about the sampling-form and interview programs, but also about general ADP and ergonomics. So when it came to the training for the production test we decided on a more gentle procedure, beginning with a four-hour course covering introduction to the computer, practice in



general ADP, and keyboard training; the participants then spent a month or so practising on their own, partly doing a set of typing exercises and partly doing a program acquainting them with the computer. This way of arranging the training proved very successful, and by the time the interviewers did the specific CADAC course they had a certain familiarity with the computer - first and foremost they were finding the right keys, and were no longer nervous about pressing the wrong one.
The most recent CADAC course had the following schedule:

Day 1	Min	Day 2	Min
Introduction, with coffee	30	S-form practice	60
Instruction file	10		
Security	45	Coffee	25
Sampling procedure, s-form	30		
Special cases in INT	35	Interview practice	45
		Sampling-form practice	50
Lunch	60		
		Lunch	60
Interview, full run-through	30		
Communication	60	Ergonomics	30
		Demo, how an interviewer	
Coffee	20	works with the sample	20
		Group work, how do you want	
Interview, practice	50	to work with the sample	25
Sampling-form, grouping & practice	50	Coffee	25
		Report on group work	25
		Conclusion	30

Figure 3.1
Rough division of the course according to subject, in hours:



4 THE CADAC SYSTEM

4.1 Presentation of the system

The CADAC system consists of software chiefly developed by Statistics Sweden, and of hardware in the shape of a central computer unit for process control and communication, together with field computers for the interviewing.

The broad purpose behind the development of the system was to facilitate and make more efficient Statistics Sweden's collection of data by way of interview at both the central and the local (regional) organisational level.

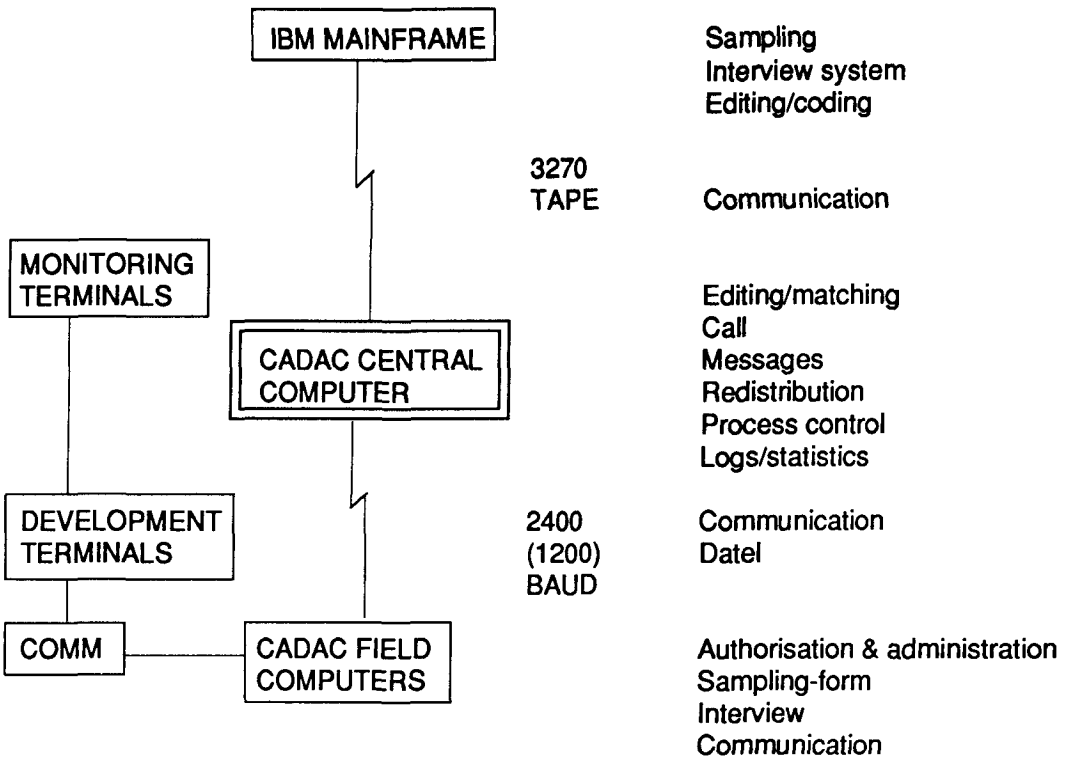
If the production of statistics in a survey is regarded as a flow that starts with the factual problem, population questions (sample) and the choice of method of measurement, and that finishes with tabular presentation, analysis and publication, then it can be said that the CADAC system forms a link between these two stages, covering

- construction of questions (the measuring instrument)
- data collection
- data registration
- editing
- correction
- coding

From this intermediate stage there comes a result file (flat file) that constitutes the interface between the CADAC system and the phase of tabulation and analysis.

4.1.1 Configuration

The following is the configuration of the hardware, with on the right the programs associated with the various parts. To make the picture more complete, all of the central computer's programs have been included, even those that are not in the CADAC system.



Statistics Sweden's mainframe is of IBM type. Communication with CADAC's central computer is either online (3270) or file conversion by way of tape. From the mainframe the central computer (a UNIX Motorola 8400) fetches information concerning persons or households to be interviewed, then later on the result of the interviewers' work is fed back to the mainframe for further processing.

The central computer is the heart of the system. Every night it has to automatically transmit tasks and information to the interviewers' field computers, and has to receive the results of the day's field work. The transmission has to be done with great sureness and precision, via several simultaneously operative lines. In the event of poor accessibility it must be possible for further attempts at contact to be made.

To the central computer are connected development terminals and PCs for system development, and terminals and PCs for administration and monitoring of operations. Furthermore the editing groups have had access to a terminal to aid them in searching for and listing the material.

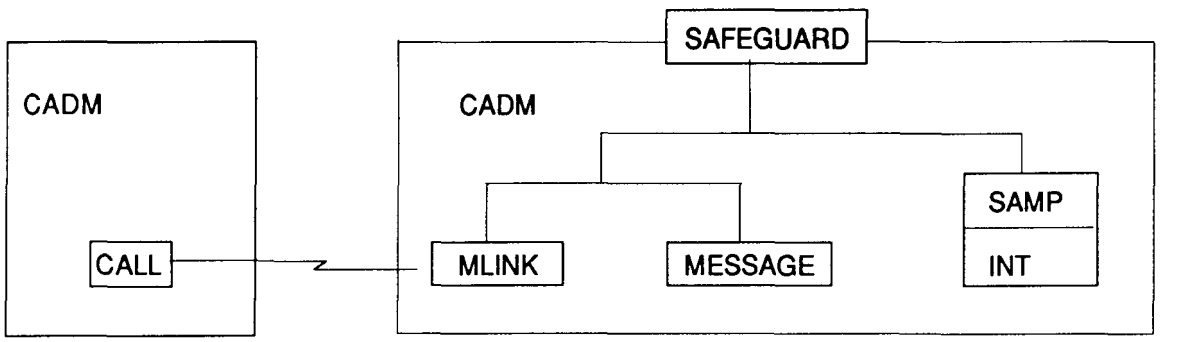
The field computer is the implement with which the interviewer works. Key features - with regard to which high demands are made - are speed, storage, weight, screen design and battery function. During the production test the interviewers used portable computers of type Toshiba 1200, having the following characteristics:

Processor	9.54 MHz 80C86
Primary store	1 Mb in RAM
Diskette station	1 x 3.5"
Hard disk	20 MB
Weight	5.5 kg

Screen	Background illumination LCD 25 x 80 digits, CGA graphics
Modem	Built-in 1200 baud (external modems also used)
Battery	Life about two hours (but with great variation)

4.1.2 Software

The following diagram shows the CADAC software:



CADM (CADAC ADMINISTRATION) in the central computer is a number of programs that arrange/distribute/edit and receive/edit the files that are to be sent/received by the communication program CALL. Here are also programs for process control and administration of the field work (e.g. for the redistribution of tasks among interviewers). Furthermore there is an electronic mail function.

The CALL program is directed by a command file for each run, where all data are labelled at file level. CALL checks that everything is written correctly, then executes the communication with automatic calling from a special phone-number file, error reporting to the log, etc.

For the communication to function, the interviewer must first connect his or her field computer to the modem and start the communication program MLINK. The field computer is in operation all through the night even if the screen display is off; MLINK is standing by to be contacted by CALL.

When the communication has been completed the CADM program in the field computer takes over control and distributes the transmitted data in such a way as to suit the other programs. CADM is also active before MLINK goes into operation, for tidying-up and re-editing; for instance name, address and civic registration number are removed before the data are transmitted.

When the field computer is started the interviewer first encounters a security program (SAFEGUARD) that e.g. protects the data from unauthorised access. Thereafter the interviewer can choose, via menus, among the following:

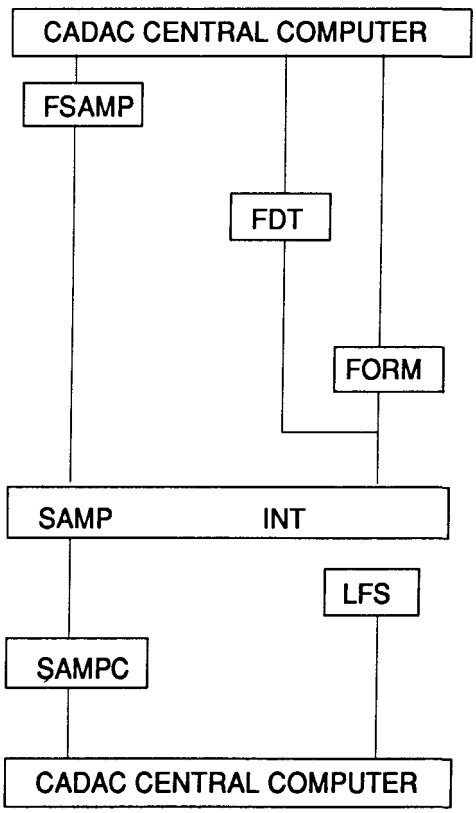
SAMPling-form, that constitutes an "office system" for planning and administration, giving support in such pre- and post-interview work as tracing, sorting, work planning, loading the right questionnaire for the interview, and coding of answers;

INTerview, that guides the interview, presenting the questions on the screen whilst at the same time checking for inadvertent jumps and making logical checks and calculations;

MESSage, that enables the interviewer to send and receive messages, containing simple word-processing functions and a certain amount of message administration;

MLINK, that starts the night's communication.
If ordinary communication via the central computer is not functioning, or if the interviewer's field computer needs checking (e.g. with regard to its content), the program CARBON COPY can be used to establish a connection between the field computer and a central PC. This program offers file conversion, error detection and interactive problem-solving. For instance the field computer can be run by one of the central staff with responsibility for the system who at the same time carries on a dialogue with the interviewer about any problem that has arisen.

The following diagram shows how the CADAC files are connected to the SAMP and INT programs.



Information about the sampling unit: name, address, civic registration no., etc.

Specific LFS information, e.g. name and address of employer as per previous interview

Form with text of questions, conditions for editing and jumping, and instructions to interviewer

SAMPling-form and QUESTionnaire programs

Answer data

Changed information about the sampling unit, and notes made on the sampling-form

4.2 Secrecy and data protection

Since 1 March 1988 (in revised form as of 1 July 1990) special "Directives for the Use of Personal Computers by Statistics Sweden" have been in force, prepared by Statistics Sweden in consultation with the Data Inspection Board. But as CADAC involves a certain deviation from what is usual when it comes to the use of PCs in the work of Statistics Sweden, there was special contact with the Board about this both before and during the production test.

In Statistics Sweden's official petition to the Board, entitled "Data Protection in the CADAC Project" and dated 25 April 1988, there is a description of the CADAC system from the security point of view.

Interview data are protected in all parts of the project against access through:

- the field computer by theft or tapping
- the field computer by a phone-call
- the central computer by a phone-call from outside
- the central computer via the mainframe
- the mainframe via the central computer or a field computer

One way in which the data in the field computer are protected is by a password. If a number of wrong passwords are entered the keyboard becomes locked off for a chosen period. Booting is possible from the diskette station, but the data on the hard disk will be inaccessible.

Other precautionary measures with regard to the field computer are:

- separate files for forms, sample data and answer data
- no more than a few days' work stored in the computer
- no communication except as initiated by the central computer

4.3 Experiences of how the system worked

The overall judgment after the test is that the system functioned well and fulfilled the high expectations that we had had with regard to it. There was no serious trouble. During the first months certain faults were discovered, but they were soon eliminated, and thereafter there was stable functioning of the system in the field computers, in the central computer and in the communication between them. It is important to point out, though, that during the entire course of the project the staff devoted such pains to keeping things running properly (being extremely active in monitoring and in correcting error) as cannot reasonably be expected on a regular basis.

4.3.1 The sampling-form program (SAMP) and the computer's administrative program (CADM)

The sampling-form program contains lists of the persons in the interviewer's sample, with the relevant information about these persons and with space for the interviewer to record the result of his or her work.

The first event of any unusual significance was that *duplicates* were created when the sample was transmitted to two interviewers in August. What had happened was that the interviewers had turned off the computer directly after the communication without pressing "Enter"(the latter command necessary if the files were to be stored in the field computer in the right way). The possibility of a recurrence of this fault was eliminated by altering the sampling-form program, and this new version of the program could be transmitted the following night in conjunction with the ordinary communication.

In October one interviewer got 40 duplicates in her computer. This was repeated in a second communication, and the program ceased functioning, but then the sampling-form program was replaced and in the third communication everything was all right. Probably it was a question of a fault arising in the program in the transmission to this particular computer. During the last three months of the test there were no duplicates.

The interviewer is to *clear-code* (by the indication "88") the persons in the sample whose data are to be fetched in during the night's communication. One interviewer did this but then blanked out the code, with the result that the interview data were fetched in but the sampling-form remained in the computer, and it proved difficult to get together a complete data record for the LFS register. A warning was sent out to the interviewers about this possibility of error.

The interviewers have the opportunity to *divide* the sample into 13 groups. It turned out, however, that if all the groups were occupied, then it was indeed possible to send out more sampling-units, but there was trouble when it came to using the sampling-form program in the field computer. For the time being one group has been artificially made occupied through being designated "blank", in order to avoid the problem, but the matter needs to be seen to in connection with a new version of the sampling-form program.

Notes from earlier interview occasions on the sampling-form take up only three lines, as against seven (one per occasion) in the PAPI version. In August the first three notes were included. From September this was changed, so that now it was the first one (giving e.g. a Christian name) and the two most recent ones that were included. In the future, when we need no longer take the PAPI version into consideration, the interviewer will have an open field in which to note down information that can facilitate the next contact.

4.3.2 The interview program (INT)

The interview program is a general one that steers the interview. The questionnaire - which thus does not itself constitute a program - is loaded by the INT program when the interviewer has chosen to interview a certain person. If it is an LFS survey, the LFS questionnaire is loaded, otherwise another one as appropriate.

During the first LFS week in September it was discovered that there must not be the character "^" in the file containing the data from the previous interview occasion, because it gets interpreted as a control character in the APL program and thus causes the interview program to break down. After that, as a preventive measure, the sample cases were scrutinised in advance to see whether the offending character was present.

This was the only problem that arose in connection with the use of the interview program.

4.3.3 The LFS form

The LFS form contains all the 161 questions that appear on the total form, with jumping and editing conditions (whereby different questions come up depending on the specific situation of the person being interviewed); furthermore there are 50 or so supplementary questions.

After four days of interviewing in August an error was discovered on the LFS form. It appeared in the field for the employer's address if you went in to edit the interview afterwards: the address of the place of work should have been automatically replaced by the employer's main address, but was not. But this was easily rectified, and a new form was sent out to every interviewer during the night. Because of the error, 25 or so places of work were difficult for the editing group to code.

The above case constitutes a clear exemplification of the fact that an error on a form can quickly be rectified, a question or an editing condition quickly be altered or added, and every interviewer's form quickly be updated.

Several interviewers, following the instructions of the paper version, put "*same*" when it came to the occupation question - referring to the preceding question, concerning principal tasks. It goes without saying that the automatic coding was unable to cope with this, therefore as of September the information was written out again even if it was the same as in the case of the preceding entry.

From October to December, inclusive, one sixth of the sample had 24 supplementary questions concerning work environment. No problems were reported the first month, but then two of the interviewers fell out of the program because of a *wrong variable*. This was put right, and a new form was sent out the following night. However, the communication took so long that not all the interviewers had received the new version by eight o'clock the following morning - some of them had to wait a day for it.

To avoid such waiting in future cases of heavy load the communication process needs to be made more efficient - there needs to be speedier transmission, etc.

In connection with a course it was discovered that the response alternative for refusal - *the refusal code - was missing* in the case of three questions. The requisite completion was sent out in connection with the following month's survey.

As of November *control interviews* (i.e. ones where the person was participating in CADAC for the second time, having participated in August too) were carried out for the first time. A number of errors were found in the questions in December, when the number of these interviews increased. The changes were sent out by gradual stages.

As of January there were *"soft" editing conditions* with regard to five of the LFS questions. If, for instance, in reply to the question how many hours more he or she wanted to work, the person said "40", then the following appeared on the screen: "Does the person want to work so many hours more? It's only the increase we're asking about."

In January it was discovered that the *jumping conditions* were as a rule affected if the interviewer had put a 0 before the answer alternative, e.g. had put 01 instead of 1: the ensuing jump was other than intended.

4.3.4 The hardware

In preparing for the test we had great difficulty concerning the installation of the Gothenburg computers. It was chiefly to do with the partitioning of the hard disk into two, and to do with the function of the built-in modem. But the installation was completed just before the field-work was to start.

The most serious fault that we encountered in the course of the test was that at least *eight field computers had the wrong date* when it came to the night's communication. This meant for instance that data files that were fetched in were misnamed (the date being part of the name), and they then had to be fetched in separately. In two cases the field computer had to be sent to Örebro for a reinstallation of the SET-UP program, because the latter had been erased and this had put a stop to communication with the computer. (Probably the culprit was a faulty clock battery.) The wrong date was to be found only in the computers that had a built-in modem and DOS 3.3, though we are unable to say whether there was in fact any connection. Normally the date and time are set in all computers as part of the night's communication.

At least two interviewers brought about a *locking of the keyboard* when changing between the sampling-form and the interview (at the start of the interview), probably through pressing the Ctrl key and some other key. We have not succeeded in reproducing this error ourselves.

One field computer proved unreliable when it came to start-up: after memory test *the screen went completely blue*. Nothing has been done to this computer, because it normally functions properly after restart.

Another interviewer maintained that the computer was not working, and it was replaced - but in fact it worked perfectly when we got it back and tried it.

In all, five computers were replaced during the test. In the case of two of them, though, we were unable to find anything wrong.

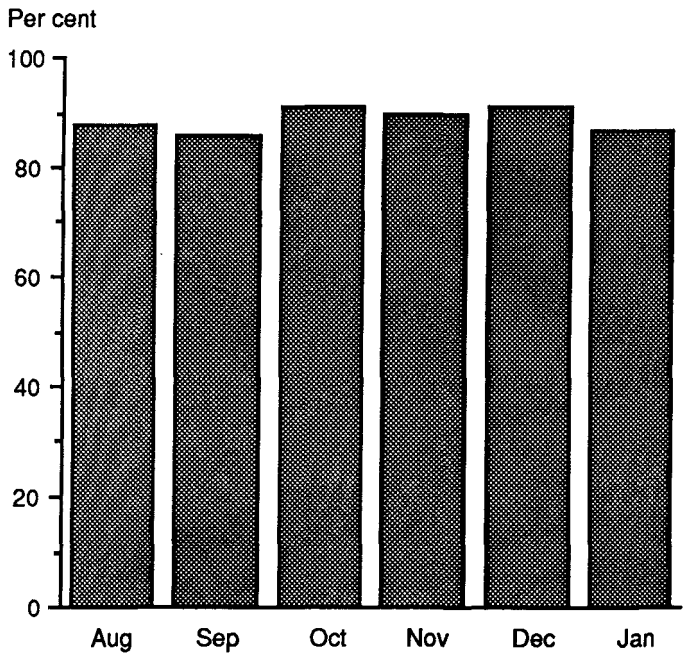
In all, seven power units were replaced. In at least one case the fuse was probably destroyed by lightning. In the other cases it is possible that the the change to a screen with background projection caused the overload that blew the fuse. The most recently purchased power units have 2.5 amp fuses instead of the earlier 2.2.

During the four months of the test *four modems were replaced* because they did not function satisfactorily: three SRT ones and a Teli one were replaced by two built-in ones and two Jackie ones.

4.3.5 The communication

Figure 4.1 indicates the proportion of attempts to communicate that were successful. It can be seen that this proportion varied between 86% and 91% during the six-month period (averaging 89%).

Figure 4.1
Percentage of success in attempts to communicate



Establishing the connection on Fridays was voluntary because there were interviewers who were often away at the weekend. The sum of this voluntary non-response has been estimated as reducing by 2% the proportion of success in attemts to communicate. Non-response for other reasons (e.g. through the interviewer's inadvertently establishing the wrong connection or no connection) accounts for a further 6%, whilst various technical faults (e.g. to do with the modem - either at the interviewer's end or centrally - or the transmission process) account for the remaining 3%.

On three occasions we had a *fault in a central modem* and were therefore unable to reach a third of the interviewers with whom we were connected (there being three modems that operate outgoing during the night). On the odd occasion there was a fault in the command file and we were unable to establish any contact with the interviewer.

A program that was frequently used during the test - and that indeed can be described as having been indispensable - was Carbon Copy, by means of which *error detection* in the field computers could be performed centrally, with no need for anyone to go out to where the interviewer was.

4.3.6 The central administration

After a long period of preparation we got off to a very fine start in August. Things went smoothly for the interviewers, and the communication functioned as it should. In the internal newsletter the test was described as "going like clockwork". In September the sample was increased, and things were still looking good. But eventually there came the final collation - and the big surprise! A large number of sampling-forms and response data from the interviewers were quite simply not there. Though we did find some of the missing material after laborious searching, the fact remained that the clockwork was not in as good a state of repair as we had thought, and 90 interviews were lost to us. The cause lay in the central processing and in the interplay with the routines of the editing group. We had to sharpen and extend the controls in several ways, and thereafter no more than a few sampling-forms have been missing per month.

During the first three months the central operations were to a large extent based on the performance of a number of data runs when the data had come in from the interviewers. It was a question of listing what data had come in during the night, of writing a list of those in the sample that were to be coded centrally, of editing the data to fit the LFS format, of transferring the result files to the mainframe and of then starting the major editing. Persons not reached were to be distributed among the telephone group's interviewers, and there was to be redistribution of the sample between interviewers where appropriate. Furthermore the communication file for the coming night was to be given its final shape.

