

A STUDY ON THE FUTURE OF THE CENSUS OF POPULATION

Alternative approaches

eurostat

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OF THE CENSUS OF POPULATION**
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**A STUDY OF THE FUTURE OF THE CENSUS OF POPULATION:
ALTERNATIVE APPROACHES**

Philip Redfern

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of the European Communities**

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SUMMARY

The study examines the recent experience of censuses of population and housing and plans for future censuses in fifteen countries: the twelve members of the EEC and also Canada, Sweden and the United States.

In the 1980 round of censuses, Denmark was unique in replacing a conventional census enumeration by a census that linked data from population registers to data from other administrative registers: a register-based census. Sweden's census was also essentially register-based; but a short census questionnaire was retained and the responses linked to the data from registers. Of the other countries, eleven took a conventional census in the period 1980-82; the Netherlands cancelled its 1981 census fearing an unfavourable public reception; and the Federal Republic of Germany is to take its census in 1987 following objections to the plan for a 1983 census that were upheld by the Constitutional Court. Among the countries that took conventional censuses the main problems were logistical rather than technical: they concerned organisation, personnel and funding.

The report considers the merits of the conventional method and its demerits, particularly cost and public acceptability. The census practices of countries are compared in such matters as topic content, measurement of coverage and the release of microdata. There is a discussion of the ways in which administrative records can support a conventional census.

The section on sample surveys concludes that sample methods play an increasingly important rôle in supporting and complementing the census, but that they cannot replace complete counts.

The report notes that every country has a wide range of administrative registers; but in some countries they are dispersed and uncoordinated while in other countries they are coordinated through an effective and accurate system of population registration and personal reference numbers, as in Scandinavia and some Benelux countries. It is argued that a register-based census is feasible only if registers are coordinated in this way. The merits and demerits of a register-based census are discussed; in particular there is an assessment of the range and quality of data held in administrative registers.

Outside Scandinavia, none of the countries in this study envisages a move to a register-based census for the 1990 round. The possibility of making such a move later is discussed in terms of their differing situations in respect of 1) the infrastructure of population registers and personal numbering and its quality, 2) the institutional framework including legislation on data protection, and 3) public attitudes. The conclusion is reached that in most of the countries population registration and personal numbering would have to be improved in quality, extended or in some cases introduced in order to make a register-based census possible.

The register-based census is set in a much wider context when the case for a coordinated record system of the Scandinavian kind is outlined. This case concerns administrative and policy objectives rather than statistics: namely, the need to create a more effective, less costly and fairer system of public administration; the need to reduce tax evasion, fraud and crime; and the need to widen the policy options open to government. The report questions the view that population registration and the use of personal numbers represent an extra burden on the public and an infringement of liberty. But it recognises that national temperament and political thinking may inhibit the maintenance of accurate population registers.

As these wider issues are resolved and information technology develops further, more countries will have the technical capability of taking a register-based census. The report concludes that they will increasingly opt for this method, possibly supported by a short conventional questionnaire, in order to secure the economy of recycling data already held by government.

I INTRODUCTION

1.1 This study has been commissioned by the Statistical Office of the European Communities (Eurostat) and it aims to describe national experiences of censuses of population and housing and to consider the advantages and disadvantages of alternative approaches in different circumstances. The countries covered by the study are the twelve member countries of the Community and three other countries which have made important contributions to census methodology - Canada, Sweden and the United States.

1.2 This report brings together and develops the material contained in two earlier reports under the same title which I prepared for Eurostat in 1983 and 1985 respectively; these are referred to throughout this document as the 1983 Report and the 1985 Report. The 1983 Report was written on the basis of visits to six countries - Denmark, France, the Federal Republic of Germany, the Netherlands, Sweden and the United Kingdom, whose experiences were described in annexes to the report. The 1985 Report was written following visits to a further six countries in the Community - Belgium, Ireland, Italy, Luxembourg, Portugal and Spain - as well as visits to Canada and the United States that were funded by Statistics Canada and the US Bureau of the Census respectively. A major feature of this report is that it contains updated annexes describing the situations in all these countries together with an annex on the census in Greece following a recent visit to that country; several of the annexes have been extended and substantially rewritten. I am most grateful to the institutions and individuals in each of the 15 countries for the time they gave me to describe their situation. Each country has seen and commented on a draft of its annex, but I accept responsibility for any errors of fact or balance in the annexes or in the general report.

The background to the study

1.3 Censuses of population are a stocktaking of a country's most important resource - its people. The census is the oldest and biggest single item among a country's

statistical activities. It has evolved continuously over two hundred years during which great changes have taken place in society and in technology, and, from a technical viewpoint, it continues to meet most of the changing demands placed on it.

1.4 There is an increase in the demand for the statistics that the census of population provides: basic figures of the numbers of people and of their main demographic, social and economic characteristics, particularly for small geographic areas and small groups of the population. But the rôle of the conventional census has been increasingly called into question for three main reasons. First, censuses are very costly and the workload is highly peaked. So cost-conscious governments look for ways of avoiding or postponing a census or of slimming it. Second, the census has been increasingly seen, at least by some vocal sections of the public, as a burden on the citizen, an intrusion into his privacy and a threat to confidentiality. The census has become an issue in the public debate on computers and privacy. Whilst the census may be backed by the full force of the law, its success is wholly dependent on the understanding and support of the great majority of people. If that support is not forthcoming, the census is in jeopardy. Moreover a statistical operation that imposes a demand on every citizen is not a cause which most politicians are overtly eager to support.