What with all these routines and a lot of phone-calls from the interviewers, seeing to the task of central administration involved considerable stress during the first months. The least little *error in the communication file* could be disastrous. In the course of time new programs have been composed that make the process more automatic and facilitate the handling of various parts of it (including e.g. the automatic listing of the data that have come in during the night, and the automatic production of a coding-list for the editing group).

The wrong date in the communication file caused us to make the mistake of fetching in the interview data from the preceding night. This happened a few times, but as of December there were new routines that improved the situation.

There was no functional trouble to do with the central computer, though on one occasion there was a power cut that necessitated a restart.

4.3.7 Security

The SAFEGUARD program worked exremely well. In an earlier test there was a function that extinguished the display after a number of minutes of inactivity, but this we had to do away with because it meant that the display was extinguished after the night's communication. There was at least one occurrence of the keyboard's locking itself off after wrong passwords had been used; a new attempt could be made after an hour.

On one occasion an interviewer went out into DOS, which occurs by way of a menu choice in SAFEGUARD. She then erased all the files in the root library, whereby the computer became unusable and had to be replaced. What she had done became evident through the logging procedure which is a part of the SAFEGUARD security system. One way to prevent the recurrence of such a complication is of course to make DOS inaccessible to the interviewer.

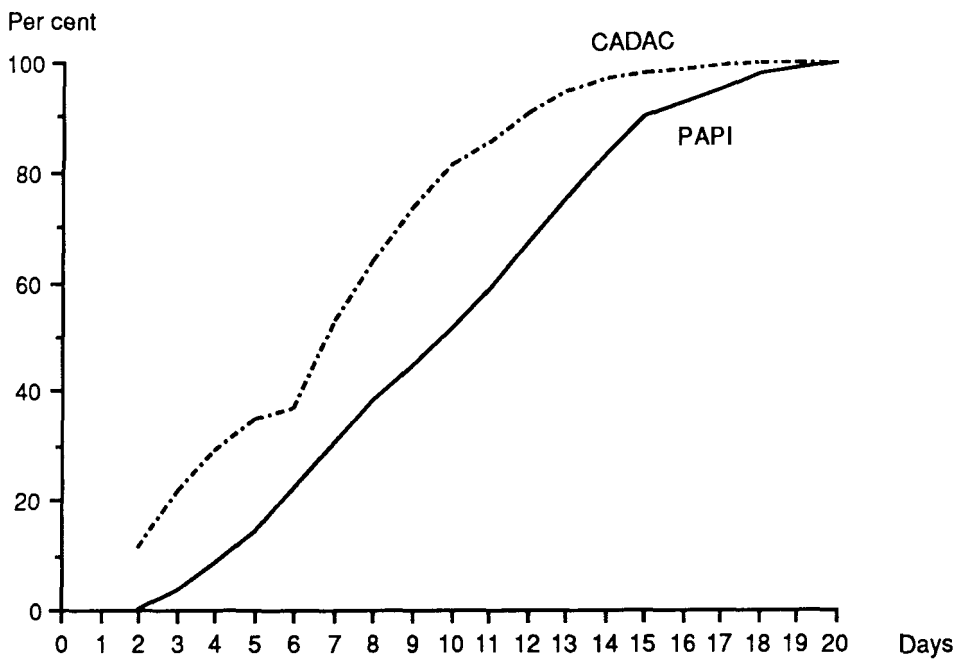
5 INFLOW AND CENTRAL PROCESSING

In August there were 1800 persons in the CADAC sample, and in September and October double this number. In November there were follow-up interviews with persons who had participated in CADAC for the first time in August, and in December and January there were a greater number of such interviews (corresponding to the larger samples in September and October). During the last quarter of 1989 a sixth of the sample received 24 supplementary questions concerning work environment.

5.1 Inflow

From Figure 5.1 it can clearly be seen that the CADAC inflow is faster than the PAPI.

Figure 5.1
Inflow for CADAC and PAPI



During the first and second weeks of field work there is a 20-30% higher inflow with CADAC than with PAPI. The values represent the averages for the months September-January. With reference to the PAPI inflow, what is meant is that the forms have come in and been registered on a computer file (corresponding to what happens during the night's communication in the case of CADAC). During October the inflow was measured more exactly, in order to ascertain how much went for coding before registration, and this factor was then used in order to obtain a truer picture of CADAC vis-à-vis PAPI. This adjustment factor varied between 0.85 and 1.15, and it was the first week of field work that had the highest.

A comparison of the months indicates that the fastest inflow was in August (which, however, only had one measurement week). The inflow during the first working week was 57% for CADAC and 21% for PAPI. During the months September-January it was about 35% for CADAC and 12-21% for PAPI - except for January, during the first week of which month no PAPI material was registered on the computer file. (In the case of PAPI there was probably a delay in taking out material registered on the computer file, making 14% a more likely figure than 12%.)

On the Friday of the second field-work week in August the inflow figures were 89% for CADAC and 54% for PAPI, and in the remaining months the corresponding figures were 79-84% for CADAC and 49-55% for PAPI. There is no tendency for the CADAC inflow to decline after a number of months, therefore these high figures cannot be said to depend on the charm of novelty.

5.2 Field-work results

There was no significant difference between the two methods when it came to the proportion of the sample that it was in fact possible to interview: 87.9% in the case of CADAC, 88.6% in the case of PAPI.

Table 5.1
CADAC and PAPI field-work results, in %.

CADAC

Rotation group	1-7	8	Total
Number	12593	6799	19392
	%	%	%
Interview	87.8	88.1	87.9
Unable to participate	0.8	0.6	0.7
Not reached	4.9	3.5	4.4
Constantly unreachable	1.0	1.6	1.2
Refusal	1.6	0.5	1.2
Constant refusal	3.9	5.5	4.4
Over-coverage	0.1	0.1	0.1
Total	100	100	100

PAPI

Rotation group	1-7	8	Total
Number	82272	6824	89096
	%	%	%
Interview	88.6	88.8	88.6
Unable to participate	0.4	0.2	0.4
Not reached	5.6	3.7	5.5
Constantly unreachable	0.7	1.3	0.7
Refusal	1.1	0.1	1.0
Constant refusal	3.5	5.7	3.7
Over-coverage	0.2	0.1	0.2
Total	100	100	100

The difference in frequency of response can be partially put down to the fact that the absence of certain data when it came to the central processing had a clearly adverse effect on CADAC's figure for September. The 90 sampling units that disappeared are classified as "Unable to participate". (See 4.3.6.) The difference can perhaps also be partially put down to the effect of the panel system - 30% of the persons in the CADAC sample were participating for the last time, but only 8% of those in the PAPI sample.

On the other hand the time for tracing is about three days longer in the case of CADAC, which ought to mean fewer "Not reached". To be set against this, however, is the fact that the CADAC sample for the individual interviewer is spread over a larger (and partly new) area, whereby the lack of local knowledge makes tracing more difficult. The total proportion of "Not reached" and "Constantly unreachable" was somewhat lower in the case of CADAC (5.6%, as against PAPI's 6.2%), which can be interpreted as indicating that the greater amount of time available for tracing had a positive effect.

There was a rather larger proportion of refusers in the case of CADAC than in the case of PAPI (5.6% as against 4.7%). The difference derived chiefly from the 1-7 panel, and half was a question of what is referred to as "constant" refusal, i.e. refusal for a second time.

5.3 The editing

The errors that there were on the forms were discovered in the course of the editing. (For the types of such error, see Chapter 4.) Basically, it was thus: one error in August, none in September or October, then several minor ones in connection with the control interviews in November (chiefly regarding the group of persons without work). These errors were gradually got rid of, and by March there were none.

The design of the test whereby there was an introductory complete interview (new class interview) proved to lead to a number of errors in our register of subsidiary occupations. The register was not updated because of the new class, and this meant that certain persons got the wrong question: they were asked, "Have you still got your extra job at ...?" even when they had said at the previous interview that they did not have any such job. In such cases there had to be manual rectification of the register.

Before the editing begins there is automatic coding of occupation and trade union (see further Chapter 6). In cases where this coding does not occur, these two classifications will come up on the editing list. This accounted for 80-90% of both CADAC and PAPI errors.

CADAC had four times as high a frequency of error with regard to the county code. If there is a new address, then a new county code has to be entered - but CADAC interviewers forgot this. It has to go on the sampling-form, but there was no control for it, and furthermore the field where it had to go was not in the best of positions.

Another error to do with the sampling-form was that a number of non-responses were given the result code for interviews. For this there is no control in the CADAC system. The consequence was that interview data were missing, and that these forms disappeared from the editing as constituting type errors. During the autumn we thereby lost some interviews because they were not included in the result run. The editing group are now on the look-out for this type of error.

All other types of PAPI error disappeared in CADAC. Small groups of errors to do with persons outside the labour force, and to do with subsidiary occupations, were gradually got rid of.

The work environment questions that formed a supplement to the LFS questions went without a hitch in CADAC. There were also supplementary questions after the end of the test, in February and April-June. The annual occupation questions in February, which involve a lot of difficult jumps, went extremely well in CADAC. Some 7% of the PAPI sample received supplementary questions because of questions that had been jumped over, but nothing of this was required in the case of the CADAC sample.

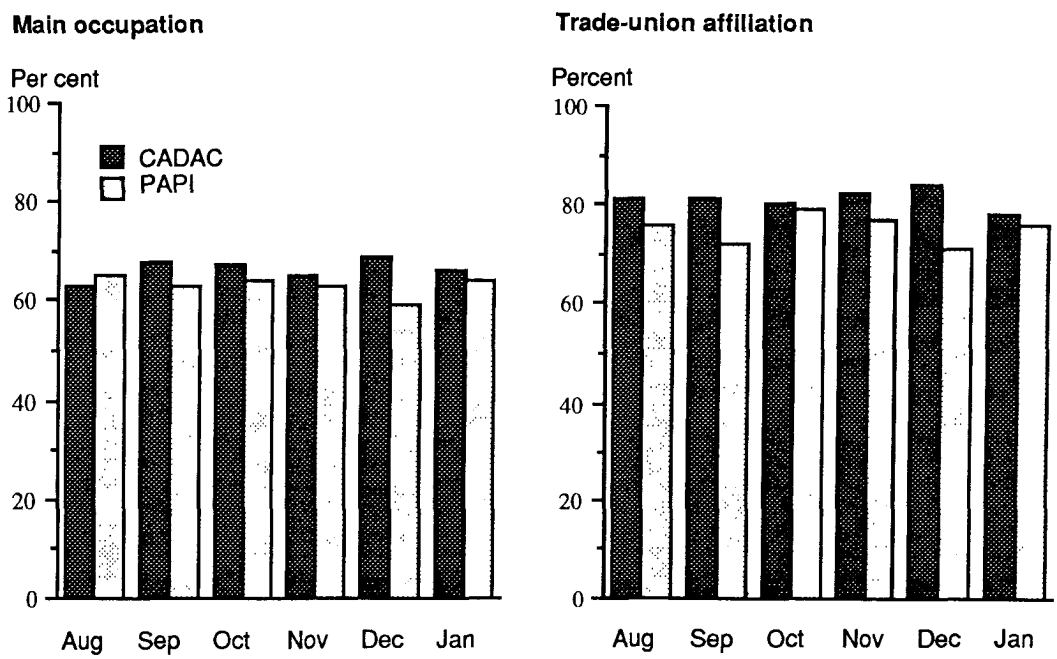
5.4 The automatic coding

In the labour force surveys there is coding of education (done direct by the interviewer), occupation (done automatically), trade union (also done automatically) and branch of industry (done centrally and manually).

In CADAC a special coding list is written out with interview data concerning place of work, and this enables the staff to code branch of industry. The code is then entered by way of a terminal, and thereafter comes the editing and the automatic coding of occupation and trade-union affiliation.

Figure 5.2 presents the CADAC and the PAPI month-by-month percentage of success with regard to the coding of trade-union affiliation and main occupation.

Figure 5.2
Percentage of success in automatic coding



It can be seen that CADAC is more successful in 11 cases out of the 12. Its average for the coding of main occupation is 66.4% as against PAPI's 63.0% (and the corresponding figures with regard to subsidiary occupation are 63.9% and 61.2%), whilst its average for the coding of trade-union affiliation is 81.2% as against PAPI's 75.3%.

The range of CADAC's success in the coding of main occupation is 63-69%, lowest for August and highest for December. The low figure for August can partly be put down to a number of misunderstandings on the part of the interviewers. For instance they wrote "SAME" if an answer was the same as the preceding one, which of course queered the pitch the automatic coding (cf. 4.3.3). The corresponding PAPI range is 59-65%, highest for August and lowest for December. In the case of PAPI the variation can probably be ascribed more to a stress factor than to anything else - the interviewers had little to do in August but a lot to do in December.
The range of CADAC's success in the coding of trade-union affiliation is 78-84%. That the lowest figure is for January is hard to explain. The corresponding PAPI range is 71-79%, highest for October - when an instruction was sent out that listed approved abbreviations - and lowest for December (as in the case of the coding of main occupation).

Failures are also coded by the editing group, therefore CADAC's higher percentage has a direct economic value.

Branch of industry is in the case of PAPI coded before registration, whilst in the case of CADAC special lists are printed out with the variables that are necessary and that facilitate the coding. In August a number of variables were lacking, which in certain cases made the work of coding more difficult. The gaps were filled in September, and thereafter there was no trouble. The editing staff enter the code in the mainframe computer by way of a terminal. This is a new task occasioned by CADAC.

5.5 Special study of the coding of branch of industry and occupation

5.5.1 Execution of the study

There might reasonably be a certain apprehension that the CADAC information gathered in for the coding of branch of industry and occupation will be incomplete, and will thereby lead to classification error or partial drop-out. If the interviewer has not mastered typing and for this reason feels under stress when doing the interviewing, he or she will experience difficulty in writing down the full information required for the coding in question: name and address of employer, designation of occupation, and designation of tasks performed. So to ascertain whether in fact the CADAC information was more meagre than the PAPI, a special study was carried out. It covered 4,127 persons who participated in the CADAC test during September-October and who had also been in the ordinary LFS sample during June-July. Since the entire CADAC samples for August, September and October were newly classified, the coding of branch of industry and occupation in the case of the persons covered by the study was based on both PAPI and CADAC information. The August sample was excluded from the study because of the risk that the first month of the test would be unrepresentative inasmuch as the interviewers would not have had time to get used to the equipment.

The September CADAC codes were compared with the June PAPI ones, and the October CADAC ones with the July PAPI ones. Wherever there was a discrepancy an expert coder used the relevant background information in order to assess its cause.

The persons from the sample who participated in the CADAC test were also in the ordinary labour force surveys, and thus contributed to the estimates. To avoid unnecessary partial LFS drop-out in respect of branch of industry and occupation, the coders could retrieve the PAPI code in cases where they regarded the CADAC information as insufficient to permit coding. (It goes without

saying that they first made quite sure that the PAPI code was indeed the product of information referring to the same branch of industry and occupation.)

5.5.2 Results

The study shows that it is in the case of only a small proportion of the CADAC or PAPI material that the information concerning occupation and branch of industry is so incomplete that the classification becomes wrong or has to be left out: the CADAC figures were 1.8% for occupation and 1.2% for branch of industry, and the corresponding PAPI figures were 1.3% and 0.8%. The proportion of *wrong codes* was on the same level in both systems, whilst the proportion of *omitted codes* was greater in the case of CADAC.

Table 5.2 shows the differences that were found between CADAC and PAPI with regard to classification. The term "Coding and answer variability" refers to cases where there was no difference in information but where different codes were assigned or the answers were differently expressed.

Table 5.2
Differences between CADAC and PAPI regarding classification

Branch of industry	No.	Per cent
Cause of difference in coding		
Incomplete CADAC info leading to	51	1.2
wrong classification	34	0.8
omission of code	17	0.4
Incomplete PAPI info leading to:	33	0.8
wrong classification	29	0.7
omission of code	4	0.1
Person has changed place of work	221	5.4
Coding and answer variability	229	5.5
Codes agree	3,593	87.1
TOTAL	4,127	100.0

Occupation	No.	Per cent
Cause of difference in coding		
Incomplete CADAC info leading to:	75	1.8
wrong classification	51	1.2
omission of code	24	0.6
Incomplete PAPI info leading to:	55	1.3
wrong classification	52	1.2
omission of code	3	0.1
Person has changed place of work	309	7.5
Coding and answer variability	366	8.9
Codes agree	3,322	80.5
TOTAL	4,127	100.0

5.5.3 Conclusions

The study shows that the CADAC interviewers have no great difficulty in writing down the information required for the coding of occupation and branch of industry. It is true that the CADAC results are in this respect somewhat less good than the PAPI ones, but in all probability the interviewers' typing will quite rapidly improve.

6 OBSERVATIONS IN THE FIELD

6.1 Design of the study

The evaluation of the CADAC production test was accomplished partly through observations in the field, whereby the interviewers' work with the computer was studied in the normal work environment, i.e. the home.

One object of the observations was to see how CADAC functioned in the interview situation - to see whether the person being interviewed reacted in any way to the use of a computer, to see whether the interview took longer, etc. Another object was to see how the preparatory work (tracing, etc.) went when a computer was used, and a further object was to see whether the computer in itself constituted an intrusion on the interviewer's work-place (including whether the work-place was suited to the use of a computer, and what drawbacks there might be).

As mentioned earlier, 43 field interviewers took part in the test. There was observation (mostly in November and December) of 17 of them, chosen on the basis of where they lived.

Some of the 17 were visited just once, but most of them twice - once during the week of preparatory work (tracing; grouping; seeing to the sampling-form) and once during the interviewing.

The following patterns of observation were used:

Pattern 1,	for the preparatory week;
Pattern 2,	for the interview week;
Pattern 3,	for each interview, to take note of any problems to do with the questions, and to provide a basis for discussing with the interviewer his or her views on the design of the CADAC system.

6.2 On the basis of Pattern 1

Work-room

Some of the 17 interviewers had separate work-rooms, others worked in an ordinary room.

With regard to the room, there is more to be thought about when CADAC is used than when PAPI is used. For instance there are interviewers who use their bedroom to work in, whereby there arises the question of the noise of the computer during the night's transmission/communication. The solution here has been to let the computer spend the night in another room or in a wardrobe, cupboard, etc.

Work-place

A basic requirement for the interviewer's being able to work comfortably with the computer is that the desk be right. There needs to be enough room not only for the computer work itself but also for paper-work and telephone interviewing - enough room, that is, without there having to be too much moving things about.

Work-places were arranged in one of three ways:
(1) two at the same desk,
(2) one at a large desk,
(3) one at a small desk.

Two work-places at the same desk - good
There was one place for the computer and one for the paper-work and telephone interviewing, together with a chair that could be rolled from one to the other.

One work-place at a large desk - satisfactory
If the desk is broad enough the computer can be shifted to the side a little but still be within reasonably comfortable reach. This was the commonest arrangement among the 17 interviewers who were observed.

One work-place at a small desk - less satisfactory
Less good is an arrangement whereby the computer has to be shifted on or off the desk depending on what work is to be done. It must be said, though, that those interviewers who did make use of this arrangement had in fact found ways of making things run reasonably smoothly - involving in the majority of cases having a trolley or roller desk on which to put the computer when not in use. In some cases the computer had to be disconnected before being moved, in some cases not.

Connecting up the computer

Several types of modem were in use, the most convenient type being the one built into the computer.

Cases were observed of awkward - and indeed even of completely unsuitable - arrangements with regard to connecting and disconnecting. There were telephone jacks that were so badly placed - down at the floor, under the desk, behind a bookshelf or on the wrong side of the room - that getting at them involved crawling, shifting furniture, etc. On occasion there were leads going right across the floor.

Lighting

Most of the interviewers had satisfactory lighting, though some of them found that the special lamp that they had acquired could not be used during an interview inasmuch as it interfered with the headset.

Since the screen is sensitive to how the light falls, the positioning of the desk, and of the computer on it, was important. If this positioning was wrong, the daylight had to be excluded for what was on the screen to be clearly legible.

How the interviewers prepared

The CADAC interviewers get their LFS allocation both for week 1 and for week 2 at the same time. Since it not impossible that the last interviews from the previous month are still there when the new sample arrives, there *may* thus be three panels in the computer simultaneously.

It is up to the interviewers themselves whether they start work on both weeks' samples together or take them one at a time. Certainly it is possible to do all the preparatory work for both weeks at the same time (though the actual interview forms for week 2 are put in later) - but what in fact most of the interviewers did was to prepare week 1 first and then towards the end of week 1 start doing the tracing for week 2.

Most of the interviewers had found a good technique of preparation. They went through all the sampling-forms and grouped them in accordance with what was noted down. Here it became evident how important it is that the notes on the form from the previous time are fairly precise. For instance "Ring p.m." meant different times to different interviewers, and this sort of thing made the work more difficult; on the other hand it was easy to group the forms on the basis of such notes as "Ring after 6" and "OK to ring at work".

But there is nothing against the grouping for each interview session being of an individual nature - the main thing is that the interviewer not be in any confusion about what the various notes indicate. In the case of new persons the interviewers either sought the telephone number direct or made a group entitled "NEW" or "TEL" or the like (the tracing in this case being done in a concentrated session later).

The Gothenburg interviewers used videotex to look for the telephone number, and this meant leaving the CADAC program, therefore they had to write the person's name down on paper.

For those interviewers who had not yet found a good way of handling the sampling-form the preparatory work was troublesome, involving a lot of jumping back and forth between list and forms.

It became clear during the observations how important it is that the interviewer has a proper understanding of the routines for grouping and sorting. If the grouping is unsuitable, things become difficult. There is a limit to the number of groups that can be employed - and if the interviewer is too specific with regard to what goes into the "group" field (writing e.g. "OK to ring after 5.30", "OK to ring after 6", etc.) this limit will soon be reached. Furthermore many interviewers felt uncertain about how to use the "sort" field in combination with the "group" one.

The first training sessions for the CADAC interviewers were mostly to do with the interview itself. It would seem that for the most part the interviewers found the handling of the sampling-form difficult and confusing. After the training they went home and practised on their own, talked things over with equally inexperienced colleagues, and ended up using sampling-form routines that were in some cases very good and in other cases not.