1.5 Whilst public acceptability and costs are two main reasons for placing a question-mark over the future of the conventional census, a third reason is of a different kind: the emergence during the last twenty or thirty years of alternative statistical methods for providing some of the information that has come from the census of population. The first such method, sampling, may be applied in independent free-standing surveys, such as a labour force survey; sampling is also widely applied in support of the conventional census. The second method is the use of data from registers that are maintained primarily for administrative purposes. Each of the three

methods - the conventional census, sample surveys and registers - has its strengths and weaknesses, and the suitability of the one or the other depends also on the circumstances of the particular country, its existing statistical infrastructure and its needs.

1.6 These points have been demonstrated, sometimes dramatically, by the experiences of the '1980 round' of censuses in the member countries of the European Economic Community. In most of the countries a conventional census was successfully taken. But there were exceptions. In the Netherlands the 1981 census was cancelled following a significant level of refusal in the preceding 1971 census and poor response to a voluntary pilot test in 1979: statistics from sample surveys and from the population registers have been the substitutes for the lost census. In the Federal Republic of Germany the census was delayed to 1983 because of the time taken to negotiate the method of financing and to enact legislation. At a very late stage the 1983 census was cancelled following a wave of public protest and a ruling from the Constitutional Court that some aspects of the census plans - in particular the use of census data to update the population registers - were unconstitutional. Plans are now being made to take a census in Germany on 25 May 1987. In Denmark, on the other hand, the use for statistical purposes of administrative registers was developed from the 1960s onwards, culminating in a 1981 census of population and housing based entirely on information drawn from registers - in particular from the Central Population Register and the Central Register of Buildings and Dwellings. Such a census may be termed a register-based census or an administrative record census (ARC).

1.7 Statistics from the census of population are important to the working of the EEC and so Eurostat has promoted a set of census tabulations to be completed by each of the member countries of the Community following, so far as possible, uniform concepts, definitions and reference point in time. Given the different statistical traditions and

statistical infrastructures in the different countries, there could be no question of a common census methodology throughout the Community. But, as a means of exchanging information on different countries' experiences and of promoting discussion of alternative methodologies, Eurostat commissioned this study.

The content and layout of the report

1.8 The report deals with the three methodologies in turn: the conventional census in Sections II and III, sample surveys in Section IV, and registers in Sections V and VI. Section II first describes the main features of the census of population and the needs that it serves, and then considers the merits and demerits of the conventional method; in particular it looks at costs and public acceptability. This section includes a discussion on the use of census data to correct population registers. Section III compares census practices in the 15 countries and deals with such matters as the definition of the household, sampling at the collection stage, the topic content, the measurement of census coverage and the release of microdata. The paragraphs on particular topics include assessments of the relative merits of collecting information by means of a questionnaire or by extraction from administrative records. The section ends with a review of the ways in which administrative records may support or supplement a conventional census.

1.9 Section IV compares sample surveys with censuses, and lists some of the ways in which sample surveys and sampling methods may support a conventional census.

1.10 Section V begins by describing the essential features of a register-based census and of the data infrastructure on which it rests. It then contrasts the dispersed and uncoordinated administrative records that are found in many countries with the situation in the Scandinavian countries where records are coordinated through an effective system of population registration and personal reference numbers. The development of the

register-based censuses in Denmark and Sweden is outlined and the advantages and disadvantages of the method in their situation are considered. The question is then posed: is a register-based census feasible in a country whose records are not coordinated along Scandinavian lines? On this question the report takes a more pessimistic view than the 1983 Report by answering "no". The 15 countries in the study are compared in terms of population registers and personal numbering, leading to the conclusion that, outside Scandinavia, a register-based census would be technically feasible in the short term only in the Benelux countries. Feasibility is examined from two other angles: the institutional and legislative framework, including laws on data protection, and public acceptability.

1.11 Section VI outlines the administrative and policy reasons why coordinated record systems on Scandinavian lines are needed, and refers to the part that statisticians should play in their development.

1.12 Section VII sums up the main points in the report. Descriptions of the situations in the 15 countries, on which the main text of the report is based, appear in annexes.

II THE CONVENTIONAL CENSUS OF POPULATION: MERITS AND DEMERITS

Features of the census

2.1 Main features of the census mechanism are that it provides statistics at a single point in time for the country as a whole and for geographical subdivisions from the region and province to the census tract, enumeration district, city block, grid square or postcode area; that it interrelates the variables at the level of the individual unit; and that it shows the relationships between the individual units of different kinds - the person, the family, the household, the housing unit^x and (sometimes) the building. These are among the important strengths of the census method.

The need for the census

2.2 The census is needed to provide a basic framework of statistics about the population and groups within the population (such as the young and the aged, the economically active and the inactive, and those with particular educational attainments) and a similar framework of statistics on housing. The statistics are needed at all geographical levels. But they are needed especially for local administrative areas and for small areas (such as enumeration districts) that can be used as building bricks to aggregate to areas defined ad hoc, because nationwide sample surveys cannot provide reliable information for local areas. Census statistics are used by public authorities, business and research institutions, often in conjunction with information from more specialised sources and surveys. Examples of uses that receive a great deal of political attention are: for distributing between one area and another the representation in parliament and in municipal councils, and for revising electoral boundaries to reflect

^xThe term "housing unit" is used in this report to refer to a structurally distinguishable unit of accommodation that may occupy the whole of a building or, as in the case of an apartment or flat, just a part of the building.

shifts in population; for funding programmes and distributing government grants on the basis of formulae that take account of population; and for planning programmes of capital investment at the local level. Census data have important uses of a technical character: as a "benchmark" for correcting the annual estimates of the populations of local areas; as a sampling frame of persons or households or housing units; as a sampling frame of geographical areas (though it is arguable that remote sensing by satellite would equally serve this end); and in other rôles in support of sample surveys (for example to validate samples and to gross up results). The needs that are served by the census grow year by year. They do not diminish.

The technical limitations of the conventional census

2.3 A serious weakness of the census is that it occurs relatively infrequently. Most users of census statistics would probably press strongly for a census at five-year intervals, so that the rapid changes in society can be monitored. But cost and the burden on the public are strong deterrents. In only three of the countries studied has there been a mid-decade census between the 1980 and 1990 rounds - in Canada (after some hesitation when the incoming government's initial proposal was to axe the census as an economy measure), Ireland and Sweden - to which may perhaps be added Spain where the 1986 canvass for the population registers is equivalent to a census covering only basic demographic topics. A decennial pattern of censuses is more common; in this case the most recent census results are out-of-date at any moment of time by, on average, five years plus the time taken to process the results.

2.4 But for many purposes annual figures are needed: for example, figures of local populations analysed at least by age and sex for planning and for the distribution of public monies, and figures of the economically active population in small areas. The conventional census cannot meet these needs. In principle registers can if they contain a wide enough range of data of acceptable quality - though, as Danish experience shows,

economic constraints may limit the frequency with which the data from registers are fully exploited. And nationwide sample surveys can provide annual figures for the country as a whole and for major regions but not for smaller areas.

2.5 A second important limitation of the census is the range of topics that it can handle. The census questions must be factual and capable of being easily and reliably answered by people in all walks of life; they must be acceptable to the great majority of the public. And, more than ever before, the total set of questions must not be seen by the public as an unreasonable burden or an intrusion on privacy. The topics of income, educational attainments and ethnic origin are examples of questions that bristle with difficulties of definition, are sensitive to a good many people and in some cases place too great a demand on a person's memory. All these questions have given rise to difficulties in one country or another and an alternative approach by sample survey or by registers may be preferable. Certainly a sample survey can ask a greater number and range of questions than a census can, and can probe a subject in greater depth.

2.6 A third limitation of the census is that it is essentially a cross-sectional instrument. The time dimension can of course be introduced into the census by asking retrospective questions about past events: for example, a list of the dates of birth of all the children born to a woman, and a person's place of residence at a specified earlier date (to measure migration). Questions of these kinds are not ideally suited to the census. They rely on the formfiller's memory and are often answered inaccurately, and so may fit better into a register system or perhaps into a series of sample surveys in which successive "sweeps" are made with an unchanged sample (a longitudinal survey).

2.7 A fourth limitation of the census is the extent of the undercount (and sometimes the overcount) and of errors and biases in the responses to census questions. To make this point is not to imply that other methods - sample surveys and registers - are

superior in these respects; it is the relative levels of accuracy of the three approaches that have to be weighed against one another. The quality of data from censuses is discussed later (paragraphs 3.52-60).

2.8 Paragraphs 2.3 to 2.7 have discussed the technical limitations of the census and suggested that some needs for information might be better met, or might be met only, by use of some other instrument. Examples were given: annual information, information on income and information involving a time dimension. But the biggest challenges to the census are economic and political rather than technical: costs and public acceptability.

The cost of the conventional census

Table 1. The costs of the 1980 round of censuses.

Country	Year of census	Currency unit	Cost per person	Cost per person in US dollars ⁽¹⁾
Belgium	1981	Belgian franc	50 ⁽²⁾	1.5 ⁽²⁾
Canada	1981	Canadian dollar	5.4	4.5
France	1982	Franc	8	1.6 ⁽³⁾
Greece	1981	Drachma	100	2.0 ⁽⁴⁾
Ireland	1981	Irish pound	1.5	2.6
Italy	1981	Lira	2,100 ⁽³⁾	2.0 ⁽⁵⁾
Luxembourg	1981	Belgian franc	140	4.1
Portugal	1981	Escudo	63	1.1
Spain	1981	Peseta	40 ⁽²⁾	0.5 ⁽²⁾
Sweden	1980	Swedish krona	17	3.7
United Kingdom	1981	Pound sterling	1.0	2.2
United States	1980	US dollar	4.7	4.7

Notes

- (1) Conversion to US dollars on the basis of exchange rates at 31 March 1981.
- (2) Covers collection stage only.
- (3) Excludes costs of data processing within INSEE.
- (4) Covers also the censuses of buildings and agriculture.
- (5) Covers also the census of industry, commerce, services and handicrafts which shares the same field operation.

2.9 Comparisons between the cost of the census in one country and the cost in another country are difficult to interpret because of differences in the scope of the figures. Thus, the expenditure of agencies outside the census agency, such as the municipalities, may not be fully covered. The figures of cost in Table 1, which have been extracted from the annexes, must be read in conjunction with this caveat. In the final column of the table, costs have been converted to US dollars on the basis of exchange rates at 31 March 1981; these figures should be treated with caution.

2.10 Undoubtedly heavy costs have been a main factor to prevent censuses from being taken more frequently. Every census organisation has looked for ways of saving costs. Sometimes limited budgets have forced cuts that have been counter-productive: insufficient provisions for publicity, for a thorough analysis of the results or for post-enumeration surveys of coverage and quality - to take some examples.

2.11 It is not just that the census is expensive. The costs are sharply peaked over a period of a few months. Money apart, the concentration of effort over a short period demands very considerable feats of organisation. The recruitment, training and management of a large and temporary field force of enumerators is a major task, and several countries have found it increasingly difficult to recruit field staff of requisite quality in the numbers needed.