Apart from this the one thing that some of the interviewers had trouble with in connection with the sampling-form was the technique of making jumps. They did the jumping somewhat haphazardly, using the arrow keys and F8 when they wanted to go to a particular location to note something down - then if they went a step too far it proved awkward to rectify it. What they had forgotten from their training was how to use the "tab" and "shift + tab" keys in conjunction with the function key for "jump between fields" in order to easily get wherever they wanted on the form.

All the 17 interviewers thought that the preparatory work went more smoothly in the case of CADAC than in the case of PAPI. "It seemed a lot more complicated at first than it turned out to be" was the typical comment. There were still bits that you were uncertain about, but it got easier and easier as your confidence grew. As one interviewer put it, "I'm not so scared any more of pressing that damn Enter key."

6.3 On the basis of Pattern 2

The observer listened in on a number of interviews and discussed with the interviewer how the preparation had been (how the tracing had gone, what contacts had been made in this respect, etc.). Furthermore there was discussion of how the interviewer had organised the work, whether he or she felt pressed for time, what (if any) specific routines he or she had worked out for phoning, writing letters, making visits, etc.

Most of the interviewers who were observed had finished the greater part of the preparatory work before the start of the interview week. They had gone through their sampling-forms to see which were new, they had looked up telephone numbers, and they had pursued the tracing by way of the relevant social insurance office, post office, parish civil registration office, etc. Some of the interviewers contented themselves with turning to Swedish Telecom, then if no telephone number was forthcoming they simply wrote and asked the person to ring them up - which the person sometimes did, sometimes not. It was only towards the end of the interview week that these interviewers tried other ways of tracing - which was a drawback if it turned out that the sampling-forms had to be redistributed.

The majority of the interviewers that we went to see had relatively fixed work routines (depending, of course, on how much other work they had to do), and thought that working with CADAC was much the same as working with PAPI (though with the reservation that working with CADAC was perhaps rather more concentrated, "once you and your computer are connected up").

Inasmuch as the interviewers not only had the LFS work to do but were engaged on other major surveys at the same time, the majority of them felt under a certain amount of pressure quite often - and this became more marked when they began with CADAC (new, a bit complicated, a bit alien).

Were there any problems to do with the communication with Örebro?
It seems that the communication with Örebro functioned well. The interviewers had found routines for making the connection, and were good at the routine for the writing and reading of messages. On the other hand some of the interviewers expressed dissatisfaction to the effect that their messages, nothing being done about them, were apparently not being read. Otherwise there were a few little mishaps but nothing serious: one interviewer had had material left in the computer in the morning without knowing why, others had received double samples (which, though, could be put right).

A couple of the interviewers in fact had more serious trouble with the communication (probably because of a modem fault), and their computers were replaced.

How does the interviewer feel about the actual interview? Does it seem to take too long? Do the pauses in the program get on the interviewer's nerves?
Most of the interviewers did not feel under as much stress now that they had been working with CADAC for a time. They had acquired a familiarity with the computer, and had acquired an idea of when during the interview procedure they needed to "fill out the silence". Many of them had devised their own line of "commentary", including such remarks as the following:

- "I'm waiting for the picture on the screen to change."

- "The computer's a bit slower than you and me."

- "I'm just putting your answer in."

This was when the interview had got going. But it was different when it came to the wait between the start (with the sampling-form, that is) and the first question - the interviewers thought it unnecessarily long and tedious.

Was there any reaction on the part of the respondent with regard to a computer's being used? Did the interviewer in fact let the respondent know?
The first time the new technique was used it happened that the interviewer told the respondent, especially if the latter had been interviewed before. This because the interviewer felt uncertain and wanted the respondent to understand if things went a bit slower than usual, and also because the interviewer wanted to explain why the same questions were being asked all over again ("Because of this new technique I haven't got access to the olsd information."). Most of the respondents were very understanding - and indeed one of them who knew about computers gave the interviewer help when trouble arose! In the case of first-time respondents it seemed less important to say that a computer was being used, inasmuch as they had nothing to compare with anyway.

How did the questions, jumps, etc. function in the actual interview situation?
Most of the interviewers did not find it difficult to jump back to an earlier question during the interview. They either used the "jump back" key or went back step by step - and the majority in fact preferred the latter method, because it did not require remembering the number of the question you wanted. A number of the interviewers, not feeling any too confident about how to jump back, postponed the attempt until after the interview.

How did the typing go? Did the interviewer use any short-cuts (e.g. abbreviations to be filled out later)? To what extent were pen and paper used?
The interviewers who were efficient typists wrote down what the respondent said direct, and were not bothered if it was a lot; other interviewers shortened some of it and then wrote it out later. It depended on how good you were at typing - and of course on to what extent you thougt the respondent was under stress.

Some of the interviewers used pen and paper to note down information that would be completed later, but the commonest thing was to make abbreviated notes direct on the form (though most of the interviewers anyway had pen and paper handy for doing figures, etc.).

What would the interviewers like to change in order to simplify/improve the CADAC work?
One improvement would be to include names and addresses on the list of sampling-form numbers which is transmitted to every interviewer. This would make it easier to find telephone numbers, would make things easier if a respondent rang up, and would - first and foremost - make things easier for interviewers working with videotex.

When the interview is finished the interviewer comes back to the sampling-form by way of one of the function keys, and the cursor is then in the "session" field. In itself this would appear perfectly reasonable, because nine times out of ten the interviewer fills in this field directly after the conversation with the respondent and then goes to the next sampling-form. However, on certain such occasions the interviewer receives information (concerning e.g. the intended next contact - "going to be away on holiday", "has to be in the evening") that needs to be noted down while the rerspondent is still on the line - and on these occasions it can seem stressful to have to make your way to the appropriate field. Some of the interviewers thought it would therefore be better if the cursor was in this "notes" field when you came back to the sampling-form (whereafter you could go to the "session" field by way of F8).

Another thing that came up was that it was thought to be somewhat trying that you can only go in one direction with the sampling-forms, i.e. to the following one. It would be more convenient if there were a "previous sampling-form" function. The trouble arises when the interviewer is working with quite a large group and one of the respondents says e.g. "Get back to me in five minutes, please": the interviewer must either write down the respondent's name and then search that way, or go right through the sampling-forms using the "next sampling-form" function.

One shortcoming of the program was that if during the interview the interviewer made even the tiniest error (got, say, one letter of an address wrong), the only way to rectify it was by rewriting everything. It would of course have been easier if it had been possible to use Del and Ins.

One thing requested by several interviewers was that the respondent's home address should remain, together with the name, at the top of the screen for all the questions. It was needed when e.g. the respondent had to be asked the address of where he or she worked. Especially important was this felt to be by those interviewers who had respondents in places of which they had no local knowledge. Furthermore there were interviewers who thought that the number of the session should also remain on the screen throughout; it happened that the respondent asked you about it, or you might for one reason or another want to inform the respondent of it ("It's your last time, you know."). Ideally, it was felt, the respondent's occupation should be there too.

There was also a suggestion that it should be possible to easily and quickly return to the sampling-form in the midst of an interview, just to have a look at something and then at once return to the interview question.

One interviewer hoped that it might be made possible to press a function key to get a "notes page" on the screen, so that there would be no need for pen and paper.

6.4 On the basis of Pattern 3

In the case of every interview that was observed, Pattern 3 was used. The idea was that a note should be made of all questions which caused any problem. The notes were of the following type: "interview went fine", "interview going smoothly", "no trouble with jumps or questions".

It became evident from the observations that most of the interviewers handled the interview itself very smoothly (thanks of course to the fact that the focus of the training was on this, but also to the fact of this being far simpler than the handling of the sampling-form).

One problem that the interviewers had previously pointed out and the existence of which was now confirmed, was that there was too long to wait from when the interviewer left the sampling-form to when the first interview question came up on the screen. Probably it feels worse to the interviewer if it is the respondent's first time or if the respondent has said that he or she is in a hurry. It causes many interviewers to "jump the gun" by starting the interview (pressing F9) directly they get in touch with the respondent; thereupon if the latter cannot participate now, this interview lands up among the ones broken off.

Several interviewers thought that the introductory passage to be read to the respondent before the start of the interview was too long. This becomes more pronounced here than in the case of PAPI, since there is only one picture at a time on the screen. As a rule the information part has been taken care of before the interview starts. After "start the interview" it should be sufficient just to say what period the questions refer to.

Some of the interviewers did the identity check before they started the interview, some of them did it when the first question came up on the screen, and some of them did not do it at all. But this is nothing specially to do with CADAC, and things are no doubt much the same in the case of PAPI. (In the case of CADAC, though, there is an extra reminder.) Some of the interviewers checked the respondent's birth registration number only on the first occasion he or she was being interviewed, evidently taking for granted in the case of subsequent interviews that it was the same person they were speaking to.

The questions (including jumps) went very smoothly. Here, as in the case of PAPI, the interviewers do not always read out the questions exactly as they are. In certain cases the respondent had already provided the requisite information, and this situation was handled in rather different ways: most of the interviewers asked the question anyway - in conjunction with some such comment as, "You said you work part-time, I think. Did I get that right?" - but some of them just marked off the question without asking it, and went on to the next one.

One problem was when the respondent could not give an answer to such a question as how many hours he or she had worked during the week the interviewer was asking about. Here the interviewer had to insist on an answer in order to be able to proceed, because there must be no non-response in the case of such a question.

In the great majority of cases the interviewers had no difficulty whatever in jumping back to earlier questions.

The way certain questions are to be handled made rather a clumsy impression. When, for instance, the respondent has answered the question about number of children, the interviewer has to confirm it ("You've got two children, then?").

Furthermore the question about education did not function satisfactorily - but this was more a matter of the layout.

6.5 Concluding comments

It is of course desirable that in the future training of CADAC interviewers there be improvements in line with the relevant information gained by way of the observations. Considerably more attention should be devoted to the handling of the sampling-form, to sorting/grouping. The goal should be that all the interviewers understand how the various fields on the sampling-form interact, what remains until next time and what disappears, and what is an (as we see it) easy method to use for sorting/grouping.

Since it would be wrong to speak of any "one right way" with regard to the handling of the sampling-form, it would appear sensible that in the basic training the interviewer should be provided with a good basis for deciding what way to to use. Of course the interview itself has to remain the centre of attention, but the fact remains that there appears to be more uncertainty to do with the sampling-form.

7 HOW IT WAS EXPERIENCED BY THE INTERVIEWERS

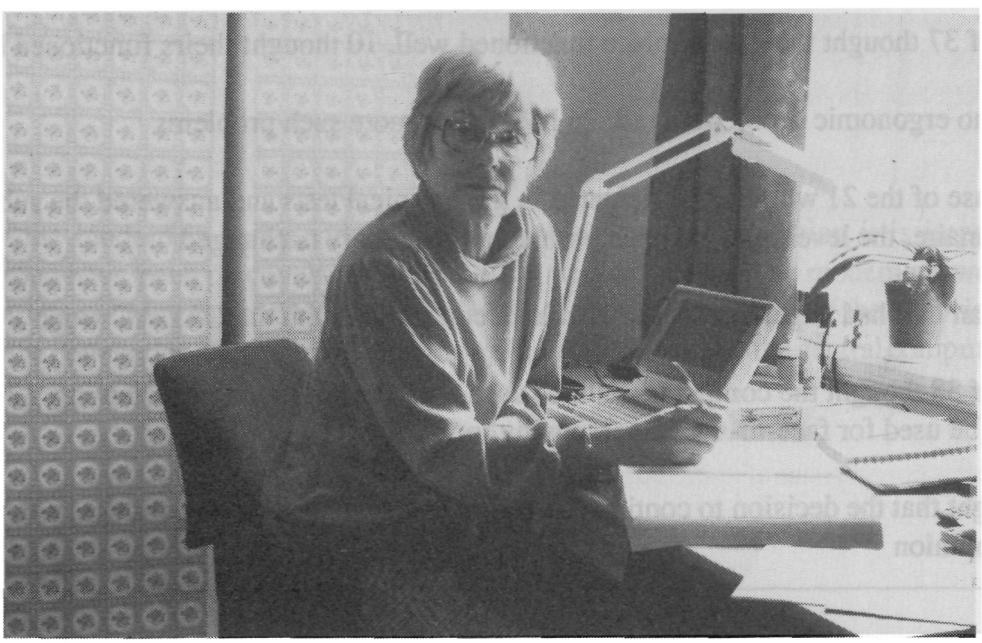
By means of two questionnaires it has been possible to find out how the production test was experienced by the interviewers. The first of these questionnaires was of rather a simple type and was intended chiefly to locate any teething troubles. It was sent out at the beginning of September, and the questions referred to August (the first month of CADAC). The second questionnaire contained much the same questions as had been asked in connection with the technical tests of June 1988, referring to ergonomics, training, comparison of CADAC with PAPI, and attitude to CADAC.

7.1 The August questionnaire

Of the 30 field interviewers who took part in the production test in August, 29 answered the questionnaire. To the question how much they had practised on their own before the test, three answered not at all, two answered 2 hours or less, twelve answered 2-10 hours, and eleven answered more than 10 hours. It is surprising that so many had practised so little in spite of our urging. To some extent it was perhaps due to the fact that the start was immediately after the industrial holiday period.

What had taken up most of the practice time was in the first place typing, in the second place the handling of the sampling-form, and finally the interview. Five interviewers had made use of the PC training program that had been made available. The interviewers were urged to practise together if they had the opportunity, and in fact a total of 10 had done so (including a group of six who did more than three hours together). Half of the interviewers thought they needed more practice before the September labour force survey, first and foremost in typing.

69% said that they had used pen and paper as a complement to the computer during the interview; this was most often in connection with tracing, when they were getting in touch with the local social insurance office or Swedish Telecom. 55% said that they had found certain elements of the CADAC



work difficult or fussy - for instance the work-notes on the sampling-form page where there was barely room, and the jump instruction in the interview. 50% said that they had had ergonomic problems; chiefly, this was to do with the desk or table (not enough room on it, wrong height), the connection of the modem for the night's communication (awkward), and the effect of computer work on the eyes (strain, etc.). Several said it was an advantage not to have to handle so many pieces of paper.

7.2 The questionnaire after the test

Directly after the last month of the test (which was January 1990), 37 field interviewers and five from the central telephone group received a questionnaire comprising 24 main questions and 15 sub-questions.

All 42 answered the questionnaire. Separate treatment was given in the subsequent analysis to the answers of the five from the telephone group regarding work-place and communication, since these interviewers work at the Örebro centre.

Some of the most important findings of the second questionnaire are summarized in the following box, and then there are sub-sections going into the findings at greater length.

---

* Most of the interviewers (81%) regarded CADAC as constituting a chiefly positive contribution to their work

* More than half (57%) thought that CADAC made the work more efficient

* A majority thought that CADAC made the interview better

* 43% thought that CADAC made the handling of the sampling-form better

* A quarter made regular use of pen and paper as a complement to CADAC

* Most thought there was just about the right amount of training

* 11 out of 37 thought their work-place functioned well, 10 thought theirs functioned badly

* 16 had no ergonomic problems at all, 26 had one or more such problems

* In the case of the 21 who had participated in the technical tests and answered the subsequent questionnaire, the level of ergonomic problems was largely unchanged

* More than half had experienced eye trouble in connection with the CADAC work

* 20 out of 38 thought the computer could be used only for telephone interviewing, 12 thought it could be used for face-to- face interviewing too

* 36 thought that the decision to continue with CADAC was correct, one thought not, and five had no opinion

---

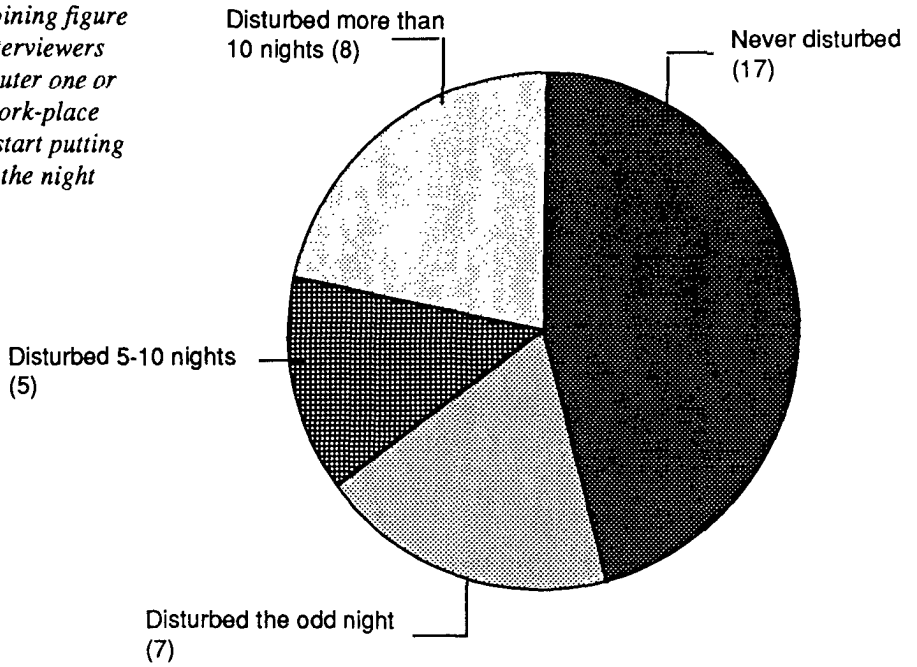
7.2.1 The work-place

The first questioned concerned each interviewer's work-place during the CADAC production test. 11 of the 37 field interviewers thought that their work-place had functioned well, 16 that it had functioned satisfactorily, and 10 that it had functioned badly. Of the latter 10, 8 thought the chief trouble was lack of space on the desk or table when the computer was there, whilst 4 thought the height was wrong.

Before the night's communication 7 interviewers moved the computer to another room, whilst 2 moved it in the same room. The commonest reason for this was that the work-place was in the bedroom and the noise of the computer was a disturbance to sleep.

Figure 7.1
Disturbance caused by the computer

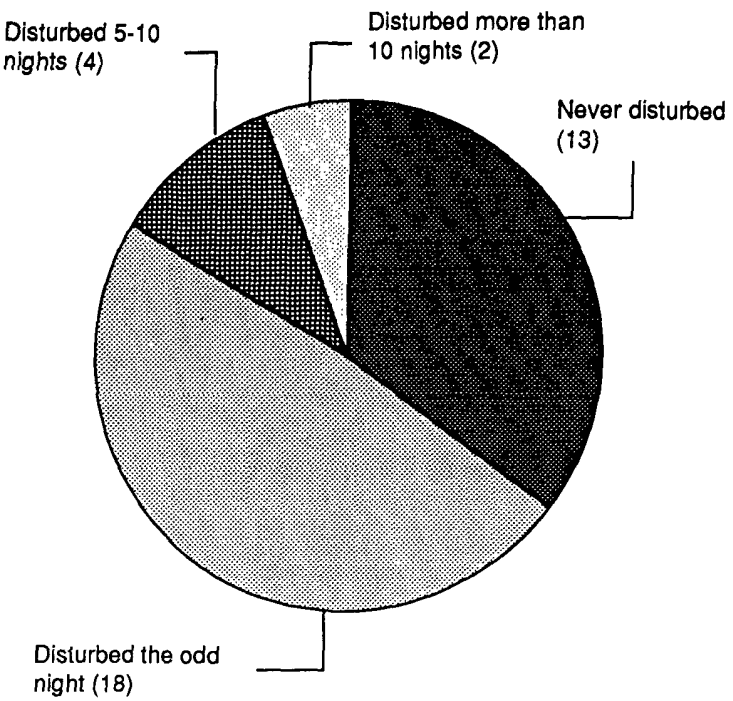
It can be seen from the adjoining figure that a fair number of the interviewers were disturbed by the computer one or more nights. Some whose work-place was in the bedroom had to start putting the computer elsewhere for the night because of this



When the modem is being connected for the night's communication it is important that the telephone have been disconnected, otherwise it will ring before the modem answers (though an answering machine can remain connected without having this effect). If the interviewer forgets to make the connection, he or she will be rung up (and woken up!) by the central computer in the night.

Figure 7.2
Disturbance caused by the telephone

The figure shows how often the interviewers were disturbed by the telephone during the night



7.2.2 Ergonomics

The questions to do with egonomics were the same as in connection with the technical tests of June 1988 (thus in line with the questionnaire of the Public Health Office). 16 of the 42 interviewers said that they had experienced no problem, 7 that they had experienced one problem, 8 that they had experienced two problems, and 11 that they had experienced three or more problems. Commonest was trouble with the shoulders (19 persons had this) and the back of the neck (18), next in order came back trouble (upper part 11, lower part 8), and finally trouble with wrists (5) and legs (3). (Elbow trouble was asked about too, but none was reported.)

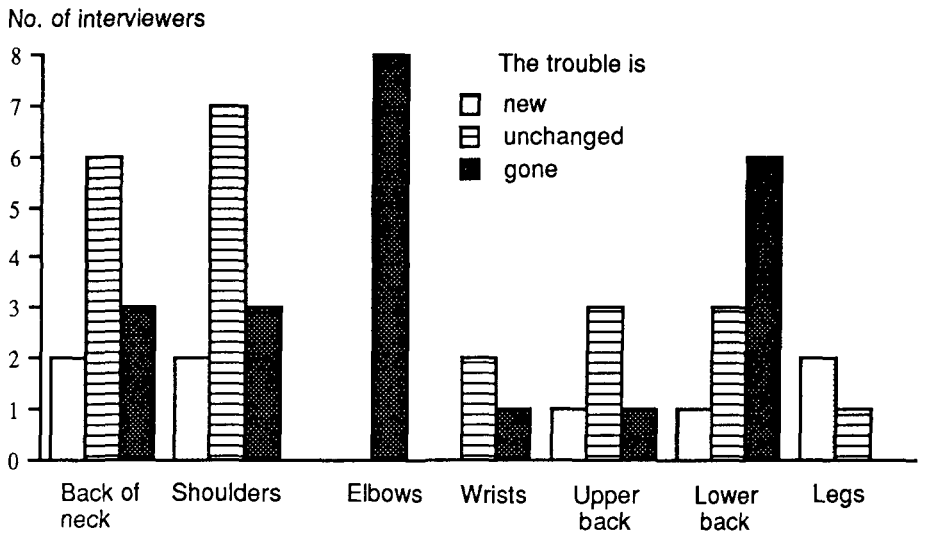
Those who had had trouble were then asked whether they thought it had had anything to do with CADAC. There were five answers to choose from: Yes, definitely; Yes, perhaps; No, probably not; No, definitely not; Have no opinion.

Of the 19 that had shoulder trouble, 15 thought it was connected with working with the computer and 4 thought this unlikely. Of the 18 that had trouble with the back of the neck, no fewer than 17 thought it was connected; this was the clearest instance of the connection. Of the 14 that had had trouble with the upper and/or lower back, 10 thought it was connected and 4 thought this unlikely. Of the 5 that had had wrist trouble, 3 thought it was connected, whilst all 3 that had had leg trouble thought it was connected.

21 of the interviewers had answered the same questions prior to the technical tests in the summer of 1988, and a comparison of their answers on the two occasions indicates little change.

Six had had no ergonomic trouble before CADAC, of whom five had none after either. Two had got rid of trouble they had had before. One had acquired leg trouble. Two had the same trouble before and after, whilst five had different. Five had had more trouble before, whilst two had more trouble after.

Figure 7.3
Incidence and location of trouble before and after the CADAC technical tests and production test



The figure presents a comparison of the frequency of various types of ergonomic problem before and after the CADAC technical tests and production test. With regard to trouble in the back of the neck, the shoulders, the wrists and the upper back, the number is roughly the same of the cases where it has stayed the same and of the cases where it has either arisen or disappeared in the year and a half between the questionnaires. Noteworthy is the fact that elbow trouble has completely disappeared. Trouble with the lower back has diminished, and leg trouble has increased.

7.2.3 Eye trouble

More than half (54%) of the CADAC interviewers said that they had had eye trouble in connection with working with the computer. Fifteen said that it occurred at the end of a work period, seven that it occurred now and then during the work, and one that it it was there throughout. Three said that it was insignificant, the great majority (19) that it was moderate, and one that it was pronounced. 70% of those that had experienced eye trouble wore terminal glasses, as against 58% of those that had experienced none; this can probably be put down to the fact that those who wore terminal glasses had poorer sight in general.

Figure 7.4
Incidence of eye trouble, distributed among ten types

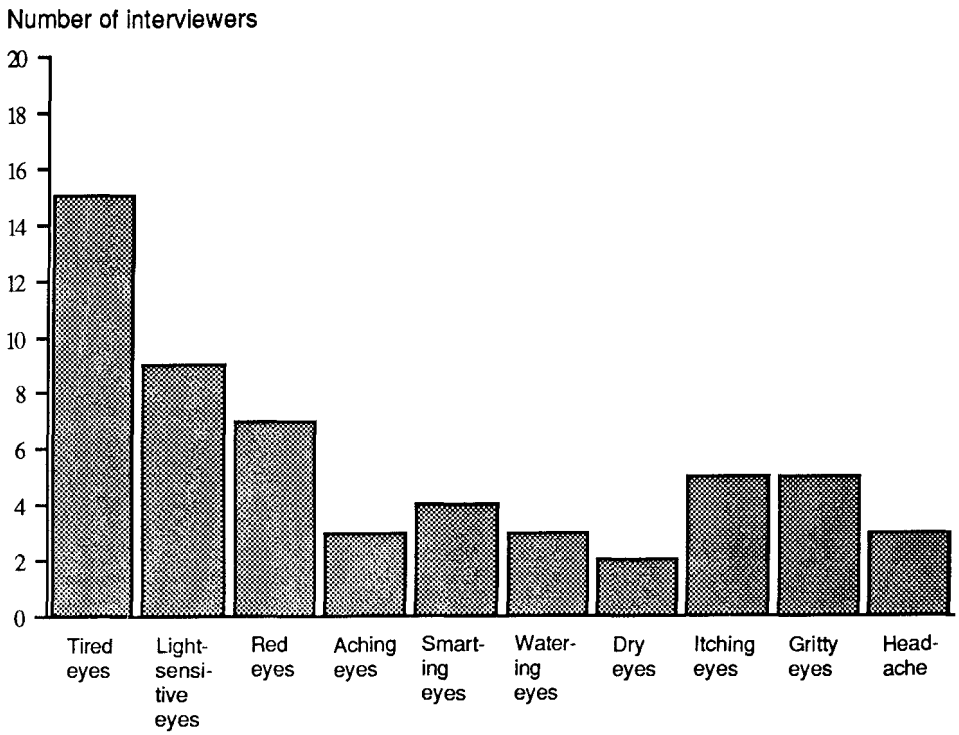


Figure 7.4 presents the incidence of eye trouble. More than one type could be marked off in the answer; 6 interviewers indicated one type, 8 indicated two types, and 9 indicated three or more types (one of whom indeed indicated no fewer than eight types).

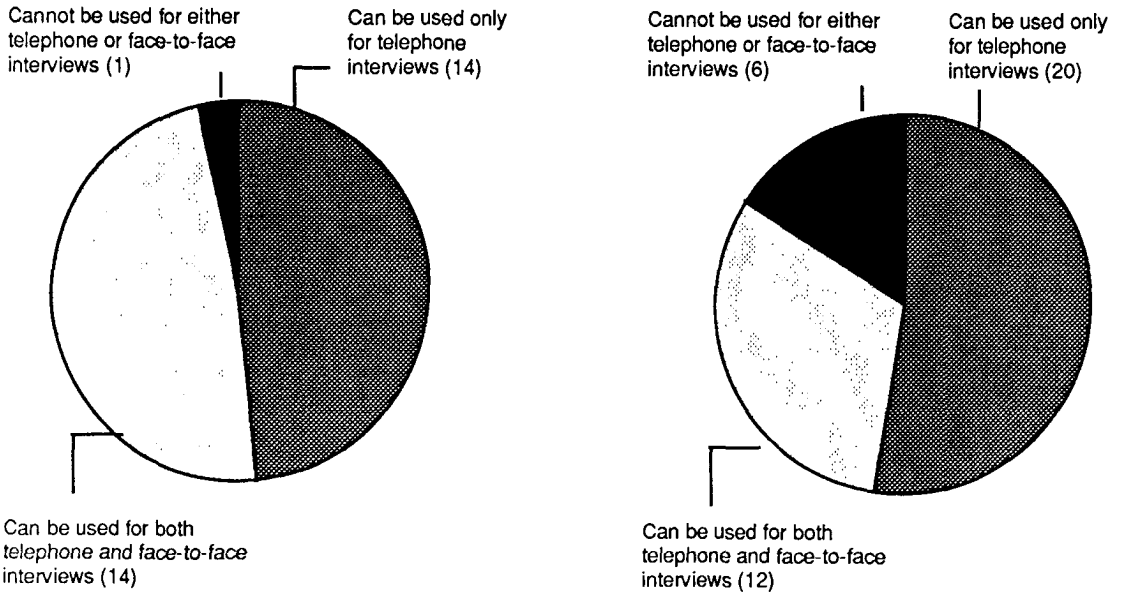
7.2.4 The computer

With regard to the question of the suitability of the Toshiba 1200 for telephone and for face-to-face interviewing (the latter involving a visit to the respondent - carrying the computer), 12 thought that it could be used for both, 20 thought that it could be used only for telephone interviewing, and 6 thought that it could be used for neither. (The telephone group were using stationary PCs and are therefore not included.)

The same question had been asked after the 1988 technical tests, and on that occasion the answers were more favourable towards the Toshiba 1200: only 1 interviewer out of 29 thought that it could not be used at all, whilst the other 28 were evenly divided regarding whether it could be used only for telephone interviewing or for both types.

Figure 7.5 offers an implicit comparison of the 1988 and 1990 results.

Figure 7.5
Range of use of the computer



With regard to the question of being able to read the text on the screen, 34 had no difficulty and 8 thought a certain effort was required. The 1988 answers had been more negative - but at that time the screen had no background illumination.

7.2.5 Working with CADAC

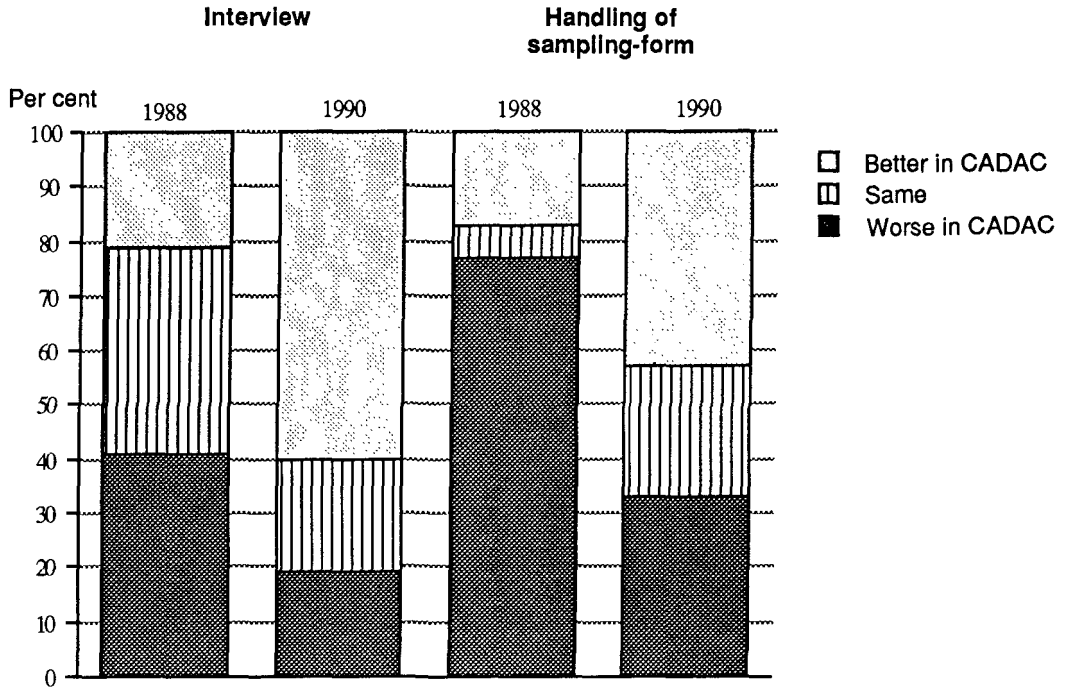
With regard to whether working with CADAC was interesting, 29 marked off "Yes, very", 10 "Yes, fairly" and 3 "No, hardly". With regard to whether the work was difficult, 6 out of the 40 who answered thought it was, the rest thought not. With regard to whether it was mentally strenuous, 9 out of 40 said yes - and the same number thought it physically strenuous.

Most of the interviewers (81%) thought CADAC had a chiefly positive effect on their work, five either had no opinion or thought there were both good and bad sides to it, and three thought it had a chiefly negative effect (it disturbed sleep; it made it impossible to do an interview sitting in the sun). In 1988 only half the interviewers had thought CADAC had a chiefly positive effect.

78% of the interviewers regarded CADAC as being chiefly positive for Statistics Sweden (as against 46% in 1988); the rest had no opinion.

57% thought CADAC made their work more efficient, 40% thought not (as against 66% who thought not in 1988). Most commonly cited as having led to increased efficiency was that paper-work and posting had gone; other things were that you had the aid of grouping when sorting out the sample, that you could jump to the right question, that you could send things in more quickly, etc.

Figure 7.6
The interview and the handling of the sampling-form in CADAC: interviewer attitudes 1988 and 1990



As can be seen from Figure 7.6, there has been a shift in the attitude to the handling of the sampling-form. In 1988 4 out of 5 thought this handling worse in CADAC, and the reasons given included the following: not enough room to note down contacts, better overall view with paper, no access to information as to where the respondent works (contained in the interview).

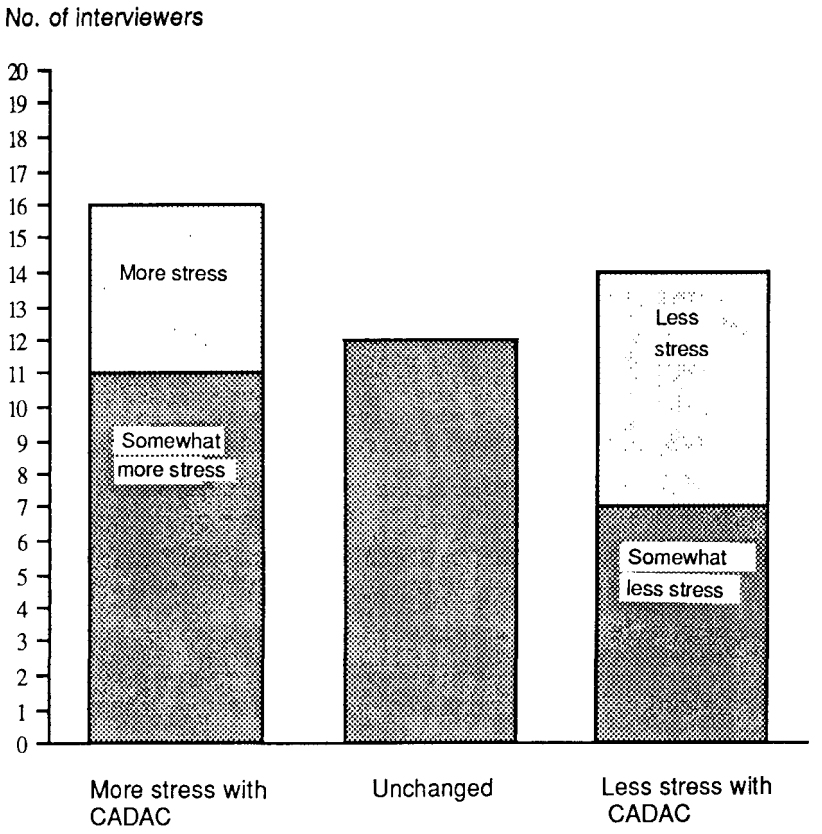
An interesting difference emerges when we look at the attitude figures from the point of view of the training. Half of the first group to be trained thought that the handling of the sampling-form was worse in CADAC, and half thought it was the same; but of the group of seven interviewers who were trained last, five thought this handling was better in CADAC, one thought it was the same and one thought it was worse. This indicates that the interviewers on the first course got substantially less adequate training (confirmation of which is to be found in the following section, 7.2.6).

It can be seen from Figure 7.6 that by 1990 there was a generally more favourable attitude towards the interview in CADAC, too: 60% now thought it better (because the jump instructions were always correct), 21% thought it the same, and 19% thought it worse (because there was too long between some of the questions).

29% thought that CADAC influenced their way of asking the questions. It was frequently commented that there was a softer pace (and this was indeed noted in the field observations too); the questions were asked in advance (from memory), and there was time to chat more while the information was being written in.

A quarter of the interviewers regularly used pen and paper as a complement to the computer, seven out of ten did so now and then, and 7% never. A third used a paper form on some occasion; most often it was in connection with the face-to face interview (as had indeed been recommended). One interviewer used a paper form when she was rung up by the respondent.

Figure 7.7
The stress experienced by the interviewers during a CADAC interview as compared with during a PAPI one



As Figure 7.7 shows, a rather greater number thought that a CADAC interview involved more stress than a PAPI one; in 1988 it had been fifty-fifty. Offered as one of the causes of there being more stress in the case of CADAC was the waiting-time between questions.

No less than 88% of the interviewers thought that the decision to carry on with CADAC during the spring too was correct. One was against it; in the first group to be trained, one was against it and two had no opinion.

7.2.6 The training

There was a question concerning each in turn of the six parts of the CADAC training, and a majority of the interviewers thought that all six parts had been just right. A third thought that too little time had been spent on typing, ergonomics and the handling of the sampling-form; with regard to the latter, half of the third were from the first group to be trained. One interviewer in six thought that there had not been enough training concerning the computer, the interview program and the communication. Here, too, the first group were over-represented. One interviewer thought the training in typing was too long, and three thought there was too much ergonomics.

Nine out of ten thought there was just the right amount of central support, one out of ten thought there was too little. One interviewer made the comment that it seemed automatically to be regarded as the interviewer's fault if the night's communication went wrong in any way.

8 THE ESTIMATES

8.1 Purpose

Estimates of the most important variables were produced during the course of the test, based on PAPI interviews and (separately) on CADAC ones. The major purpose was to investigate whether *the design of the test* would affect the regular LFS time series. One condition for continuing the test on the intended scale was that the disturbance in the main variables employed and unemployed should not exceed 40% of what was standard deviation for a monthly estimate. The continuous comparisons indicated that the samples in the test could be kept the same size as planned.

Comparing PAPI and CADAC estimates was an important part of the general comparison of the two methods from the point of view of quality. The reinterviews and field observations also provided valuable information in this respect.

The introduction of CADAC can cause interruption of the LFS time series, and such interruption is always negative from the users' point of view. What we can do to counterbalance this is to estimate the specific difference in levels that is to be attributed to the change of method. For practical reasons, though, any change-over to CADAC has to be gradual - it cannot be effected from one month to the next. Since month-to-month changes in LFS estimates are of the utmost importance to the users, the new method has to be introduced in such a way as to cause the least disturbance in this respect; there is need to consider, for instance, over how long a period the introduction should extend, and whether during this period a special method of estimation should be used.

8.2 Results

The tables below implicitly present a comparison between the estimates based on the PAPI interviews and those based on the CADAC interviews, August 1989 - February 1990. It is important to know the size of the differences when it comes to assessing how the estimates of change are affected by a given rate of introduction. A feasible criterion is that such estimates regarding the main variables shall not be affected more than corresponds to 20% of the standard deviation. With a rate of introduction comprising a 20% quarterly increase in the proportion of CADAC (whereby complete introduction would take a year) the differences in the methods shall not then exceed the standard deviation in the estimate of change between adjoining quarters.

The uncertainty in estimates of change from one quarterly average to the next is 40-60% as great as the uncertainty in an individual monthly estimate. Despite being based on a six-month test period, our estimates of the differences between PAPI and CADAC have an uncertainty approximately 130% as great as that of a monthly estimate. Nevertheless all significant differences need to be taken into account - not only as a guide if CADAC should be introduced, but also, in conjunction with the quality evaluation, as an expression of a bias difference between the methods.

Table 8.1
Percentage with regard to main LFS variables

	PAPI	CADAC	diff	s diff
In labour force	84.5	84.6	-0.1	0.4
Employed	83.3	83.4	-0.1	0.4
Working	71.0	70.9	0.1	0.4
Absent	12.3	12.5	-0.2	0.3
Unemployed	1.2	1.2	-	0.1

No significant differences.

Table 8.2
Percentage with regard to labour-force status

Status	PAPI	CADAC	diff	s diff
1 outside l f (also 5)	13.1	12.9	0.2	0.3
2 working	71.0	70.9	0.1	0.4
3 absent	12.3	12.5	-0.2	0.3
4 unemployed	1.2	1.2	-	0.1
5 outside l f (also 1)	2.3	2.5	-0.2	0.1

No significant differences.

Table 8.3
Percentage with regard to degree of attachment (3-part)

Degree of attachment	PAPI	CADAC	diff	s diff
Firm 0.4	75.8	76.8	-1.0	0.4
Loose	15.8	13.9	1.9	0.3
None	8.4	9.3	-1.1	0.3

The probable reason for the significant differences here is that the answer alternatives did not have the same layout in the two systems. After the test the layout in the CADAC system was changed. (See further 10.1.)

Table 8.4
Percentage with regard to working-hours classification

Hours	PAPI	CADAC	diff	s diff
Measurement week				
PE + TE				
1 - 19	7.3	7.7	-0.4	0.2
20 - 34	22.1	21.6	0.5	0.5
35 - 39	8.8	9.1	-0.3	0.3
40	38.5	36.6	1.9	0.6
41 - 98	23.4	24.9	-1.5	0.4
OB + MF				
1 - 19	6.2	6.4	-0.2	0.8
20 - 34	12.4	11.8	0.6	1.2
35 - 39	4.7	4.4	0.3	0.8
40	17.9	14.6	3.3	1.3
41 - 98	58.8	62.9	-4.1	2.0
Typical week				
PE + TE				
1 - 19	3.7	3.9	-0.2	0.2
20 - 34	20.8	20.5	0.3	0.5
35 - 39	12.0	12.4	-0.4	0.3
40	52.5	50.8	1.7	0.6
41 - 98	11.1	12.3	-1.2	0.4
OB + MF				
1 - 19	4.3	5.4	-1.1	0.8
20 - 34	10.3	10.2	0.1	1.2
35 - 39	3.9	3.1	0.8	0.8
40	21.9	16.4	5.5	1.3
41 - 98	59.6	65.0	5.4	2.0

PE = persons permanently employed
TE = persons temporarily employed
OB = owners of businesses
MF = members of the family giving unpaid assistance

It can be seen from Table 8.4 that there is a greater distribution of the working hours in the case of CADAC. It can be seen, too, that quite a number of the differences are significant.

There was also a comparison of PAPI and CADAC estimates with regard to the proportion of the employed in each branch of industry and type of occupation.

Table 8.5
Percentage of the employed in each branch of industry

Branch of industry	PAPI	CADAC	diff	s diff
Agriculture, forestry, etc.	3.7	3.4	3.4	0.1
Mining, manufacturing, etc.	22.9	22.6	0.3	0.5
Building	6.7	6.6	0.1	0.3
Commerce, catering, hotel	14.5	14.4	0.1	0.4
Transport, post, tele	7.1	6.7	0.4	0.3
Banking, insurance, etc.	8.3	9.1	-0.8	0.3
Public administration, etc.	37.1	36.8	-0.3	0.5
No information	0.1	0.2	-0.1	0.1

Table 8.6
Percentage of the employed in each type of occupation

Occupation	PAPI	CADAC	diff	s diff
Technical, etc.	16.2	16.4	-0.2	0.4
Health, etc.	15.7	16.1	-0.4	0.4
Administrative, etc.	16.3	15.7	0.6	0.4
Commercial	9.4	9.3	0.1	0.4
Agricultural, forestry, etc.	3.5	3.4	0.1	0.2
Transport, etc.	5.7	5.5	0.2	0.3
Mining, stone-work, etc.	23.7	23.5	0.2	0.5
Service, etc.	9.4	9.8	0.4	0.4
No information	0.2	0.4	-0.2	0.2

To sum up, the differences between PAPI and CADAC estimates with regard to the main variables can justly be described as small. It is our view, in the light of this, that CADAC can be introduced at the planned rate of 20% per quarter without need of any special method for arriving at the estimates during the period of introduction.

When CADAC has been completely introduced into the monthly labour force surveys we shall be able to give a considerably more precise account than now of what significance the change of method has with regard to the estimates, since we shall by then have two years to go on.

9 THE REINTERVIEW STUDY

9.1 Design of the study

In Chapter 3 it was explained why it was essential that the production test should include a reinterview study. The main point was that if the PAPI and CADAC estimates differed, then information was required on the basis of which it would be possible to say which of the methods was the more reliable. Reinterviewing both PAPI and CADAC respondents would provide such information.