2.12 Census-takers are looking in a number of directions to save money. A form with fewer questions costs less at almost every stage of the census process; and the shorter the form the more acceptable it is to the public. A balance has to be sought between the savings from a shortened form and the loss of information. Other ways of cutting costs are discussed in Section III, including sampling at the collection stage and use of the mail.

A rolling census?

2.13 A radical way of saving cost and making the census more efficient has

sometimes been suggested, namely a 'rolling census'. A fraction of the territory, say a tenth in population terms, would be enumerated each year so that over a ten-year period the whole territory would be covered. Each year's tenth could be a sample of large areas, of small areas (such as conventional census enumeration areas) or, if address lists were maintained, of addresses. The merit of this proposal is that the census organisation would be continuously running - rather than building up from a low starting level to a feverish peak and then dying away again. So a much smaller, better trained and more experienced staff could be deployed both for the fieldwork and for processing. Just as the effort required for a rolling census would not peak to anything like the extent it does for a conventional census, so the public awareness of the rolling census would not be highly peaked. Whilst that might well lessen the risk of public protest, the reduced publicity would adversely affect the level of coverage achieved. Moreover, some of the procedures employed in a normal census to ensure a high level of coverage cannot be applied when only a sample of the population is to be enumerated. And, even if any sampling problems peculiar to the design of a rolling census could be resolved, the complete (100 per cent) count for a given area - as distinct from the annual sample estimates available for the larger geographical areas - could relate either to one particular year in the 10-year cycle or to some kind of average situation in several, or all ten, years; this would complicate the interpretation of the census results, especially comparisons between areas. Simultaneous national coverage, one of the virtues of the census, would be lost. The idea of a rolling census has not yet been developed and applied.

Public acceptability of the conventional census

2.14 To the citizen, obliged by law to complete a questionnaire, the census may seem a burden or an intrusion into his privacy. He may fear that personal data about himself will be used for purposes other than the preparation of anonymous census statistics or will become known to persons to whom he would not wish to reveal them.

He may see the gathering of census data as a way by which a potentially oppressive bureaucracy acquires more power over the citizen. Alternatively he may feel that he has already provided the government with much or all of the information on other occasions or that the census is an ill-judged use of the taxpayers' money.

2.15 For these and similar reasons the citizen may be reluctant to participate in the census, the more so if he has not been made aware of the positive side - the value of the census results. In every country there are groups within society ready not only to voice their own objections but to play on the fears of others and to incite them to obstruct the census enumeration. For some the census is seen as another opportunity to challenge the government and authority. And the media provide a vehicle by which the voice of protest reaches a nationwide audience.

2.16 This is the experience of the Netherlands in 1971, when there was widespread refusal to complete the census form (Annex 10), and of the Federal Republic of Germany in 1983, when, following a boycott campaign and a case before the Constitutional Court, the census was postponed and its procedures modified (Annex 5). Something of a similar kind happened in the UK in 1971 but on a smaller scale that did not seriously endanger the census. It has always been recognised that the census could only be successfully taken if it received the willing support of the great majority of the population. The truth of this has now been demonstrated. There seems no reason to believe that any highly-developed country enjoying unfettered public debate is immune from this hazard. And if the census comes under attack, the census authorities would be unwise to assume that they will receive strong political backing in countering the attacks: there are few votes to be won by politicians who defend the census.

2.17 The problem for census-takers is that the public mood at the time of the census is unpredictable: it can be disturbed by unforeseen and extraneous events. Few Germans

would have foreseen the 1983 controversy. And this kind of controversy is contagious and can cross frontiers. A conventional census is almost certainly more vulnerable to a sudden wave of opposition than a register-based census is.

2.18 Several things can be done to forestall public criticism. First, the number of questions in the census can be reduced to the minimum by off-loading to independent sample surveys topics which do not have to be analysed for local areas, and particularly questions that are sensitive, contentious, difficult to formulate or difficult to answer. It may be possible to off-load other difficult topics to register sources that can be linked to the census on a sample or full 100 per cent basis. Income and disablement are examples of topics that may be dealt with better through sample surveys or registers than through the conventional census. A number of countries, including the Federal Republic of Germany, Sweden and the UK, have made major cuts in the number of census questions asked - though not always primarily for reasons of public relations. The burden on the public can also be lessened by sampling in the field as is done in Canada and the United States (see paragraph 3.10).

2.19 Second, procedures designed to maintain confidentiality can be tightened. Examples are:

- (a) the provision of forms for an individual (or married couple) rather than for the household, as in the French and Swedish censuses and, now, in the revised plans for the 1987 German census;
- (b) use of mail-back or sealed envelopes to avoid personal details being seen by the enumerator collecting on the doorstep - though there are disadvantages in doing this (there is less help for the formfiller, and obvious errors or omissions can no longer be corrected at doorstep collection but necessitate a later call back or phone back); the return of completed forms by mail will be an option in the 1987 German census;

- (c) more care in the selection of enumerators and in ensuring their placement in areas where they are unlikely to be known;
- (d) the rigorous enforcement of vows of secrecy on the part of enumerators and others working on the census;
- (e) tight security, both physical and electronic, for census data;
- (f) publicity on the guarantees of confidentiality and on the means of enforcing them.

2.20 Census legislation usually embodies its own adequate and well-tested rules for the protection of personal data. But general legislation on data protection introduced in several countries on the lines of the Council of Europe's Convention of 1981 (the Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data) may be helpful in reassuring public opinion - particularly if it provides another mechanism for scrutinising the census procedures. There may be costs however: an additional burden on the census authorities and new restraints. Thus, the French legislation of 1978 on data protection provided the individual with a right of access to (and correction of) data relating to him collected in statistical surveys; and the Commission Nationale de l'Informatique et des Libertés (set up by the legislation) did not authorise the use of the files of the taxe d'habitation for the purpose of improving the coverage of the 1982 census enumeration.