The usual type of reinterview, as like the original interview as possible (including from the point of view of quality), was not appropriate for the purpose in mind. What was wanted was that the reinterviews should give the true values, the latter thereafter functioning as a key against which to check the accuracy of the estimates. We approximated this by use of an interview method based on *delayed reconciliation.* Briefly, it was as follows:

> A further, meticulous, LFS interview - regarding the same measurement week - was conducted, this time by the PAPI method and with a new-classification form in respect of every respondent. The specially trained interviewer had no knowledge of the results of the ordinary interview, but afterwards he or she looked at the most important of these results - those concerning degree of attachment and labour force status - and on this basis asked the respondent a number of additional questions to penetrate deeper and achieve maximum sureness. If there remained a difference between the information brought forth by the ordinary interview and the reinterview, a host of further additional questions were asked in order to achieve a thorough description of the respondent's work situation. On the basis of this description there would then be an expert assessment as to which interview was the accurate one.

Through this delayed reconciliation the maximum relevant information was obtained concerning persons in the case of whom there was a discrepancy between the ordinary interview and the reinterview, at the same time as there was no colouring of the reinterview by any knowledge of the ordinary interview. The procedure had emerged from the experience of a 1978 LFS reinterview study.

There are two problems associated with the fact that the reinterviews come later than the ordinary ones:

(1) The greater distance the measurement week means that there is danger of error deriving from the time factor, and this puts an especial weight of demand on the reinterview.

(2) Since the CADAC procedure is faster than the PAPI, CADAC respondents are more quickly available for reinterview, and this may introduce an artificial difference between the methods.

It is important, though, to avoid putting too much emphasis on the time factor - there is no indication in the literature that the answers are in any evident way affected by such moderate gaps in time as are in question here. Later in this chapter there is an account of the method that was chosen to reduce the interval between the CADAC and PAPI reinterviews, together with a figure illustrating the temporal displacement regarding interview and reinterview in the case of each method.

9.2 Sample

The above-mentioned procedure with both a meticulous reinterview and reconciliation meant an increased burden for the respondent, and thereby an increased risk of the respondent's refusing to go on participating in the labour force surveys. To counteract this effect the reinterviews were conducted chiefly with respondents whose panel was just finishing. It was judged that it would be possible to conduct and administer about 600 reinterviews a month, which is to say that there would be *a sample of about 3,600 for the complete period of the test (August-January).* Half of the reinterviews were CADAC ones, half PAPI.

Furthermore the reinterviews were to be allocated in such a way as to ensure *maximum precision in estimating the measurement-error bias regarding the estimates of employment, unemployment and degree of attachment to the labour market.* The one restriction in respect of this allocation - a restriction deriving from the aforesaid risk that interviewers would refuse to continue participating in the surveys - was that only the panel just finishing could be over-represented.

The allocation was determined on the basis of (a) the results of the 1978 LFS reinterview study and (b) estimates of the relevant variables from the ordinary labour force surveys. The sample was stratified in respect of status on the basis of the ordinary interviews, then drawn sequentially with the aid of the random part of the sampling-form number. Through this procedure it was possible to reduce the interval between interview and reintertview, since it meant that there was no need to wait until all the ordinary interviews had been completed before starting the reinterviews.

Table 9.2 (towards the end of 9.4.1) presents a break-down of the CADAC and PAPI halves of the allocated reinterview sample.

The allocation made it possible to estimate the systematic measurement error with the following standard deviations (whereby the non-response in the reinterview study is taken into account).

Table 9.1
Precision in estimation of systematic measurement error

Estimate of	Standard deviation (thousands)	
	CADAC	PAPI
Firm attachment	23	21
Loose attachment	25	22
No attachment	23	20
Employed (statuses 2 & 3)	23	19
Unemployed (status 4)	8	8
Outside the labour force (statuses 1 & 5)	22	21
Status 1	17	17
Status 2	18	20
Status 3	24	24
Status 4	8	8
Status 5	19	16

9.3 Execution

9.3.1 Time

It had been planned that the reinterview study should be carried out throughout the period August-January, but this proved impossible owing to a shortage of interviewers. During November the study was broken off, and in December there were no reinterviews at all. In order, therefore, to reach the planned figure of about 3,600, some 900 (instead of 600) were conducted in January and a further 900 or so in February.

The reinterviews were to be conducted as near the measurement week as possible, to minimise the risk of lapse of memory. The field work started about ten days after the measurement week. Since the sample was stratified in respect of labour-force status on the basis of the ordinary interviews, it could not be drawn until these had been corrected. The CADAC and PAPI halves of the sample were to be reinterviewed after the same interval, which meant that the CADAC reinterviews (made possible more quickly by the greater speed with which the original interviews were corrected) had to wait until the PAPI system caught up.

9.3.2 Interviews

The reinterviews were conducted (all from the centre) by 15 persons (8 field interviewers and 7 from the telephone group) who underwent special training with the emphasis on knowledge of the LFS definitions that are decisive with regard to degree of attachment and status.

As far as humanly possible the reinterview was to be with the respondent direct.

All the reinterviews were done by the PAPI method, with a form for new classification.

The reinterviews were done in three stages:

1. Following the form as exactly as possible (and paying special attention to the indications of time on it), the interviewer did a meticulous LFS interview, noting degree of attachment, status (hours worked and weeks of looking for work) and the name of the employer.

2. After the interview the interviewer opened up the lowest part of the sampling-form to see how the corresponding questions had been answered in the ordinary interview, and compared the two. Then, if degree of attachment, status and employer were the same in both cases, the green reconciliation form was chosen, whilst if there was any difference, the red reconciliation form was chosen.

3. The questions on both the green and the red form were divided into three categories: those concerning degree of attachment, those concerning the measurement week (together with ones concerning the week before and the week after), and those concerning education.

   The questions on the green form were also on the red. The latter form gave in addition a number of points to be checked, this to aid the interviewer in establishing the true value and finding an explanation as to why the two interviews produced different results.

9.3.3 Judging true/incorrect. Coding of type of error

The reinterview method was chosen with a view to *obtaining a basis for establishing - as far as humanly possible - the true value for degree of attachment and status.* (The information as to the employer was included in order to be certain that the two interviews did indeed refer to the same job.)

An LFS expert went through the interviews, judging - with the aid of the information on the reconciliation form - which was the true one if the results differed. On the odd occasion the respondent was got in touch with again.

If it was the reinterview that was the incorrect one, it was corrected. When, therefore, in the account of the results (in 9.4) there is set out the degree of attachment or status "according to the reinterview study", what is meant is the "true" value. But both the original answers and comments on the errors have been noted down on the reconciliation form.

In conjunction with the judgment the material was coded according to type of error, and the reason why the ordinary interview turned out wrong was noted down.

9.3.4 Coding, data registration, correction

After the LFS forms for the reinterviewing had undergone the expert scrutiny and been (if necessary) corrected, they were coded, entered on the computer file and corrected in the ordinary way. The reconciliation forms were put on file too.

Thereafter a total file for the reinterview study was made, and it was checked against the sample file and corrected. It contains the ordinary LFS interview, the true reinterview and the answers to the reconciliation questions, together with coding of type of error and comments.

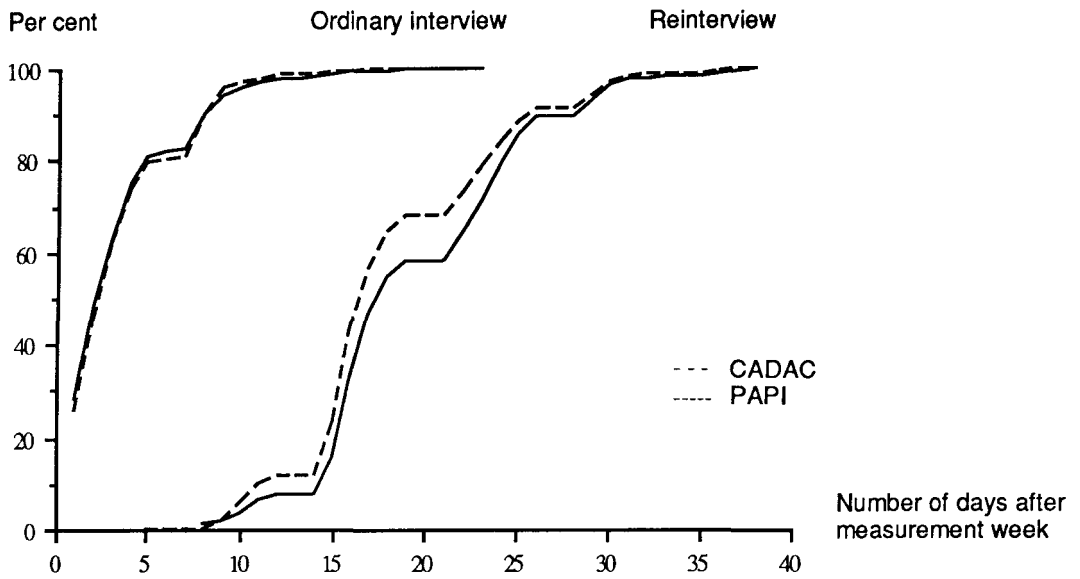
9.4 RESULTS

9.4.1 Field work

As mentioned before, it was impossible to carry out the reinterview study in the way originally planned. No more than 68% of the November quota of reinterviews were conducted, therefore this month has been excluded from the account of the results.

It was part of the design of the reinterview study that the sample should not be drawn until the PAPI interviews had had time to catch up with the CADAC ones, to eliminate differences between the two methods that might be due to the fact that (as would otherwise have been the case) there was a shorter interval between the CADAC interview and reinterview than between the PAPI.

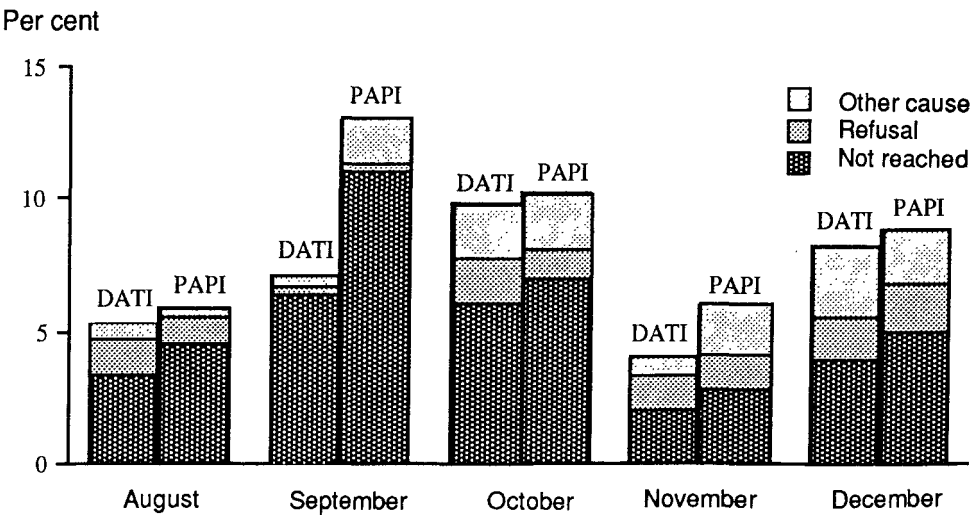
Figure 9.1
Length of time from measurement week to ordinary interview and to reinterview, CADAC and PAPI



It can be clearly seen from the figure that there is little difference between the methods when it comes to the length of time between the ordinary interview and the reinterview.

The non-response - the proportion not reached - varied considerably from one month to another, owing chiefly to the fact that there were not always enough interviewers. For January (after the breaking off of the November reinterviews and the cancellation of the December ones) the booking of interviewers was better, as can be gathered from the results. Overall, there were comparatively few refusers, and this indicates that it is indeed possible to motivate people to participate in this type of quality inquiry. (Most of the respondents were now - in the reinterview study - participating in the labour force surveys for the ninth time.) The rest of the non-response was chiefly a question of units coded thus (because of wrong sampling-unit numbers, missing forms, etc.) in connection with the correcting and with the checking of one sample against the other.

Figure 9.2
Non-response distributed in accordance with cause, CADAC and PAPI



In all, 92.4% of the sample were interviewed, 93.2% in the case of CADAC and 91.5% in the case of PAPI.

For all months there is a somewhat higher percentage of PAPI non-response than of CADAC. This can be traced to the difference in the numbers not reached, which in turn can probably be traced to the fact that there was a somewhat shorter time for field-work in the case of PAPI (since the PAPI sample was drawn somewhat later).

Table 9.2
Sample sizes and field-work results of the reinterview study, distributed in accordance with labour-force status and method at the ordinary interview

	CADAC				PAPI			
	Interview	Non-response Number	%	Total	Interview	Non-response Number	%	Total
Firm attachment - employed	**1 295**	**82**	**6.0**	**1 377**	**1 261**	**97**	**7.1**	**1 358**
Loose attachment	**251**	**25**	**9.1**	**276**	**291**	**39**	**11.8**	**330**
- employed	110	11	9.1	121	115	18	13.5	133
- unemployed	42	4	8.7	46	57	7	10.9	64
- not in the labour force	99	10	9.2	109	119	14	10.5	133
No attachment	**132**	**15**	**10.2**	**147**	**95**	**17**	**15.2**	**112**
- unemployed	14	3	17.6	17	5	1	16.7	6
- not in the labour force	118	12	9.2	130	90	16	15.1	106
Total	1 678	122	6.8	1 800	1 647	153	8.5	1 800

It can be seen from the table that in the case both of CADAC and of PAPI the proportion of non-response varies from one stratum of the sample to another. In the tables where the CADAC and PAPI results are compared, the non-response has been compensated for in the following way. The reinterview respondents were divided up in accordance with status and method, then in the case of each group there was an adjustment upwards to the estimates of number based on all interviews during the period August 1989 - February 1990.

9.4.2 True/incorrect interviews

The reinterview study involves 3,325 interviews, 1,678 from the CADAC sample and 1,647 from the PAPI sample.

If - as mentioned above - the reinterview did not give the same degree of attachment and/or labour-force status as the ordinary interview, the two interviews were regarded as being different. 189 (11%) of the CADAC interviews/reinterviews were different, and 204 (12%) of the PAPI ones.

In the case of these 393 interviews/reinterviews, 71 (18%) of the reinterviews were judged to be incorrect (32 CADAC and 39 PAPI), i.e. 71 of the ordinary interviews were judged to be true. Thus it can be said that the reconciliation questions and the judging by experts made a substantial contribution to the attainment of a true value. Some of the interviews were wrong with regard both to degree of attachment and to labour-force status (whereby the error concerning the latter cannot

be explained by the error concerning the former). In a few cases neither the ordinary interview nor the reinterview was true.

To be sure that the two interviews referred to the same job, the red form was to be used even in cases where only the name of the employer was different. These cases are included in the above account. It could be a question of a data registration error, of a company that had recently changed name or that went under more than one name, of a parent company and subsidiary, etc. This was commoner in the case of PAPI than in the case of CADAC, inasmuch as the ordinary PAPI interview was more often done with the aid of a control form (all the CADAC interviews during the first three months being done as new-classification ones). Interviews where the only differences are with regard to the name of the employer are regarded as true in the tables below.

After it had been judged which interview was true, and after errors of name had been rectified, the following result was arrived at.

Table 9.3
Number of true and of incorrect interviews in CADAC and in PAPI

The sample

Ordinary interview	CADAC No.	%	PAPI No.	%	Total No.	%
True	1540	92	1525	93	3065	92
incorrect	138	8	122	7	260	8
Total	1678	100	1647	100	3325	100

Thus the ordinary interview is true - regarding degree of attachment and status - to about the same extent in the case of CADAC as in the case of PAPI (92 and 93%, respectively).

In the following sections we go into the differences that nevertheless do exist between the results deriving from the two methods, together with the question of what can have caused the errors and what can be done to reduce the number of incorrect interviews in the future.

9.4.3 Degree of attachment

The degree of attachment variable was introduced into the monthly labour force surveys in 1987. In interpreting the results of the reinterview study the emphasis is on the three main groups into which the variable is divided. These - given here with their sub-groups too - are the following:

Firm attachment
permanently employed (PE)
owners of businesses (OB)
members of the family who help (MF)

Loose attachment
temporarily employed (TE)
without work, byt have worked the last year (LY)

No attachment
without work the last year (WW)
others non-attached (ON)

The following tables - the first referring to CADAC, the second to PAPI - indicate the number in each sub-group according to the ordinary interview and according to the reinterview study (the latter being taken as giving the true value).

Table 9.4
Degree of attachment according to ordinary interview and reinterview study - CADAC

The sample

Degree of attachment act to ordinary interview	according to reinterview study								
	PE TE	OB	MF	LY	WW	ON	Total	%	true
PE	**1139**	27	3	1	1	-	-	1171	97
TE	14	**89**	-	-	6	1	-	110	81
OB	5	1	**108**	-	1	-	-	115	94
MF	-	-	1	**6**	-	2	-	9	67
LY	2	7	-	-	**128**	3	1	141	91
WW	3	4	-	-	13	**99**	6	125	79
ON	1	-	-	-	-	-	**6**	7	86
Total	1164	128	112	7	149	105	13	**1678**	94

Table 9.5
Degree of attachment according to ordinary interview and reinterview study - PAPI

The Sample

Degree of attachment act to ordinary interview	according to reinterview study								
	PE TE	OB	MF	LY	WW	ON	Total	%	true
PE	**1133**	13	2	-	3	-	-	1151	98
TE	11	**95**	-	-	8	1	-	115	83
OB	5	-	**102**	-	-	-	-	107	95
MF	2	-	-	**1**	-	-	-	3	33
LY	-	7	1	-	**152**	14	2	176	86
WW	-	3	-	-	5	**74**	4	86	86
ON	1	-	-	-	-	-	**8**	9	89
Total	1152	118	105	1	168	89	14	**1647**	95

The observations represented in these two tables are the ones on which was based the quality evaluation of CADAC as compared with PAPI (see Chapter 10). As can be seen, there were very few for the degrees MF and ON.

To be able to assess the effect of the wrong classifications on the total estimates it is necessary that the number of observations be adjusted upwards to population level, so as to take into account the fact that the sampling probabilities and non-response were not the same in all strata.

The percentages arrived at through this adjustment upwards are presented in the following two tables.

Table 9.6
Degree of attachment according to ordinary interview and reinterview study - CADAC
Adjusted upwards, per cent

Degree of attachment act to ordinary interview	according to reinterview study							
	PE	TE	OB	MF	LY	WW	ON	Total
PE	**67.3**	1.6	0.2	-	-	-	-	69.2
TE	0.9	**5.4**	-	-	0.3	-	-	6.6
OB	0.4	0.1	**6.6**	-	-	-	-	7.1
MF	-	-	0.1	**0.4**	-	0.2	-	0.6
LY	0.2	0.4	-	-	**6.1**	0.2	-	6.8
WW	0.2	0.2	-	-	0.6	**5.8**	0.3	7.3
ON	0.4	-	-	-	-	-	**2.1**	2.5
Total	69.3	7.7	6.8	0.4	7.1	6.2	2.5	**100.0**

Table 9.7

Degree of attachment act to ordinary interview	according to reinterview study							
	PE	TE	OB	MF	LY	WW	ON	Total
PE	**68.9**	0.8	0.1	-	0.2	-	-	70.0
TE	0.6	**5.6**	-	-	0.4	0.1	-	6.7
OB	0.3	-	**6.1**	-	-	-	-	6.4
MF	0.1	-	-	**0.1**	-	-	-	0.2
LY	-	0.3	-	-	**7.7**	0.8	0.2	8.9
WW	-	0.2	-	-	0.2	**4.7**	0.3	5.4
ON	0.3	-	-	-	-	-	**2.0**	2.3
Total	70.3	6.9	6.2	0.1	8.5	5.5	2.4	**100.0**

94% of the ordinary CADAC interviews and 95% of the PAPI ones are correctly classified (true) in respect of the degree of attachment variable (see the bold-type diagonal in each table).

This means - to put the same thing in another way - that the relative gross error is 6% for CADAC and 5% for PAPI.

If the variable is instead presented only in terms of the three main groups (firm attachment, loose attachment and no attachment), the aforesaid error is reduced to 5% for CADAC and 3% for PAPI.

The relative gross error is a measure of the reliability of the classification of private persons, therefore its size is of great importance when it comes to e.g. judging the quality of a study of streams on the labour market (involving following private persons). With luck, the individual errors will cancel one another out (through there being the same number wrongly excluded as wrongly included) and thus not affect the total estimates.

Another measure of quality is the relative net error, which indicates the reliability of the estimate of the number of individuals in a certain class - indicates, that is, by how much the true value has been overestimated/underestimated. The relative net error is calculated as the relation between the estimate deriving from the ordinary interview and the estimate according to the reinterview study.

In the table below is presented the relative net error as calculated with the aid of the upwardly adjusted values according to the ordinary interview and the reinterview study. A rough calculation can be made on the basis of the percentages in the two preceding tables: for instance the relative net error for TE in the case of PAPI is 6.7/6.9 = 0.97, which is to say that the figure deriving from the ordinary interview involves an underestimation of the true value for TE by 3%.

Table 9.8
Estimation of the relative net error for the degree of attachment variable, CADAC and PAPI

	CADAC	%	PAPI	%
Firm attachment (PE, OB, MF)	no error	-	no error	-
Loose attachment (TE, LY)	*underestimated*	9	overestimated	2
No attachment (WW, ON)	*overestimated*	12	underestimated	3
PE	no error	-	underestimated	1
TE	underestimated	13	underestimated	3
OB	overestimated	4	overestimated	3
(MF	overestimated	39	overestimated	181)
LY	underestimated	5	overestimated	5
WW	overestimated	17	underestimated	2
(ON	no error	-	underestimated	3)

Below is given the size of the measurement error (95% confidence interval) for each of the three main groups firm attachment, loose attachment and no attachment to the labour market - CADAC and PAPI.

	CADAC		PAPI	
Firm attachment (PE, OB, MF)	+16 000	(±46 000)	-2 000	(±42 000)
Loose attachment (TE, LY)	-73 000	(±50 000)	+13 000	(±44 000)
No attachment (WW, ON)	+57 000	(±46 000)	-12 000	(±40 000)

Thus when it comes to the estimates of the degree of attachment to the labour market in accordance with the tripartite division (firm attachment, loose attachment, no attachment), no significant error is to be found in the case of PAPI, whilst systematic measurement error is to be found in the case of CADAC regarding both loose attachment and no attachment.

9.4.4 Labour-force status

Reconciliation was performed not only in respect of the degree of attachment variable but also in respect of labour-force status, which is the foremost LFS variable. The following division was applied:

In the labour force	**Outside the labour force**
Employed	status 1
status 2 - working	status 5 - unable to work
status 3 - absent from work	
Unemployed	
status 4	

The tables in this section are of the same type as those in the preceding one, bringing out differences between CADAC and PAPI.

Table 9.9
Status according to ordinary interview and reinterview study - CADAC

The sample

Status according to ordinary interview	Status according to reinterview study					
	1	2	3	4	5	Total
1	**188**	9	4	2	7	210
2	3	**1162**	8	1	-	1174
3	3	20	**204**	4	-	231
4	3	3	-	**50**	-	56
5	**-**	**-**	**1**	**-**	**6**	**7**
Total	197	1194	217	57	13	**1678**

Table 9.10
Status according to ordinary interview and reinterview study - PAPI

The sample

Status according to ordinary interview	Status according to reinterview study					
	1	2	3	4	5	Total
1	**183**	7	-	4	6	200
2	2	**1153**	13	-	-	1168
3	10	24	**174**	-	-	208
4	9	4	-	**49**	-	62
5	**-**	**-**	**1**	**-**	**8**	**9**
Total	204	1 188	188	53	14	**1647**

There being so few observations for statuses 4 and 5, it is very difficult to draw any conclusions about these groups.

Table 9.11
Status according to ordinary interview and reinterview study - CADAC
Adjusted upwards, per cent

The sample

Status according to ordinary interview	Status according to reinterview study					
	1	2	3	4	5	Total
1	**11.4**	0.6	0.3	0.1	0.4	12.9
2	0.2	**70.2**	0.5	-	-	70.9
3	0.1	1.0	**11.2**	0.2	-	12.5
4	0.1	0.1	-	**1.0**	-	1.2
5	**-**	**-**	**0.4**	**-**	**2.1**	**2.5**
Total	11.9	71.8	12.3	1.4	2.5	**100.0**

Table 9.12

The sample

Status according to ordinary interview	Status according to reinterview study					
	1	2	3	4	5	Total
1	**12.0**	0.5	-	0.3	0.4	13.1
2	0.1	**70.1**	0.8	-	-	71.0
3	0.5	1.5	**10.3**	-	-	12.3
4	0.2	0.1	-	**1.0**	-	1.2
5	**-**	**-**	**0.3**	**-**	**2.0**	**2.3**
Total	12.8	72.1	11.4	1.2	2.4	**100.0**

The gross error with regard to the assignment of status on the basis of the ordinary interview is 4% for CADAC and 5% for PAPI.

In the 1978 study where the reinterview was in each case independent of the ordinary interview, 7% of the sample were not given the same status on both occasions.

Both CADAC and PAPI have a 2% gross error with regard to the three main groups - persons employed, persons unemployed and persons outside the labour force.

The following table presents the relative net error - i.e. the overestimation/underestimation - for each of the various elements of the status variable, calculated in the same way as in the case of degree of attachment.

Table 9.13
Estimation of the relative net error for the labour-force status variable, CADAC and PAPI

	CADAC	%	PAPI	%	1978 study	%
Status 1	*overestimated*	8	overestimated	3	overestimated	11
Status 2	*underestimated*	1	*underestimated*	2	underestimated	1
Status 3	overestimated	1	*overestimated*	8	overestimated	19
(Status 4	underestimated	16	underestimated	2	underestimated	3)
(Status 5	no error	-	underestimated	3	underestimated	46)
Employed (2 + 3)	underestimated	1	no error	-	overestimated	1
Unemployed (4)	underestimated	16	underestimated	2	underestimated	3
Outside l f (1 + 5)	*overestimated*		overestimated	2	underestimated	2

Below is given the size of the systematic measurement error (95% confidence interval) for each of the three labour-force status groups.

	CADAC		PAPI	
Employed (2 + 3)	-39 000	(±46 000)	-12 000	(±38 000)
Unemployed (4)	12 000	(±16 000)	-1 000	(±16 000)
Outside the labour force (1 + 5)	+51 000	(±44 000)	+13 000	(±42 000)

Thus the study shows that when it comes to the tripartite division there is in the case of PAPI no significant systematic measurement error at all, whilst there is in the case of CADAC a significant error of this type with regard to the group outside the labour force.

There is significant systematic measurement error (underestimation) with regard to status 2 in the case of both CADAC and PAPI, with regard to status 1 (overestimation) in the case of CADAC, and with regard to status 3 (overestimation) in the case of PAPI.

9.5 Causes of incorrect classification

9.5.1 Degree of attachment

Permanently and temporarily employed (PE and TE)
The CADAC underestimation of PE is considerably greater than the PAPI. It was observed at an early stage of the test that there was a difference between the CADAC and PAPI estimates of PE, and it was discussed what the cause of this might be. It turned out that the answer alternatives for the decisive question G9, i.e. the question concerning the respondent's permanent or temporary employment, were not laid out the same in the case of CADAC and PAPI: in the case of the former the PE alternatives were at the top and the TE ones below them, whilst in the case of the latter all the alternatives were in columns.

As of March there was a new CADAC layout, and the difference between the CADAC and PAPI estimates of PE and TE was reduced. Thus through the change of layout the net error should in the

long run become lower in the case of CADAC - though not exactly as low as in the case of PAPI. It is likely that the errors that came with CADAC during the period of the test will remain until the entire sample has been renewed. It is doubtful whether earlier cases of incorrect classification will be detected by way of the control form.

Even assuming, though, that the CADAC net error will eventually be more or less as low as the CADAC, there remains the gross error - probably as great in the case of CADAC as in the case of PAPI. During the 1988 revision of the content and definitions of the labour force surveys we found cases of wrong classification in respect of the degree of attachment variable, and for this reason it is now emphasised in the LFS letter of instructions that we shall be asking what type (permanent/ temporary) of employment the respondent has. During the revision test it was most often a matter of TE being wrongly classified as PE, but the errors are now made in both directions.

Evidently it is a question that the respondent finds difficult to answer, and what was said in the letter did not completely dispose of the problem. It would no doubt be a good idea to try giving the question another formulation (and perhaps make two separate questions out of it).

Owners of businesses and members of the family who help (OB and MF) Both CADAC and PAPI put the percentage of owners of businesses too high. The chief cause of this is that persons who both own and work in small companies answered in one interview that they were OB, and in the other that they were PE. There is incorrect classification in both directions. There is in fact no rule as to how such persons are to be regarded in the labour force surveys - they can themselves decide which of the two classifications is the more appropriate.

The number of members of the family giving help is altogether too small for any conclusions to be drawn. In the majority of accounts these persons are put together with owners of businesses.

Persons who do not have work (LY, WW and ON)
When it comes to LY and WW the CADAC and PAPI net errors go in opposite directions. When more than a year had elapsed since the respondent last had a job, there ought to have been an automatic recoding from LY to WW - but there was not. This error occurs only when a control form is used, and was therefore considerably more common in the case of PAPI - because of the design of the test, whereby there was only CADAC new classification during the first three months. This was the cause of all the 14 instances of incorrect (LY -> WW) classification in the case of PAPI, and of 1 out of 3 in the case of CADAC. It is reckoned that the PAPI and the CADAC net error in respect of each of the two degrees in question will go in the same direction once recoding has been implemented: underestimation of LY by about 5% and overestimation of WW by 15-20%.

All the cases of CADAC and PAPI incorrect classification where WW ought to have been LY were caused by the fact that the respondent had forgotten some minor temporary job or some job near the one-year boundary. This type of error does not occur so often when the control form is used, because there we ask just about the most recent three-month period instead of about the last year. Of the 13 CADAC instances of the incorrect WW instead of the correct LY, 9 were new classifications or reclassifications, whilst every PAPI error of this type stemmed from the control form. If it be assumed here, too, that the differences between CADAC and PAPI are to be ascribed to the design of the test, one can look forward to a substantial reduction in CADAC error of this type once the method is in full operation.

The control form does not cover new ON. If this can be rectified by means of e.g. a new question, there ought to be fewer errors - in the case of both CADAC and PAPI - regarding WW and ON.

(Actually these two are most often put together, which means that the incorrect classification of one as the other is not as a rule of any consequence. The ON degree was introduced chiefly for the sake of simplifying the field work.)

CADAC is somewhat less efficient than PAPI when it comes to capturing odd jobs or any job that the respondent still formally has during illness, time off for study or paternity/maternity leave. But errors concerning this are small in number - and probably the difference between the methods in this respect is to be put down partially to the design of the test (involving more CADAC than PAPI new classifications).

9.5.2 Labour-force status

Errors concerning labour-force status are more difficult to explain than ones concerning degree of attachment to the labour market - the former variable being of course highly dependent on how things are during the measurement week, the latter being more stable over time.

Employed (statuses 2 and 3)
In the case of neither method has any measurement error been ascertained with regard to the group of the employed as a whole. There are indeed instances of incorrect classification (in the case of both CADAC and PAPI), but these have no effect worth mentioning on the relative net error inasmuch as the employed are such a large group.

But there are incorrect classifications that do affect the estimates of persons working (status 2) and persons absent from work (status 3). Such classifications are more common in the case of PAPI (37) than in the case of CADAC (28). They go in both directions, so of course the net error is lower than the gross error - but it does lead to an overestimation of the number absent (and to a corresponding underestimation of the number working): by 12 in the case of CADAC, by 11 in the case of PAPI.

Some 50% of such errors have to do with the fact that the interview refers to the wrong week - refers, that is, to the week before or after the intended one (this because for instance the interviewer has not sufficiently stressed which week is meant, or because the respondent has misunderstood or forgotten). It is more commonly status 3 than status 2 which is noted when it ought not to be - the respondent for instance remembers having been ill or on holiday some week, and then "thinks" that it was the very week the interviewer is now asking about.

However, in 18 cases - 9 CADAC and 9 PAPI - this cannot be the explanation of the error. In 15 (8 + 7) of them the respondent was put down as status 3 in spite of the fact that he or she had been working all the three weeks that we asked about in the reinterview study (i.e. the week to be measured, the one before and the one after). Inexplicable!

If - to hypothesise - the incorrect classifications concerning statuses 2 and 3 within the group of the employed were got rid of, the number of persons working would be underestimated by 1% (about 20,000) in the case of both methods, whilst with regard to the number of persons absent there would be a CADAC underestimation by 3% and a PAPI overestimation by 2%. Yet all the incorrect estimates lie within the margin of error, therefore the differences between CADAC and PAPI regarding persons absent from work cannot be explained by this type of error - the cause has instead to be sought in incorrect attribution as between status 3 and persons who are without work.

Having work

Persons who "have work" in the sense that there is an employer calling on their services when required (the persons themselves perhaps first having rung and arranged it) - without there being any fixed schedule - do not come under the LFS definition of absent. This is one of the causes of the overestimation of status 3. Most of these persons were classified as status 1 in the reinterview study. The error was more common in the case of PAPI (10) than in the case of CADAC (3). Since 10 of the 13 cases involved the use of the control form, the difference between PAPI and CADAC in this respect can to some extent be put down to the design of the test. There is great risk, most likely, that the respondent who "has work" in the sense here under consideration will say that he or she has a job but is absent (despite not being so from the LFS point of view) - which indicates that the control form is not a good measuring instrument in such cases.

A calculation indicates that, excluding this type of error, the CADAC estimate of the proportion of those absent from work would be accurate, whilst the PAPI estimate would be 3% too high. Thus if such error could indeed be excluded the estimates would be better, and the difference between CADAC and PAPI smaller. However, the probability is that once CADAC is in full operation - with the same proportion of control forms as PAPI - it will have the same proportion of these errors as PAPI, and thus make the same overestimation.

Four respondents classified in the ordinary CADAC interview as absent from work were classified in the reinterview study as unemployed. The original classification had of course caused not only an overestimation of the proportion absent but also an underestimation of the proportion unemployed.

Outside the labour force

It has been ascertained that in CADAC there is a systematic measurement error leading to overestimation both of the number of persons outside the labour force and of the number in the sub-group status 1. The difference between CADAC and PAPI in this respect can to a large extent be put down to the incorrect classification to do with absence (see above), since the same error leads to underestimation of status 1 as well. A calculation - of the same type as above - of the remaining net error indicates that there would be a 9% CADAC overestimation of status 1 and a 7% PAPI, which is to say that there would be less difference between the two methods but a significant estimation error in the case of PAPI too.

The overestimation of status 1 in the case of both methods can be explained by the same thing that affected the estimation of degree of attachment, namely their not capturing odd jobs that the respondent does, nor a job that he or she formally still has during e.g. illnes. This error is somewhat more common in the case of CADAC.

Furthermore there were a number of cases where status 1 became status 5 in the reinterview study, but the initial error was in fact of no great importance inasmuch as these two statuses combine to form the group of those outside the labour force.

10 QUALITY EVALUATION

This chapter offers an overall evaluation of the response quality in CADAC as compared with that in PAPI. (For a discussion of the economic aspect, see the next two chapters.) The fact that the method study was of so comprehensive a nature, with some 17,000 CADAC interviews (in fact over 20,000 when the February reinterviews are included) - to be put beside many times more PAPI interviews - and with a variety of additional supportive information (e.g. from observations in the field), greatly facilitates a quality comparison.

The quality comparison is based first and foremost on the following: comparison of estimates (Chapter 8), results of the reinterviews (Chapter 9), findings of observations in the field (Chapter 6), what the interviewers thought (Chapter 7), coding and editing comparison (Chapter 5) and system design comparison (Chapter 4).

10.1 Differences between CADAC and PAPI estimates

What is of the greatest weight with regard to the LFS response quality is that the estimates of *degree of attachment* to the labour market and of *labour force status* should be correct (and this is especially true in respect of the estimates of the employed and the unemployed), therefore the most fundamental comparisons concern the variables in these two areas. The CADAC and PAPI estimates were in fact very much the same when it came to the proportion of the employed and the unemployed, and indeed when it came to almost all the other variables in the said areas. Nevertheless there were the following four exceptions:

(1) Some % more were firmly attached to the labour market according to CADAC than according to PAPI, and some 2% fewer loosely attached. There are two reasons for believing that the PAPI estimates are the more accurate:

(i) The PAPI results are more in accord with the reinterview results, which to the extent that this is possible give the true values.

(ii) An inspection of the data collection procedures revealed that there was a difference in layout whereby the answer alternatives in CADAC were less clearly grouped than those in PAPI, therefore the CADAC layout was altered in order to bring it more into line with the PAPI one. Estimates of the differences between CADAC and PAPI have been made for the six months following the alteration, i.e. March-August, and theseestimates indicate that the gap has decreased, though there is still too much uncertainty for any firm conclusions to be drawn.

(2) There was according to CADAC a somewhat broader distribution of number of hours worked than there was according to PAPI. This is probably a sign of CADAC being of higher quality. The standard class, 40 hours, was not coded as often in CADAC, no doubt partly because in CADAC it is easier for the interviewer to code other classes than it is in PAPI.

(3) The rate of matching with regard to the automatic coding of trade-union affiliation and occupation was a few per cent higher for CADAC than for PAPI.

(4) The percentage of cases where there was incomplete informationfor the coding of occupation and branch of industry was somewhat higher in the case of CADAC than in the case of PAPI (1.8 and 1.2 as compared with 1.3 and 0.8). Probably this was due to the fact that some of the interviewers are not used to typing and therefore as CADAC interviewers did not write

as much as they would have done as PAPI interviewers. So the percentage differences can be expected to decrease as the interviewers get more used to typing. Nor must it be forgotten that the typewritten text has the advantage of not being vulnerable to misinterpretation in the way the handwritten text is.

10.2 A comparison with regard to gross proportion of error

The aforesaid differences in estimates have in each case to do with the net proportion of error. But the labour force surveys are a panel-type inquiry, affording us the opportunity of e.g. estimating flows - and for such estimation we require to know the gross proportion of error, which is to say the error of the individual measurement.

On the assumption that the results of the reinterview study indicated the true values, the gross proportions of error for the two main variables degree of attachment (three-part division) and labour force status (five-part division) were the following:

	CADAC	PAPI
Degree of attachment	5%	3%
Labour force status	4%	5%

Thus the gross proportions of error were in the region of 4%, with little difference from one method to the other. This percentage of error can be regarded as acceptable, and by way of comparison it can be mentioned that in a 1978 LFS methods study the proportion of error with regard to labour force status was estimated at 7%. Even taking into account random error, and also the fact that the way in which the true values were attained may have led to a moderate underestimation of measurement error, it seems reasonable to conclude that the estimates of degree of attachment and labour force status are of a quality adequate for most forms of flow analysis - a quality that bears comparison with what e.g. American inquiries in the area have achieved.

For further information concerning the gross proportion of error in the case of different estimates, see Chapter 9. It will be seen there that the results consistently indicate only slight differences between CADAC and PAPI.

10.3 Differences in level of non-response

There were no more than small differences with regard to level of non-response. This was to be expected, because earlier experience had shown that respondents do not react negatively to the use of a computer in the interview. On the other hand the more unpractised interviewer can find the handling of the sampling form in the computer trickier than its handling in the PAPI system, and on occasion this no doubt had a certain effect on the energy with which the tracing was pursued. It is worth pointing out, though, that the electronic transmission of material in the CADAC system makes possible a prolongation of the time spent on field work and an improvement in the following of the data collection, whereby the level of non-response becomes lower.

During the production test there were no face-to-face CADAC interviews: the PAPI method was used, and the results were then transferred to the CADAC system. The reason for this was that the face-to-face interviews often have to be conducted in inconvenient circumstances (e.g. standing on the stairs) where it is impracticable to use a computer. Furthermore the face-to-face interviews were often conducted by a different interviewer from the original CADAC one, the latter having

got a larger and different "catchment area" than usual in order that the CADAC and PAPI samples should be comparable.

The extended catchment area and the over-representation of respondents on the point of leaving the panel may have made the work of the CADAC interviewers more difficult, since to a greater extent than the PAPI interviewers they were working in districts of which they had no local knowledge. But in spite of this, and in spite of the greater difficulty when it came to making visits to persons in the CADAC sample (such visits having more often to be allocated to another interviewer), the level of non-response was a mere 0.7% higher than in the case of PAPI, probably because of the counterbalancing effect of CADAC's longer period of field work.

One problem arising from the face-to-face interviews when it comes to comparing CADAC and PAPI is that a number of CADAC ones were carried out by PAPI interviewers - but the problem is in fact insignificant inasmuch as the proportion of face-to-face interviews was so low (less than 1%).

10.4 Further comments

CADAC met with the general approval of the interviewers, who did not want to go back to PAPI. It seems reasonable to say that working with CADAC strengthens the interviewer's motivation - though one must be careful not to exaggerate this, because much that is new tends to be experienced as positive and exciting in the beginning (simply because of its novelty, that is - a variant of the Hawthorne effect). On account of the positive attitude of those working with CADAC, and on account of the fact that the method gives the interview a firmer structure, there should be a better quality of answer. Support for this comes from the field observations, even though certain problems were encountered (e.g. the time spent waiting during the course of the interview, and communication difficulties). Furthermore the CADAC system's development potential became evident in several ways - many of the problems that came up during the course of the production test could be quickly eliminated, and CADAC after the test was clearly better than CADAC before it. Nor does it seem unreasonable to suppose that this development potential has not been exhausted.

One more thing was that an extensive addition to the monthly surveys could be put into execution via the CADAC system without any difficulty to speak of (though CADAC and PAPI have not been compared in respect of the quality of answer for this part).

There is need for a word of warning here. In the experience of Statistics Sweden "new" interviewers are more likely to go by the book than "old" ones are (the latter sometimes acquiring mannerisms and their own ways of doing things). Unfortunately there would seem to be scope for not going by the book even in the case of CADAC, but such divergence will not emerge until the standard procedure has been assimilated.

To sum up, the production test shows that CADAC can become standard in the monthly labour force surveys without this having a negative effect on quality. Rightly used, the new system can on the contrary bring about an improvement in quality. It needs to be borne in mind, however, that the test indicates merely that *the necessary conditions* exist for the efficient functioning of CADAC, whereas the extent to which the system actually does *function efficiently* depends on how well it is implemented and operated by, first and foremost, the Interviewer Unit (IU) and the new Planning and Development Unit (PDU).

In addition to all this it can be mentioned that CADAC makes it possible to follow the data collection process more closely - and this in turn facilitates improvement of the process. A further point is that CADAC faciltates the performance of split-ballot experiments, where for instance different parts of the sample get differently formulated questions; new questions, etc. can thereby be more efficiently tested.

11 ECONOMICS

This chapter offers an account first of the cost estimate and outcome for the production test, then of a time study where CADAC and PAPI are compared, thereafter of CADAC time reports, and finally of estimated future LFS production costs with CADAC.

11.1 Cost estimate for the production test

The total estimated cost of the production test was SEK 1,101,000 at 1989/90 prices (SEK 1,002,000 at 1988/89 prices). This cost (which did not include the normal cost of interviewing) comprised the following: SEK 595,000 for reinterviews, SEK 193,000 for extension of the interview time by five minutes (for CADAC new classification of respondents), SEK 273,000 for extra coding work, and SEK 40,000 for a general rehearsal in May.

It was at the same time estimated that there would be a saving of SEK 277,000 on editing, distribution, data registration, paper and postage, thus bringing the net extra cost for the production test to SEK 824,000. Central resources are not included in this - they came under the CADAC project and the administrative department.

Table 11.1
Cost estimate and outcome for various parts of the production test, in thousands of crowns (1989/90 prices).

	Estimate	Outcome	Difference E-O
Reinterview	582	595	-13
Additional interview time	193	337	-144
Coding	273	318	-45
Total	1048	1250	-202
Saving	277	277*	

* Estimated sum

11.2 Time study

This part of the chapter has to do with a time study that was carried out during December 1989 and January 1990 for the purpose of comparing CADAC and PAPI from the point of view of the time required for the various parts of the LFS data collection phase (e.g. tracing, interview and editing).

A similar LFS time study was carried out in April 1985, whereby a total of 31 interviewers noted how much time the various parts of their work took. What was learnt from that study influenced the design of the later one.

11.2.1 Method

The sampling procedure used by the CADAC interviewers (of which there is a description in 3.1) cannot be regarded as random, so we had to forgo statistical methods that depend on random samples, in spite of the great drawback that we were thus prevented from ascertaining the degree of precision of the results in a statistically correct way. In the light of this we chose to give the study the following design.