Use of names in the census

2.21 Critics sometimes suggest that names should not be asked in a census; or that the record of the name should be destroyed at an early stage, for example when the remaining data are converted to electronic form. The feasibility of a census that does

not ask for names seems highly doubtful: names are needed for the accurate completion of the form and to enable errors and omissions to be rectified. Names may also be needed for linkage with data from sample surveys and registers. Census data may be used in medical follow-up studies or other types of longitudinal study, and here the names of the persons need to be retained throughout the duration of the study; but the link between the names and the data may be made less direct by giving each study member a special study reference number.

2.22 Different countries adopt different practices concerning the retention of names. Thus, in the Federal Republic of Germany the census data in electronic form do not include names and the census forms carrying the names are in due course destroyed. In the UK on the other hand, whilst the main census tapes do not carry names, the data for studies of a longitudinal kind necessarily carry the study members' reference numbers; moreover the census forms themselves are made public 100 years after the census for purposes of historical and genealogical research.

The use of census data to correct population registers

2.23 In some countries the census of population is a statistical operation in its strictest sense. In such countries firm assurances can be given that the census data referring to an individual will not be used for any administrative purpose and will not therefore be passed on to another agency in identifiable form except, perhaps, in limited cases for a purely statistical purpose. Assurances of these kinds are regarded as very important in securing wide public acceptance of the census. But in most of the countries that maintain registers of the resident population certain of the individual data from the census returns - the basic demographic data including addresses - are used to check, and as necessary to update, the registers (see Table 2, last column, on page 70). Even in countries whose population registers can be maintained to a high level of accuracy through the prompt notification of events, the periodic census may be seen as

a very desirable if not essential method of correcting accumulated errors and of providing a new bench-mark; in particular the names of people who have left the country without reporting the fact can be removed from the registers by means of the census check. Belgium offers an example of this situation. But in countries in which the public are often slow to notify events such as a change of address, the census is a key source of data for updating the population registers. This is the case in Italy and Spain. On the other hand, given that the registers serve administrative needs, reliance on an infrequent census as an updating mechanism can hardly be an adequate substitute for the prompt notification of events.

2.24 Because population registers serve administrative purposes, the use of census data to update the registers destroys the notion that the census has purely statistical ends. Moreover, it may encourage the public to imagine that all of the census data are made available for administrative use, and so jeopardise the public's willingness to respond. On the other hand, there is a rational argument that data needed for both administrative and statistical purposes should be collected in a single operation in order to save cost and the burden on the public. A note printed on the census questionnaire may inform the public that their answers to certain of the questions will be used for updating the population register. In Belgium, Italy and Spain the point is exposed in a more obvious way because the householder has to complete a separate (or detachable) questionnaire destined for use by the municipality in maintaining the population register at the same time as he completes the main census questionnaire destined only for statistical analysis.

2.25 However rational it may be to collect information needed for both administrative and statistical purposes in a single operation (the census), it is nonetheless controversial: it exposes the census to criticism and may undermine public confidence. This was confirmed by the events of 1983 in the Federal Republic of Germany, when the

Constitutional Court ruled that the practice of using census data to update the population registers - which followed the precedent of previous German censuses and was explained on the census questionnaire - violated the individual's right to privacy laid down in the Constitution.

2.26 Many would argue that inaccuracies in administrative registers arise from failures in the administrative system; and that the right way to ensure a high level of accuracy in the population register is to use it as an integral element of a wide variety of administrative schemes, as happens in the Netherlands. In that situation the corrections that can be made using data from the census are minimal in extent and are unlikely to justify the extra risks to the census.

Publicity

2.27 Apart from the serious problems faced in the Federal Republic of Germany in 1983 and the problems that were anticipated in the Netherlands in 1981, public support for the 1980 round of censuses was generally good. Part of this success has been attributed to well-prepared publicity campaigns. Publicity for the United States 1980 census was described as "unprecedented" in scale and was directed particularly at minority communities that had been undercounted in the past. Some of the failures - notably in Germany in 1983 and less seriously in Portugal in 1970 - may be attributed, at least in part, to inadequate arrangements for handling public relations. As a result of these experiences, the Portuguese census of 1981 was accompanied by a more thorough publicity campaign; and a substantial financial provision has been set aside for publicity for the German census planned for 25 May 1987.

2.28 An important aim of publicity should be to maximise the number of people who identify themselves with the census. But every successful salesman or publicist needs a good product to work on: in this case a well-designed census in which public

acceptability has been given its proper weight as a design criterion. As the results of the census emerge, their presentation to a wider audience than the expert analyst not only extends the use of census statistics but also helps to increase public awareness of the census and hence public cooperation. At a deeper level there is a need to convince users and the public generally that census results are reliable and fair; the number of legal challenges to the results of the 1980 census in the United States suggests that many people remained to be convinced.

III THE CONVENTIONAL CENSUS OF POPULATION: COMPARISONS AMONG 15 COUNTRIES AND WITH THE REGISTERED-BASED CENSUS

The aim of this section of the report

3.1 Comparison of the census experiences of the countries in this study reveals both similarities and contrasts, and this section aims to identify some of them. The paragraphs on particular topics also make comparisons with a register-based census.

Who should be counted in the census?

3.2 There are two ways of counting the people at a given address or in a given geographical area: those present there at the time of the census and those usually resident there. There is little ambiguity in the concept 'present', but for some people there is uncertainty in the concept 'usually resident'. On the other hand, the numbers usually resident are more stable, and less affected by the fortuitous circumstances of census day, than the numbers present. Moreover, most users' needs are better served by statistics of the usually resident population; in particular, household composition is better recorded in terms of those usually resident in the household.