All of the 36 field interviewers who took part in the CADAC test during December and January were included in the study, as were half of the PAPI interviewers (a systematic sample). Despite the fact that a random selection of sampling units would undoubtedly have led to a better estimate of the interview time, we preferred to let a random selection of interviewers note how long they spent on the various parts of their work, and the reason for this was that there are several parts which are common to the two methods and are difficult to refer to an individual sampling unit.

First the interviewers were classified on the basis of the following background variables: age, length of service, field of work and level of costs. Then at the end we looked to see what correlation there was between these variables and the reported working-time. If we found a fairly strong correlation in the case of one or more of the variables we would on this basis pair CADAC interviewers with PAPI interviewers. By way of these "twins" we would then be able to keep constant other variables that affected the working-time than the one under investigation (PAPI/ CADAC).

If there were no such correlation there would be no such "twins", in which case we would compare the two groups just as they were. This comparison would be a purely subjective one, statistical tests being (as mentioned above) out of the question.

The study is made up of two identical sub-studies, one carried out in December 1989 and the other in January 1990.

11.2.2 Measurement variables

Each interviewer received a form on which to note down the working- and travelling-time day by day, whereby the following parts of this time were differentiated:

	CADAC	PAPI
Working-time		
- tracing	x	x
- interviewing	x	x
- editing		x
- communication	x	
- other	x	x
Travelling-time		
- post journeys		x

The interviewers had a degree of trouble with this classification, therefore they received instructions covering every possibility. For instance, the coding of education and training (if impossible to incorporate in the interview) was to be counted as editing.

When it comes to analysis of the study it is important to bear in mind that the time measured is the time which the interviewer reports and is paid for - which is not necessarily the *actual* time.

During December there were 24 supplementary questions about work environment, put to 17% of the total sample. Since this extra interviewing had to be left out of the analysis, we needed to get an idea how long it took.

The new-classification interview (the first of eight) contains more questions, and takes more time, than an ordinary interview. Everyone who was in the CADAC sample for the first time went through this longer type of interview. In December and January the number of such persons was

1,125, amounting to about 32% of the entire sample, whilst the corresponding proportion for the PAPI group was about 13%. The difference between these percentages becomes somewhat smaller if one takes into account both reclassification (because of change in circumstances) and the fact that new classification can be replacing former non-response. It is difficult to afterwards adjust for the difference between CADAC and PAPI with regard to the percentage of newly classified respondents.

It can be seen from the above that measurement is fraught with difficulty, and this calls for extreme caution when it comes to drawing conclusions from the study.

11.2.3 Results

There was no correlation between the above-mentioned background variables and the reported working-time, therefore the "twins" idea had to be discarded. What was done, therefore, was to directly compare CADAC and PAPI from the point of view of the average time per sampling unit for the various parts of the interviewer's job.

In the case of the CADAC interviewers we got back questionnaires from 31 (December) and 27 (January), which constitutes a response rate of 86% (N=36) and 77% (N=35) respectively. The corresponding PAPI figures were 55 and 46, or 82% (n=67) and 72% (n=64). (The lower response rate in January can no doubt be put down to certain interviewers' having got tired of recording the time.) Inevitably the high degree of non-response increases the element of uncertainty in the study. Furthermore a number of the interviewers were anything but meticulous about how they filled in the form (doing some extreme rounding-off), though after further instructions this did improve in

Table 11.2
Working-time in minutes (mean, minimum and maximum values) for each part of the LFS interviewer's work during December 1989 and January 1990, CADAC and PAPI.

	Month	Mean	Min	Max	No. of interviewers responding
Tracing					
CADAC	Dec 89	8.0	1.0	16.4	31
	Jan 90	7.0	1.3	13.8	27
PAPI	Dec 89	6.2	1.2	19.2	55
	Jan 90	6.3	0.6	17.8	46
Interviewing					
CADAC	Dec 89	13.0	3.8	30.6	31
	Jan 90	10.3	5.4	15.9	27
PAPI	Dec 89	12.4	4.5	27.3	55
	Jan 90	9.9	2.9	39.1	46
Editing					
CADAC	Dec 89	1.6	0.0	6.7	31
	Jan 90	1.3	0.0	4.5	27
PAPI	Dec 89	2.9	0.3	8.6	55
	Jan 90	2.4	0.0	6.4	46
Communication					
CADAC	Dec 89	2.9	0.0	12.3	31
	Jan 90	2.2	0.0	5.9	27
Posting					
CADAC	Dec 89	0.16	0.0	1.7	31
	Jan 90	0.02	0.0	0.3	27
PAPI	Dec 89	0.65	0.0	2.9	55
	Jan 90	0.65	0.0	4.3	46
Other					
CADAC	Dec 89	1.5	0.0	6.7	31
	Jan 90	0.75	0.0	4.2	27
PAPI	Dec 89	0.73	0.0	5.6	55
	Jan 90	0.57	0.0	5.9	46
Total					
CADAC	Dec 89	27.2	15.0	50.4	31
	Jan 90	21.5	12.8	32.6	27
PAPI	Dec 89	22.9	10.2	48.0	55
	Jan 90	19.8	9.9	55.2	46

11.2.4 Discussion

Broadly speaking, the method of measurement functioned badly. For instance there was a comparatively high rate of non-response. Then again, there was a broad spread of mean values reported for the number of minutes taken up by the various parts of the work. Furthermore some of the reported values were plainly implausible - how on earth, for instance, can a tracing take an average of 15-20 minutes when one has about 100 persons on one's list? Implausibility is also to be found in the maximum values for interviewing and editing. Finally, some of the PAPI interviewers reported no time at all for posting the forms - yet these forms arrived safe and sound.

Nevertheless there is reasonably close agreement between the December and January mean values, indicating that the reported data did have a certain reliability. Furthermore there was unequivocally measured a marked reduction in interviewing time between December and January. The supplementary questions on work environment should add an average of 2-2.5 minutes to the length of the interview (12-15 minutes extra for 17% of the CADAC and the PAPI sample). In the present case the average was 2.7 minutes for CADAC and 2.4 minutes for PAPI.

If we take the mean totals deriving from what was reported in the time study and compare them with the mean totals deriving from what was reported in the ordinary way, we find the following: for December the time-study total was 2.2 minutes higher, and for January it was 0.8 minutes lower. Some of this difference can possibly be put down to an increase in non-response in the case of the time study. Experience from the 1985 time study would suggest a certain amount of under-reporting.

It was very useful to obtain the values for the various parts of the job as carried out by CADAC and by PAPI interviewers. Take, for instance, the information concerning the time taken up by communication and going to the post - it played an important part in the estimation of the cost of using CADAC in the monthly labour force surveys. The editing is retained in the CADAC method, involving on the one hand the coding of education and training, and on the other the correction of mis-spelt names and addresses.

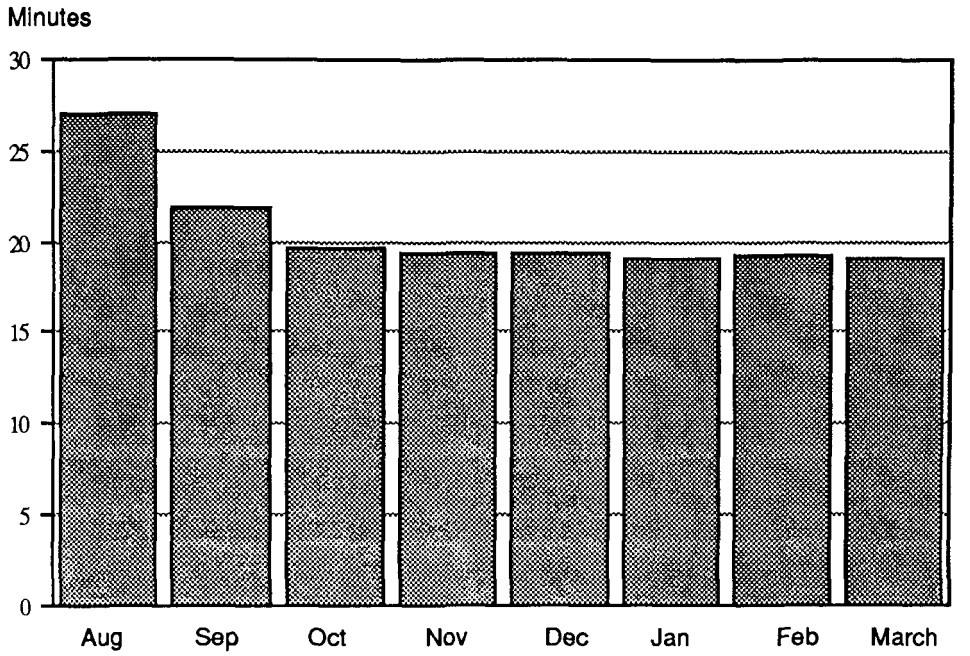
The comparison of the CADAC and the PAPI working-time is analysed in the following chapter, against the background of the interviewers' time reports. Our time study indicates that for January the CADAC average total was 1.7 minutes higher than the PAPI, which can be explained by the time required for the night communication. Furthermore we have not thereby taken into account the fact that the proportion of persons to be newly classified (involving as a whole considerably more interview time) was higher in the CADAC sample (32% as against 13%), nor the fact that the CADAC interviewers had samples outside their ordinary areas (involving more tracing time).

11.3 Working-time with CADAC

There is another way of finding out about the time required. The total working-time for every interviewer is to be found in the time-reports that come to the Statistics Sweden financial department and on which the interviewers' pay is based. The time is divided into travelling-time and other time.

Figure 11.1 shows the reported working-time (for February and March too) adjusted to exclude differences of method (extra new class in the case of CADAC), supplementary questions and work in extended areas.

Figure 11.1
Reported working-time per sampling unit (adjusted to exclude differences of method, supplementary questions and work in extended areas)



For every person being newly classified an extra 7 minutes has been added to the interview time as a correction factor, whilst the supplementary questions have been estimated as taking up an extra 12.5 minutes, and the annual labour force questions (in February) 7 minutes. Tracing has been treated as requiring an extra 1 minute per person in the case of CADAC (the extra time during the two months covered by the time study being 1.8 and 0.7 minutes).

Once the above corrections have been made, the average working-time per CADAC sampling unit comes to 27.0 minutes for August. This is 35% higher than the corresponding PAPI average, but it includes time spent on learning the system - and probably the difference has also to do with the fact that the August work load was light, leaving time for practising (not required by the PAPI interviewers). (CADAC training and practice have been reported elsewhere and will not be gone into here.) In September five interviewers participated in CADAC for the first time, thus that month's average of 21.8 minutes also includes time spent on learning the system.

From October to March the CADAC adjusted mean value for total working-time is 19.3 minutes per sampling unit, whilst the corresponding PAPI value is 19.5 minutes. That there is no change in March (despite no extra new classification or supplementary questions) confirms that the corrections were reasonable.

Thus the working-time for CADAC is a mere 0.2 minutes less than that for PAPI if we adjust for CADAC's greater proportion of persons to be newly classified, the greater areas to be covered, and the supplementary questions. Furthermore the working-time can be affected by a host of external factors, e.g. low work load. We therefore consider it reasonable to say that a CADAC interview does not take longer than a PAPI one.

A routine for automatic connection would reduce the communication time by half (1 minute), at the same time as there is a saving of 0.6 minutes or so because there are no more journeys to the post. The following section has to do with the estimation of CADAC production costs, and there we count the working-time as 1 minute shorter.

11.4 Estimate of CADAC production costs

Things learnt from the production test have made an important contribution to the estimate of CADAC production costs. Earlier estimates indicated a certain degree of saving, but they were based far more on theory than on experiment.

The effects of bringing CADAC into use can be described in the form of

- measurable economic data
- changes in quality
- development potential

But in the cost estimate just the first of these three has been taken into consideration, the value of the other two not being strictly translatable into economic terms.

The costs are for development, computer equipment (depreciation), training and operation, whilst the "earnings" are the savings resulting from replacing PAPI by CADAC.

The following table presents the estimate in broad outline:

Table 11.3
Cost estimate (in thousands of crowns)

Costs & savings	3-year estimate 90/91 - 92/93	5-year estimate 90/91 - 94/95
Costs		
Development	3020	3020
Equipment	3900	5550
Operation	3410	6350
Training	1210	1210
Total	11540	16130
Savings		
LFS	12320	22170
Other	4630	11900
Total	16950	34070

This estimate indicates that CADAC can be self-financing with regard to current expenditure on development, equipment, training and operation. The estimated saving for the three-year period is in excess of SEK 5m.

If we look a couple of years ahead, to when the new technique has become firmly established, the annual saving as compared with what would be the case if the old technique were used is about SEK 5.5m (taking into account only the Labour Force Surveys, the Surveys of Household Purchasing Plans and the Surveys of Political Preferences, at full volume), at the same time as the increase in cost for equipment, operation and maintenance is about SEK 2.5m - thus giving a net saving of about SEK 3.0m.

The table shows only that the savings are large enough to produce a net surplus - but where, more specifically, are they to be made?

The most typical sources of economy on which the estimate is based are the following:

- The printing of forms (including the preprinting of data from earlier interviews) virtually disappears; just a few basic forms are required so that the interviewers have a reserve.

- Envelopes and postage largely disappear.

- Data registration disappears as a separate operation.

- The greater accuracy of the automatic coding reduces the work of the editing group.

- There is a reduction in central editing and completion of imperfect data.

- The interviewers, too, need less time for editing and completion (involving getting in touch with respondents again), and less time for going to the post.

- Unforeseen changes required in the forms can be carried out more quickly and easily.

It needs to be pointed out that earlier development costs, for instance in the form of reimbursement, have not been taken into account in the estimate. Furthermore there is a degree of uncertainty about the estimate. The cost of equipment (computer, modem, software and licences) has been put at SEK 30,000 per interviewer, but this is merely an assessment, since purchasing has not been completed. On the other side of the balance-sheet there are savings in the form of reduced personnel costs, whereby we assume that such savings are not theoretical but can be put into practice by assigning other tasks to the persons affected or by reducing the number of personnel.

12 EVALUATION AND DISCUSSION

The report sets out the design, etc. of the production test (including its background), and gives a full presentation of the results. To facilitate the task of the reader, summaries and conclusions have been given special prominence in the text, and certain chapters have been of a summarising character. Nevertheless it remains to offer an overall evaluation of the test and to interpret the most important results.

Governing factors here are of course on the hand what the purpose of the test was, and on the other hand what information is required for deciding whether or not to make CADAC standard in our surveys.

The discussion is based chiefly on the results but also on the experience of more than a year of planning, carrying out and evaluating the test.

The test was planned, closely followed during the entire field-work phase, and evaluated, by a broadly composed working group with representatives from the labour market department (responsible for the subject-matter), the development department (statistical methods unit) and the data processing department (responsible for CADAC development and for the work of the interview unit). Experience had shown that the broad composition was necessary in order to on the one hand bring in the various parties with a direct interest in such an extensive study, and on the other hand to involve the users in the new technique right from the start.

What, then, was the chief purpose of the test, and how does the result compare with this purpose? Can it be said that the purpose has been achieved?

The chief purpose was to acquire a basis for deciding whether CADAC had attained such a degree of maturity as to make feasible its replacing PAPI in the monthly labour force surveys. The criteria to be fulfilled by CADAC were of

- quality
- economy
- reliability

Experience of earlier changes of method with regard to the labour force surveys lay behind the requirement of comprehensive and sustained measurement for determining whether CADAC would lead to different estimates of central LFS variables, especially degree of attachment to the labour market and labour force status. One previous change of method, for instance, caused the estimate of the proportion employed to go up by 0.7%, and that of the proportion unemployed to go down by 16%.

The economic side was considered important when it came to the decision inasmuch as the development of the system had been costly and the acquisition of equipment for the interviewers would also be costly. It was necessary to have the anticipated savings (reduction of costs for editing, data registration, paper, etc.) verified, and to ascertain whether there were any unforeseen costs that would affect the estimated expense of having CADAC in operation.

It was further necessary to find out whether CADAC had sufficient reliability for the day-to-day production of statistics, especially in the case of the monthly labour force surveys with their short production time and their well-tried, well-functioning operational routines.

Self-evident as it may be, it is perhaps as well to mention that the interviewers' acceptance of the new method is an indispensable prerequisite for the change to be undertaken. It was therefore important that their attitudes and views be ascertained and taken into account.

By way of the test we collected a very extensive range of material that we meticulously analysed and evaluated. Everything that had been planned was carried out, and we regarded there as being an adequate basis on which to decide about CADAC's future.

Parts of the material (e.g. to do with the field-work process) are in fact so large in themselves that there is reason for further information and analysis in order to provide the interview organisation with a deeper understanding of the nature, conditions and development potential of the new method. Such an understanding can play an important part with regard to how future interviewers are to be trained.

We take up now the question of what the chief results were with regard to each of the three above-mentioned criteria.

Quality

That the test was of so comprehensive a scope - with some 17,000 CADAC interviews and many times that number of PAPI ones, together with more than 3,000 reinterviews and other supportive information - ensured that there was a fine basis for a quality comparison. We found that the CADAC and PAPI estimates regarding the central LFS variables were very much alike, and in the light of this it should be possible to bring CADAC into use at a rate of about 20% per quarter without recourse to a special technique of estimation during the introductory period.

Thus it should be possible to completely replace PAPI by CADAC in the labour force surveys within the space of one year, at the end of which time it will be possible to say more definitively, and with considerably greater precision than today, what effect the change of method has on the estimates.

Nevertheless there are significant differences between certain PAPI and CADAC estimates, first and foremost concerning the permanently employed and the temporarily employed. It would seem, though, that these differences are to be explained by the fact - which went unnoticed until a late stage of the test - that the CADAC and PAPI forms did not have the same layout. This is a crystal-clear example of how even the slightest change of layout can have a marked effect on the estimates of central variables. The effect of the readjustment will be closely followed by way of further comparison of CADAC estimates with PAPI ones.

There was according to CADAC a somewhat broader distribution of number of hours worked than there was according to PAPI. Probably this was because deviation from the standard class, 40 hours, is easier to code when one has the CADAC system to aid one in one's calculations.

It seems of interest to at this point extend the discussion by considering a number of other sources of error associated with the data-collection process. One of them is data registration, and here CADAC represents an improvement, because whilst in the case of PAPI the handwritten information on the questionnaire had to be separately registered (whereby errors could occur), the CADAC interviewer does the registration direct. It has been said now and then that a disadavantage of CADAC is that it may not provide a sufficient basis for the coding of the open type of answer. Can this have to do with the interviewer's poor typing ability and inexperience concerning the computer? Our own observations indicate that CADAC's limitation with regard to the coding in

question is very tiny, anyway when it comes to the description of occupation and branch of industry in the labour force surveys. Furthermore we believe that it will become tinier and tinier as the interviewers get more used to typing and to the computer. (The proportion of incomplete information was in fact low in both PAPI and CADAC.)

Did, then, CADAC lead to an improvement in quality? There is no evidence of any general improvement in the case of the estimates, though the matter of the distribution of number of hours worked does indicate that CADAC would appear to have the potential to raise quality by way of offering the interviewer support with regard to questions that involve calculation or some other form of complication. One might think that the absence of wrong jumps on the CADAC questionnaire would mean better quality, but in fact we found no evidence of this, and the reason must be that the PAPI interviews had been subjected to an editing and correction process that put their results on a par with those of the CADAC interviews. On the other hand CADAC does dispose of the work of correction of error, and has the data ready faster - which is an improvement in quality from the temporal point of view.

It is evident that CADAC offers a much better control and follow-up of the data-collection process than does PAPI, and this is of great importance with regard to the development potential of Statistics Sweden's interview organisation inasmuch as the latter is based on decentralisation.

Used in the right way, the new method can mean a raising of the overall quality of the work of data collection - and there are observations and results in the study that confirm this. Since with CADAC the interviewer has more time for tracing within a given field-work period, for instance, this important part of the work ought to become more efficient, resulting in a lowering of the proportion of persons not reached. The value of having quick access to information about the work situation in the field can hardly be exaggerated in this connection.

Realising the potentialities of CADAC is one of the more interesting challenges awaiting us. *But whether such potentialities are realised or not depends to a large extent on how the interview unit implements and operates the method.*

One of the things learnt from the test was that CADAC facilitates the attachment of supplementary questions. It was also learnt (partly through mistakes that were made) that CADAC makes it possible to quickly and relatively easily make changes in forms and instructions, so that every interviewer can start the day with a new version made overnight. In the light of all this it would seem an attractive prospect to undertake a greater number of split-ballot experiments in the future, whereby for instance different parts of the sample receive differently formulated questions. The final result should be a better and more frequent use of these possibilities in connection with various types of experiment.

Economy

The test largely confirmed what had been assumed with regard to costs and potential savings, at the same time as it has enabled us to give greater precision to our financial estimates.

First and foremost the big savings were just as expected, deriving from the disappearance of separate data registration, of central editing and correction, and of the need to complete inadequate answers (this inadequacy being mostly the result of wrong jumps on the forms), and deriving, too, from reduced costs for paper and postage.

We are unable to say whether the interviewing time as such (i.e. the time from the start of the interview itself to its finish) diminished or increased in CADAC as compared with PAPI, but the interviewers' total time (i.e. including planning, tracing, etc.)
was somewhat less. Since, however, the quality of the time measurement is far from satisfactory, we have been unable to assess where the saving occurred. The interviewers' communication routines are to be rendered more efficient, and this should lead to a further time reduction, whereafter it seems reasonable to reckon on a total saving of some 10% of the interviewers' total time (as compared, that is, with PAPI).

The estimated cost of having CADAC in operation instead of PAPI indicates a saving of some SEK 5m during a three-year period. This, though, is without taking into consideration the pretty appreciable development costs in the past; furthermore it assumes on the one hand an efficient implementation of CADAC in day-to-day operation, and on the other hand the extension of its use beyond the monthly labour force surveys.

Reliability

At the same time as there could be no question of deciding to make CADAC a standard feature of the labour force surveys unless it fulfilled the high demands regarding the basis of information to be provided for making the appropriate estimates, there was doubt as to whether it had attained the technical level required for efficient day-to-day operation in these important surveys (whose current production system was fast and well-functioning).

The scope and length of the test facilitated the evaluation of CADAC's technical side and enabled the system to be "tuned up" in circumstances that were realistic but at the same time made favourable by the specific test situation. Furthermore the evaluation acquired especial weight inasmuch as the test was incorporated in the ordinary labour force surveys (a separate test almost invariably involving a degree of uncertainty as to what would "really" happen). To have brought CADAC into operation directly after the limited 1988 technical tests might have had a disastrous effect with regard to its further development, such were the risks of interference that obviously existed.