3.3 The people for whom the term 'place of usual residence' presents difficulties are those who have connections with more than one address: they may therefore be counted twice in a census of usual residents or in some cases omitted by the form-fillers at both addresses. Examples are: persons with second residences; workers living part of the week (or year) away from their families - perhaps abroad; students living part of the year at college and part at home; personnel of the armed services; members of a family boarded out at old people's homes or children's homes; and married couples living apart. Most of these categories present the same difficulties to those in charge of population registers as they do to those taking a census of usual residents. The uncertainties can be resolved only by laying down rules - which, indeed, may not suit the needs of all users.

3.4 The fieldwork for an enumeration of the persons present at every address must be completed in a few days if it is to accurately record the transient situation on census day (or night). But for an enumeration of the persons usually resident at every address, the fieldwork may be spread over a longer period, sometimes several weeks.

3.5 In almost all the countries studied the census form asks for a return of those usually resident - an essential requirement in those countries in which data from the census are used to update the population registers. In the Federal Republic of Germany a person with more than one place of residence must be returned in the census at each place - in line with the procedure followed for population registration; double counting in the statistics is avoided by means of the answers to a filter question which asks "Is this dwelling here the one which is predominantly used? (No/yes)". In several countries (Greece, Italy, Portugal, Spain, UK) the census form asks for a return of both those usually resident and those present in the household, with filter questions (or a questionnaire layout that serves the same purpose) to distinguish the three categories: resident and present (P), resident and absent (A), transient or visitor (T). This enables statistics to be compiled on either basis, though the majority of tables are compiled on the usually resident basis. In Belgium, Canada and Luxembourg too, the census obtains a return of both those usually resident and those present in the household; in Belgium and Canada a distinctive individual form is to be completed for each visitor. But in these three countries the purpose of asking for details of each visitor is to ensure that he is not missed from the enumeration at his place of usual residence; the information collected is sent back (on a sample basis only in Canada) to the area of usual residence.

3.6 Of the countries in this study, Ireland is the only one in which the census form asks for a return only of those present. Most of the Irish tables are therefore on the basis of persons present; but analysis of the responses to the census question asking about the person's place of usual residence enables some basic tables to be compiled by area of usual residence.

3.7 One way of eliminating duplication in census returns of the usually resident population is to link the returns to a central register of the population. The method has been considered but not yet adopted in Luxembourg; it is a built-in feature of the register-based censuses in Denmark and Sweden. In Belgium a procedure for identifying cases of duplication exists within the census itself - see Annex 1 paragraph 16.

How is a household defined? How is a housing unit defined?

3.8 Questions that have to be resolved both in a conventional census and in a fully-developed population register are how to define the household, the housing unit and therefore the relationship between the two. A household is commonly defined as one or more persons living together and sharing common housekeeping. A housing unit is, in principle, a structurally-distinguishable unit of residential accommodation. A housing unit may therefore be occupied by one household or by more than one household. This variable relationship between the household and the housing unit is recognised in some censuses, for example in Sweden and the UK. In some countries however, the definitions are changed so that for census purposes there is a 1:1 correspondence between households and housing units (unoccupied housing apart). One way to do this is to re-define the housing unit as simply the accommodation occupied by the household (as defined above); this is the Belgian practice. The alternative and more common practice is to re-define the household as all the persons occupying a structurally-distinguishable housing unit; this is the practice in the Canadian and French censuses and in the Danish register system.

3.9 The recognition that more than one household may occupy one housing unit reflects the reality of the situation 'on the ground'. But the absence of a 1:1 correspondence complicates both the data collection and the analysis, whether in a conventional census (as in the UK) or a register-based census (as had been proposed in Sweden). This point is taken up again in paragraph 3.23.

Sampling at the collection stage

3.10 Sampling at the collection stage is a regular feature of censuses in the United States and Canada. There, a form asking the full set of questions (the long form) is addressed to a sample of households and a form with a restricted set of questions (the short form) is addressed to the remaining households. This saves costs and the burden on the majority of the public, but these merits are offset by the sampling errors in the statistics of variables that appear only on the long form. Bias in the sample selection is another hazard in this approach. Bias may be avoided by the preparation, in advance of the enumeration, of a sampling frame of households or housing units, as with the mailing lists prepared in the United States; or by laying down strict procedures where sampling is an integral part of the enumeration in the field (see Annex 2 paragraph 11 for details of Canadian procedures).

3.11 Sampling at the collection stage has featured less regularly in European censuses. The long form/short form approach was adopted in the 1961 census in the UK; but bias was introduced into the results, probably because of the way in which enumerators in the field handed out the long forms. In the subsequent census of 1966 (the UK's only mid-decade census), questionnaires were addressed to only a 1 in 10 sample of addresses using a sampling frame compiled in advance in the office - a "sample census"; errors in the results were due on this occasion to deficiencies in the sampling frame. Subsequent censuses in the UK have avoided sampling at the collection stage. A long form/short form approach was used in the 1970 census in the Federal Republic of Germany, but in this case the sampling units were not individual households but complete enumeration districts (each containing 30 to 50 households). The method is not being repeated in the 1987 census because the list of questions is much shorter and because there is no up-to-date sampling frame (- in 1970 an up-to-date sampling frame was available from the census of housing taken two years previously). Sampling at the collection stage, though of a different kind, was a feature of the French censuses

of 1975 and 1982 and the Greek census of 1971: in both countries a supplementary questionnaire was addressed to a sample of women and asked about their marital and childbearing histories.

3.12 Sampling at the collection stage carries penalties in some kinds of research, for example in medical surveys and longitudinal surveys that draw some of their data from the census. This is because the number of individuals in the survey may already be minimal from the point of view of getting reliable results even before the census introduces a further stage of sampling.

Mail-out/mail-back

3.13 The use of the mail is well established in North America. In most areas in the United States forms are mailed out following a lengthy and expensive preparation of mailing lists; they are then mailed back. In Canada forms are delivered by enumerators but mailed back in urban areas. Among the European countries studied, only Sweden has adopted the mail as the standard method of transmission. Its 1975 census saw the introduction of mail-out/mail-back and the use of the population registers to generate the mailing lists. The method has been a notable success with a high rate of mail-back without prompting (over 95 per cent). If it is possible to achieve a high rate of mail-back of correctly-completed forms, there are savings in costs and fewer of the overt risks to confidentiality that arise from face-to-face contact between the citizen and the census enumerator. Some countries are considering use of the mail in the next census. Other countries question the cost savings if the mailed-back response is poor (as pretests have suggested it might be), so that the costs of follow-up by call back or phone are heavy; and they see advantages in the enumerator's presence on the doorstep to explain and give help both at delivery and collection and to carry out the first checks on the completed forms.

Preprinting from population registers

3.14 On the forms mailed out in Swedish censuses from 1975 onwards, names and addresses together with personal reference numbers have been preprinted from the population registers. In respect of these data therefore the recipients have had to do no more than check (and if necessary correct) the entries. This procedure reduces the demand on the public and the later task of data input. Though enumerators delivered the forms in the Belgian census of 1981, these forms too carried basic information, preprinted from the national population register, about each member of the household: the information (in addition to the address) covered name, sex, date of birth, nationality, marital status, and relationship to the head of household. Preprinting in this way is a useful method only if the information in the population registers is accurate and up-to-date.

Programmes to extend coverage

3.15 Some countries have developed well defined programmes that supplement the main census enumeration with the aim of increasing coverage. Such programmes are a noteworthy feature of censuses in the United States and Canada. In the US census of 1980 one program involved a visit by a second enumerator to housing units that had been classified as unoccupied by the first enumerator. Where doubt about occupancy of the housing unit remained, the status of occupied or vacant was assigned by imputation, and, where the status occupied was assigned, the number of occupants was also imputed. A second program involved comparisons between lists of persons enumerated and administrative records: if a person in these records had not been enumerated, an enumerator called at the address to check and, as appropriate, to add the person to the census records. This approach was followed in areas with significant minority populations, using records of immigration, naturalisation and drivers' licences.

3.16 Checks against administrative records are a feature of several other countries' censuses. Thus, a number of countries in Europe check the lists of persons and households enumerated against the population registers to ensure that no one has been missed. This may lead to the enumerator visiting missed persons or addresses or, in cases in which a person cannot be contacted but is known to be resident, to the construction of a census form on the basis of the data in the population register (possibly supplemented by data on other characteristics imputed by hot-deck methods). When the 1981 count in the City of Luxembourg fell short of the expected total, it proved possible to make good the under-coverage by comparing the lists of persons enumerated with the tax records and with the population registers. In Canada, coverage in the urban areas is improved by comparing the lists of housing units that have been prepared before census day with Post Office lists, and similar checks against postal records are an important part of the preparation of the mailing lists used in the US census.

3.17 In some countries in which the census counts refer only to the usually resident population, the enumeration at an address includes not only the persons usually resident there but also each visitor, who is questioned about his usual address; a check can then be made in the census record for the latter address to make sure that the person has been correctly included in it. As already noted in paragraph 3.5, this is a standard part of the enumeration procedure in Belgium, Canada and Luxembourg, although in Canada only a sample of visitors' returns are checked back to their places of usual residence in this way.

The census fieldwork: the rôle of the municipalities

3.18 In most countries of continental Europe (Greece is an exception) it is the practice to delegate the collection process to the municipalities under the overall direction of the central census authority. The municipalities recruit the enumerators (often selected mainly from municipal employees), oversee their work, check the census

returns in the office - often involving cross-checks against the municipally-maintained population register - and, in one or two cases, carry out coding and conversion of data to computer-readable form. Main arguments in favour of this approach are: first, a local organisation already exists that is knowledgeable about its locality and about population registration, so avoiding the need to create a local census organisation ad hoc; and, second, the municipalities have inevitably to be involved in the cross-checks between the census and the population registers. But the central authority's lack of direct control over the actions of the municipalities is an organisational weakness: several countries reported the need for better working relationships. The fact that the municipalities have a financial interest in the result of the population count is another weakness.

3.19 In countries that delegate the management of the census fieldwork to the municipalities but do not use the census data to update population registers, there is a clear gain to confidentiality in ensuring that the municipal office handling the census fieldwork is separated off from all other municipal functions, as will happen in the German census of 1987. The difficulty of making this separation - in fact and in terms of the public's perception - explains why some countries such as the United Kingdom do not entrust management of the census fieldwork to the municipalities and instead set up a field organisation ad hoc at all management levels. An interesting difference of practice is that in some countries (as in the UK) the policy is to place enumerators in areas where they are unlikely to be known, so as to emphasise the concern to safeguard confidentiality, whereas in other countries (as in Ireland) the enumerators work near their homes where their knowledge of the locality and its people is seen as a positive advantage in securing a good enumeration.