Though during the course of the test it emerged that there were shortcomings in the administrative system, they were got rid of quite quickly, and during the final stage the data collection process was under firm control. To a large extent, however, this achievement was due to the remarkably energetic and committed efforts of the project's development staff and those responsible for the system's operation. But it cannot be expected that such efforts should be repeated again and again, therefore it is important that the "tuning up" of the system should continue during the coming build-up period. The goal must be to achieve such a degree of automatisation and process control that the interview unit can operate the system with relatively little effort. Maintenance and development, on the other hand, will of course continue to require the expert.

Further comments

The interviewers' attitude to the new technique is consistently positive, as emerges rather clearly from the survey. By and large the working conditions are experienced as being good, and the majority of interviewers have no difficulty reading from the computer screen. On the other hand there do exist ergonomic problems which must be attended to in the future development of CADAC. Not that these problems are more serious than in the case of PAPI - but they are anyway serious enough (as became clear both from the earlier technical tests and from the production test).

It is important that there be good training for the interviewers, and proper follow-up during the first CADAC period. It became clear from the test that inadequate training leads to lower efficiency and a less positive attitude to working with the computer. Thus a reorganisation of the interviewers' basic training - given greater emphasis by the work with CADAC - should be accorded high priority in connection with the further implementation of the new method.

CADAC after the test

From the beginning it was not quite clear what would become of CADAC after the 6(7)-month test period, though the general opinion was that there should be implementation provided that the test did not indicate that CADAC caused serious disturbance in the labour force surveys, or indicate that there were operational problems of a more technical sort.

The continuous evaluation of the test did not indicate any serious disturbance. Problems had arisen, but had also been eliminated step by step, therefore the working group recommended that the pilot operation of CADAC be continued pending further evaluation and analysis. Thus CADAC was to go on, on the same scale and with the same interviewers. It was first and foremost the results of the reinterviews that had to be waited for, therefore it was too early at that stage to say anything definite about differences in estimates.

Continued pilot operation would also provide further valuable material and improve the the accuracy of the quality comparison.

Postscript

In the light of the result of the test Statistics Sweden has taken the decision (June 1990) to computerize the interview work and implement CADAC. The acquisition of equipment and the training of all the interviewers are to take place during the fiscal year 1990/91, in accordance with a special plan. CADAC is to be gradually brought into use in the monthly labour force surveys, the process to be completed by June 1991.

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Questionnaire Used in Labour-Force Surveys

English Version

INTRODUCTION

Start the interview by giving a short introduction. Do not hesitate to use own words, but the contents should be as follows:

The questions I would like to ask concern work, studies and wishes about work. I am not going to ask about income or profit from work, only what kind of work you are doing and how many hours you are working.

The period I am asking about is up to and including ..... (last day of the measurement week).

First I have som questions regarding your normal situation at work, and then regarding a specific week (the measurement week).

GENERAL CLASSIFICATION

G 1 Do you have a job/are you gainfully employed?
1 YES
2 NO

G 2 You must include all paid work even if it is only for a few hours and if you are self-employed or work freelance. Do you have any work of such a kind?
1 YES
2 NO

G 3 Although you are not working in a job/are not gainfully employed just now do you have any work from which you have sick leave or leave of absence?
1 YES
2 NO

G 4 Do you usually do unpaid work on the farm or in the business of some member of your family?
1 YES
2 NO

MAIN EMPLOYMENT

G 5 Whom do you work for? Name ....
Address ....

G 6 Are you employed, self-employed or do you do unpaid work helping a member or your family: name (see QUESTION G 5)?
1 Employed
2 Self-employed
3 Helping member of your family

G 7 Do you employ anyone?
1 YES
2 NO

G 8 Do you work full time or part time?
1 Full time
2 Part time

G 9 What sort of employment do you have?
Is it for a limited time. e.g. as a substitute, is it relief work, seasonal or similar work, or are you employed on a permanent-staff basis/on a further-notice basis. IF NOT PERMANENT. What kind of employment for a limited time do you have?

PERMANENT APPOINTMENT

01 On the permanent staff/on a further notice basis

02 Substitutes for someone else (you were already a member of the permanent staff or on a permanent staff elsewhere)

EMPLOYED FOR A LIMITED TIME

03 Substitutes for someone else (you were not then a member of the permanent staff or on a permanent staff elsewhere)

04 Appointment on a trial basis

05 Practical work experience

06 Relief work

07 Youth-opportunities-scheme place

08 Member of a youth team

09 Vacation work

10 Seasonal work

11 Appointed for a special purpose/project

12 Sent for when needed

Something else. Describe

.....

. ...

G 10 What is the address of your place of work? ☐ Same as G 5

G 11 What is the main line of business (manufacture) of your place of work?

ISIC ☐☐☐☐

1 governmental
2 public utility
3 municipal
4 county council
5 some other official institution
6 private

G 12 What, mainly, is the nature of your work?

G 13 In what occupation would you class your work?

SIDE-LINE (SECOND JOB)

G 14 Do you have more than one job/kind of work? If you do, it might be extra work, a side-line or that you usually work without pay on the farm or in the business of some member of your family.

1 YES
2 NO

G 15 Are your employed, self-employed or do you work without pay, helping a member of your family?

1 Employed
2 Self-employed
3 Helping member of your family

G 16 Where do you work at your (main) side-line (second job)?

Name ... .
Address ....

G 17 What is the address of your place of work? ☐ Same as G 16

G 18 What is the main line of business (manufacture) at your place of work?

G 19 What, mainly, is the nature of your work?

G 20 In what occupation would your class this work?

G 21 Are you a member of a trade union?

G 22 What union do you belong to?

G 23 ONLY TO THOSE EMPLOYED FOR A LIMITED TIME

To get an idea of how much you usually work, I should also like to ask you how much you have worked in the past year, that is from the beginning of .... last year. You only need to give me a rough idea.

If we first think of the last three months

... .

..... . how much did you work altogether then? Was it practically equivalent to full time or part time or was it for less? (You should count absences e.g. holidays, illness and leave of absence, as work, too).

4.

And the months before then ..... that is ....

Hours					
0 Not at all	1-99 Less than one day/week	100-199 Less than part time	200-299 Part time	300-399 More than part time	400- Full time
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

G 24 Do you mainly regard yourself as ... .?

1 Gainfully employed

2 Studying

3 Having old-age/occupational pension

4 Having early-retirement pension

5 Running your home

6 Looking for work

Something else. Describe
....

G 25 NO WORK

Do you mainly regard yourself as .....?

01 Studying

02 Running your home

03 Having old-age/occupational pension

04 Having early-retirement pension

05 Looking for work

06 Doing military service

Something else. Describe
....

07 Admitted for institutional treatment (less than 1 year)

08 Illness (less than 1 year)

11 Admitted for institutional treatment (1 year)

12 Prolonged illness (1 year)

13 Place of work abroad (1 year)

14 Place of work abroad (less than 1 year)

G 26 Have you had any work in the past year, that is since . ..... last year?
1 YES
2 NO

G 27 We should like you to think carefully about this so that you include minor temporary work you have undertaken. Have you had any such work?
1 YES
2 NO

G 28 Which was the last month you had work? Month ....

G 29 Was your last work employment or did you work as self-employed or unpaid in the business of a member of your family?

1 Employed

2 Self-employed

3 Helping member of your family

G 30 What sort of employment did you have? Was it for a limited time e.g. as a substitute, was it relief work, seasonal or similar, or were you employed on a permanent-staff basis/on a further notice basis. IF NOT PERMANENT. What kind of employment for a limited time did you have?

01 On the permanent staff/on a further notice basis

02 As a substitute for someone else (you were already a member of the permanent staff or on a permanent staff elsewhere)

03 As a substitute for someone else (you were not then a member of the permanent staff or on a permanent staff elsewhere)

04 Appointment on a trial basis

05 Practical work experience

06 Relief work

07 Youth-opportunitites-scheme place

08 Member of a youth team

09 Vacation work

10 Seasonal work

11 Appointed for a special purpose/project

12 Sent for when needed

Something else. Describe:

....

G 31 To get an idea of how much you usually work, I should also like to ask you how much you have worked in the past year, that is from the beginning of ... ... last year. You only need to give me a rough idea.

If we first think of the last three months.

.....

..... how much did you work altogether then? Was it practically equivalent to full time or part time or was it for less? (you should count absences e.g. holidays, illness and leave of absence, as work, too)

And the months before then . .. that is .....

Hours					
0 Not at all	1-99 Less than one day/week	100-199 Less than part time	200-299 Part time	300-399 More than part time	400- Full time
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6
1	2	3	4	5	6

MEASUREMENT WEEK QUESTIONS Note: (I:E = Interviewee)

PERMANENT APPOINTMENT AND EMPLOYED FOR A LIMITED TIME

INTRODUCTION: The questions that now follow relate to a certain week, Monday / until and including Sunday /, that is week ....

M 1 How many hours did you work that week? (IF I:E HAS A SIDE-LINE, (SECOND JOB) ASK ABOUT HOURS WORKED IN BOTH MAIN EMPLOYMENT AND SIDE-LINE)

Main employment	Side-line (second job)	Total	Absent whole week
⌊_⌋_ hours	⌊_⌋_ hours	⌊_⌋_ hours	⌊_⌋

M 2 How many hours per week have you agreed to work for your employers(s) (IF I:E HAS A SIDE-LINE, ASK ABOUT HOURS WORKED IN BOTH MAIN EMPLOYMENT AND SIDE-LINE)

			Only worked in measurement week
⌊_⌋_ hours	⌊_⌋_ hours	⌊_⌋_ hours	⌊_⌋

M 3 Work out the difference between Questions M1 and M2 in main employment ⌊_⌋_ hours

1 Less than usual
2 More than usual
3 The same as usual

M 4A Why did you work less than you should have just this week (in your main employment)?

M 4B Why did you not work at all this week (in your main employment)?

01 Ill

02 Holiday

03 Military service/refresher military training

04 Paid parental leave in conjunction with birth of a child

05 Some other paid parental leave

06 Unpaid leave of absence for care of child

07 Leave of absence to study (without pay)

08 Some other leave of absence

09 Distribution of working hours

10 Flexible working hours

11 Compensatory leave/time off in return for extra hours

IF I:E SPONTANEOUSLY GIVES SEVERAL REASONS, GIVE REASON NO. 2 HERE ⌊_⌋

12 Began/ended a job

13 Short-time week

14 Laid off

15 Shortage of work

16 Industrial dispute

17 Not sent for by employer
18 Had not started work measurement week
→ WRONG, go back to G 1

Some other reason. Describe
. . . . . .
. . . . . .

M 5 Why did your work more than you should have just this week (in your main employment)?

1 Overtime
2 Extra time (only for part-timers)
3 Distribution of hours
4 Flexible working hours, worked extra hours to get hours or days off

Something else. Describe ... .
....

M 6 You say you work .... hours/week (total - according to Question M 2) Would you like to work more?

1 YES
2 NO

M 7 By how many hours/week would you then like to increase your (total) hours of work?

|_|_| hours more

M 8 What is the chief reason why you are not already working so much?

LABOUR-MARKET REASONS

1 No more work to be had at present at employer's and I:E does not want to change job
2 General shortage of work locally

Some other reason. Describe:
....
....

Go to M 36

PERSONAL REASONS

4 Ill yourself
5 Busy looking after the home/-caring for the family
6 Child care could not be arranged
7 Does not pay, economically

Some other reason. Describe:
. ...
....

M 9 Have you done anything about getting more hours of work?

1 YES
2 NO

M 10 In what way have you looked for more work?

1 Present employer
2 Some other employer
3 Employment office
4 Advertisement

Some other way. Describe .....
... .

MEASUREMENT WEEK QUESTIONS

SELF-EMPLOYED AND UNPAID FAMILY WORKERS

INTRODUCTION: The questions that now follow relate to a certain week, Monday / until and including Sunday /, that is week .....

		Main employment	Side-line (second job)	Total	Absent whole week
M 11	How many hours did you work that week? (IF I:E HAS A SIDE-LINE, (SECOND JOB), ASK ABOUT HOURS WORKED IN BOTH MAIN EMPLOYMENT AND SIDE-LINE)	⌊__⌋ hours	⌊__⌋ hours	⌊__⌋ hours	⌊_⌋
M 12	How many hours do you work on average per week (during this season) (IF I:E HAS A SIDE-LINE (SECOND JOB), ASK ABOUT HOURS WORKED IN BOTH MAIN EMPLOYMENT AND SIDE-LINE)	⌊__⌋ hours	⌊__⌋ hours	⌊__⌋ hours	Only worked in measure-ment week ⌊_⌋

IF THE I:E'S TOTAL HOURS ARE LESS THAN 8 HOURS/MONTH AND I:E HAS NOT WORKED IN THE MEASUREMENT WEEK, THE I:E BELONGS TO 'PAST YEAR' GENERAL CLASSIFICATION

M 13 Work out the difference between Questions M 11 and M 12 in main employment ⌊__⌋ hours

1 Less than usual
2 More than usual
3 The same as usual

M 14A Why did you work less than you usually do just this week (in your main employment)?

M 14B Why did you not work at all this week (in your main employment)?

01 Ill
02 Holiday
03 Military service/refresher military training
04 Paid parental leave in conjunction with birth of a child
05 Some other paid parental leave
06 Unpaid leave of absence for care of child
07 Studying
08 Lack of work
09 Distribution of working hours
10 Flexible working hours

Some other reason. Describe:
... .
. . ..

IF THE I:E SPONTANEOUSLY GIVES SEVERAL REASONS, GIVE REASON NO. 2 HERE ⌊__⌋

M 15	Why did you work <u>more</u> than you usually do just this week (in your main employment)?	1 Increased work load (temporary) 2 Distribution of working hours 3 Flexible working hours Some other reason. Describe . . . . .

IF 1-40 HOURS ACCORDING TO M12, 41 HOURS OR MORE → M36

M 16	You say you work .... hours/week (total - according to Question M 12) Would you like to work more?	1 YES 2 NO
M 17	By how many hours/week would you like to <u>increase</u> your (total) hours of work?	⌊_⌋⌊_⌋ hours <u>more</u>

MEASUREMENT WEEK QUESTIONS

DOES NOT HAVE WORK (PAST YEAR and NO WORK)

INTRODUCTION: The questions that now follow relate to a certain week, Monday / until and including Sunday /, that is week .....

M 18 Would you have liked to have gainful employment that week?
1 YES
2 NO

IF I:E WORKED MEASUREMENT WEEK -- WRONG -- RETURN TO G1

M 19 What is the main reason why you do not want work?

01 Studying
02 Retired
03 Health reasons
04 Care of children
05 Care of relative
06 Running a home
07 Little chance of getting work
08 Young people first
09 Doing military service
10 Waiting for new work

Some other reason. Describe:
. .....
.....

M 20 How many hours would you like to work?
hours

M 21 Would you have been able to take work that week?
1 YES
2 NO

M 22 What was the reason why you could not take work?

01 Studying
02 Child care could not be arranged
03 Care of relative
04 Running a home
05 Ill yourself
06 Doing military service

Some other reason. Describe:
.... 09

PREVENTED TEMPORARILY BY (maximum 14 days)

10 Ill yourself

Some other reason. Describe:
.....
.....

M 23A Would you have looked for work that week if you had not been prevented temporarily?
1 YES
2 NO

M 23B Have you looked for work and, if so, when was the most recent occasion?

1 Measurement week

2 Waiting for new job to begin within 4 weeks

3 Waiting for notification within 4 weeks

4 Before the measurement week but within 4 weeks (excl. alternatives 2-3)

5 1 month - 6 months ago

6 7 months - 1 year ago

7 More than 1 year ago

8 Never looked for work

M 24 Why did you not look for work that week?

1 No suitable work locally
2 Little chance of getting work
3 Young people first
4 Never got around to do it

Some other reason. Describe:
. . ..
. ...

M 25 In what way did you look for work?

1 Employment office
2 Employer
3 Advertisement

Some other reason. Describe:
... .
. ...

M 26 How many weeks have you been looking for work? ⌊_⌋⌊_⌋ weeks

---

M 27 IF 'PAST YEAR' GENERAL CLASSIFICATION: PUT 'YES' WITHOUT ASKING THE QUESTION

Have you ever worked before?

1 YES
2 NO

M 28 One can of course begin to look for work IMMEDIATELY after one has left a job, or one can prefer to begin working again after a BREAK for a time. How did you begin looking for work. By 'immediately' we mean no more than a month

1 Began looking IMMEDIATELY (no more than a month) after previous job

2 Began looking after a BREAK for a time

M 29 Did you stop working because of redundancies or stoppages, because the work you were employed to do has been completed, or for some other reason?

01 Redundancies or stoppages
02 Work employed for terminated
03 Child care could not be arranged
04 Wanted to care for your children in the home yourself
05 Health reasons
06 Studying
07 Retirement
08 Family member transfer
09 Did not get on well

Some other reason. Describe
. . . . . .
. . . . . .

M 30 Whom did you most recently work for?

Name . . . . . .
Address . . . . . .

M 31 What was the address of your place of work? . . . . . Same as M 30

M 32 What is the main line of business (manufacture) of your place of work? . . . . . .

M 33 What, mainly, was the nature of your work? . . . . . .

M 34 In what occupation would you class your work? . . . . . .

M 35 Are you a member of a recognized unemployment-insurance fund?

1 YES
2 NO
3 DON'T KNOW

QUESTIONS ABOUT STUDYING
TO EVERYONE (EXCEPT THOSE CLASSIFIED AS BEING OUTSIDE THE LABOUR FORCE)

IF THE ANSWER TO QUESTIONS M4, M14, M19,
OR M22 WAS STUDYING" MARK WITH A 'YES'
NOTE! NOT APPLICABLE DURING SUMMER VACATION

M 36 Are you studying anything at present?
1 YES
2 NO

M 37 Are you studying full time or part time?
1 Full time
2 Part time

M 38 How many hours in all were you studying in this week? Include both lesson time and other time used for studying
⌊_⌋⌊_⌋ hours
1 NOT STUDYING IN MEASUREMENT WEEK

FAMILY QUESTIONS

Now here are some questions about you and your family

F 1 Are you married, cohabiting or single?
1 Married
2 Cohabiting
3 Single

DO NOT ASK IA (Admitted for institutionel care more than 1 year)

F 2A Do you have any children at home under the age of 25?
1 YES
2 NO

F 2B How many?
⌊_⌋⌊_⌋

F 2C When were the children born?

(IF MORE THAN 6 CHILDREN, GIVE THE 6 YOUNGEST)

Year	Month
⌊_⌋⌊_⌋	⌊_⌋⌊_⌋
⌊_⌋⌊_⌋	⌊_⌋⌊_⌋
⌊_⌋⌊_⌋	⌊_⌋⌊_⌋
⌊_⌋⌊_⌋	⌊_⌋⌊_⌋
⌊_⌋⌊_⌋	⌊_⌋⌊_⌋
⌊_⌋⌊_⌋	⌊_⌋⌊_⌋

GO TO U1 OR U2 OR TERMINATE THE INTERVIEW

15.

LAST OF ALL, A QUESTION ABOUT YOUR EDUCATION

U 1 What sort of schooling have you had? Include vocational training in a school form, full time, if it was at least 2 months in duration

GIVE THE TYPE AND LENGTH OF THE EDUCATION AND THE SCHOOL

... .
.. ..

CODE THE TYPE AND LEVEL OF THE EDUCATION BELOW

TYPE

0 General basic education

1 Arts, humanities and religious education

2 Teacher training

3 Administration, trade and commercial as well as economic, social science and behavioural science education

4 Industry and handicrafts as well as technical and scientific education

5 Transport and communications

6 Nursing, etc

7 Agriculture, horticulture, forestry and fisheries

8 Service occupations as well as training for civil guard duties and military service

9 No education and also education that cannot be classified under a specific main group

THE HIGHEST, COMPLETED education is to be marked.

N.B.
A study course of at least 20 points at a university or university college is counted as completed education

LEVEL

10 Pre upper-secondary-school education, less than 9 years

20 Pre upper-secondary-school education 9 (10) years, unified, comprehensive schooling

31 Upper-secondary-school, education, at most 1 year

32 Upper secondary-school, education, more than 1 year, no more than 2 years

40 Upper-secondary-school education, more than 2 years

50 Post upper-secondary-school education, at most 2 years

60 Post upper-secondary-school education, more than 2 years

70 Postgraduate education

No particulars available. (Reason given below)
. ...

Non-response because of

☐ Indirect interview
☐ Foreign education impossible to give a code
☐ Refusal
☐ Other non-response

( ) DOUBTFULL CODING

R & D Reports är en för U/ADB och U/STM gemensam publikationsserie, som fr o m 1988-01-01 ersätter de tidigare "gula" och "gröna" serierna. I serien ingår även **Abstracts** (sammanfattning av metodrapporter från SCB).

R & D Reports Statistics Sweden are published by the Department of Research & Development within Statistics Sweden. Reports dealing with statistical methods have green (grön) covers. Reports dealing with EDP methods have yellow (gul) covers. In addition, abstracts are published three times a year (light brown /beige/ covers).

Reports published earlier during 1990:

1990:1 (grön)	Calibration Estimators and Generalized Raking Techniques in Survey Sampling **(Jean-Claude Deville, Carl-Erik Särndal)**
1990:2 (grön)	Sampling, Nonresponse and Measurement Issues in the 1984/85 Swedish Time Budget Survey **(Ingrid Lyberg)**
1990:3 (grön)	Om justering för undertäckning vid undersökningar med urval i "rum och tid" **(Bengt Rosén)**
1990:4 (gul)	Data Processing at the Central Statistical Office - Lessons from recent history **(M. Jambwa)**
1990:5 (beige)	Abstracts I - sammanfattning av metodrapporter från SCB
1990:6 (grön)	Sequential Poisson Sampling from a Business Register and its Application to the Swedish Consumer Price Index **(Esbjörn Ohlsson)**
1990:7 (grön)	Kvalitetsrapporten 1990 - huvudrapport **(NN)**
1990:8 (grön)	Kvalitetsrapporten 1990 - bilagor **(NN)**
1990:9 (grön)	Datorstöd vid datainsamlingen **(Carina Persson, Marit Jorsäter)**
1990:10 (beige)	Abstracts II - sammanfattning av metodrapporter från SCB

Kvarvarande **beige** och **gröna** exemplar av ovanstående promemorior kan rekvireras från Inga-Lill Pettersson, U/LEDN, SCB, 115 81 STOCKHOLM, eller per telefon 08-783 49 56.

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