3.20 The recruitment of a sufficient number of enumerators of requisite ability has been a problem in the 1980 round of censuses in several countries. Attempts to recruit

among the unemployed are seen in retrospect as only partially successful. In the Belgian census of 1981 there were difficulties both in recruiting enumerators and in securing the full collaboration of the municipalities, and so consideration is being given to the case for centralising responsibility for the fieldwork rather than delegating it to the municipalities.

The topic content of the census

3.21 The length and complexity of census questionnaires vary widely: the long forms of the Canadian 1981 census (with 46 questions) and of the US 1980 census (with 65 questions) have been the longest of those studied here. The Belgian and Portuguese questionnaires of 1981 each contained 40 or more questions. A decade earlier, the Dutch census of 1971 had asked over 40 questions; this and the fact that the questionnaire took the form of a set of punched cards were probably factors contributing to the unfavourable public response. There is pressure in some countries to save money or reduce the burden on the form-fillers, and so the high-water mark of questionnaire length has been passed in the Federal Republic of Germany and in the UK. In Sweden the length of the census questionnaire has been drastically cut because much of the information formerly asked for is now extracted from registers. In most countries the trend in questionnaire length is fairly flat; in few countries is the trend markedly upward.

Demographic topics

3.22 Virtually every census of population covers the basic demographic topics: name, date and place of birth, sex, marital status, household composition, relationship to a 'reference person' (formerly the 'head of household') and, of course, place of residence. Most countries' censuses ask questions on nationality and migration (address at an earlier date or, alternatively, length of residence at the present address); some ask about year

of immigration for those born abroad. These topics, with perhaps one exception - household composition, are the basic data contained in registers of the resident population.

Household composition

3.23 Household composition, defined in a statistically desirable way as one or more persons living together and sharing common housekeeping, has no place in the usual administrative records. This explains why the Swedish censuses from 1975 onwards have been register-based so far as most of the basic demographic information is concerned but have asked in the census questionnaire for information on household composition. The Swedish proposals of 1983 for a census wholly based on registers envisaged the creation of a register of household composition. The register would be updated by extending the information that a person moving house provides: he would give information on the person(s) with whom he is going to live and on the number of rooms in his new housing unit - a proposition that might perhaps not be well received by everyone. This proposal has not been implemented. In the Danish register-based census the problem of collecting information on household composition is resolved in a different way: first, by defining the household as all the persons resident in the housing unit; second, by creating a register of housing units each of which has (or is assigned) a distinct address that is recorded in an identical form in the population register. The composition of the household in each housing unit can then be established by linking the register of housing units with the population register. This is a much simpler approach than the Swedish proposal, but at the price of departing from the statistically-desirable definition of the household.

Economic activity

3.24 Together with the basic demographic topics, economic activity is at the core of the census of population in every country. The topic covers the nature of a person's

activity if any (in a job, unemployed seeking work, student, housewife, retired, etc) and details of the job - usually including status (employee, self-employed, etc), occupation, branch of economic activity (industry), place of work and perhaps hours of work. Sometimes questions are asked about economic activity at an earlier date. The Italian census of 1981 asked about a person's economic activity five years ago.

3.25 A register-based census is feasible only if the information on economic activity that can be extracted from administrative files is of adequate range, quality and timeliness. Important sources are the returns made to the tax authorities by persons in respect of their own sources of income and by employers in respect of the earnings of their employees, and registers maintained in connection with state schemes of health insurance, unemployment insurance and pensions. But some extension to administrative data systems may be required. For example, in Denmark and Sweden the returns that employers make to the government in respect of their employees have been extended (in the case of employers with more than one establishment) to show each employee's place of work (establishment). With this additional information the industry in which the employee is engaged can be read off a file relating establishment to industry and his commuting journey from home to work can be identified; it also becomes possible to analyse employment by the area in which the work is located. The topics of occupation and hours of work are not well suited to the register approach because there are few administrative reasons for maintaining up-to-date information on them. The Danish register system is using a variety of sources of information on occupation which, even when taken together, provide data of uncertain reliability; a main source is the individual's annual tax return in which he is asked to update the information on occupation, but he has little incentive to do so. In the Swedish proposals of 1983 for a census wholly based on registers it was envisaged that details of occupation would be extracted from the forms on which employed persons report changes in their incomes to the national insurance offices; and that information on hours of work would be added to the returns that employers make to the government in respect of their employees.

But, when the decision was taken to retain a conventional questionnaire in the Swedish census of 1985, occupation was one of the small number of topics included in it because of doubts about the quality of the information available from administrative sources; and hours of work was a topic lost from the census because to have included it in administrative returns as proposed would have placed an unnecessary burden on employers. Thus, Scandinavian experience shows that economic activity is a topic that presents difficulties in a register-based census. However for measuring changes through time in a person's economic activity, the longitudinal dimension of a register system offers clear advantages over a conventional census (which is essentially cross-sectional in character).

Journey to work or to study

3.26 Information on daily journey to work or to study is a topic that has increasingly found a place in censuses of population, reflecting the growing problems of urban transportation. If the census collects details of the person's place of work (or of study) as well as his place of residence, the end-points of the journey are known and the census data can then be analysed to show the spatial pattern of commuting. That limited information may equally be available from registers. But census questionnaires frequently ask for additional details on, for example, mode of transport or times of travel; however these kinds of details did not feature in the censuses carried out in the 1980s in Canada, France, Greece and Sweden, nor do they ever find a place in administrative registers.

Some difficult census topics

3.27 Among the more difficult and sensitive topics that appear in some countries' censuses are: the inter-related subjects of ethnicity, language and religion; for women, marital and childbearing history; education and training; the important economic variable of income; and disability. These topics are discussed in turn.

Ethnicity, language and religion

3.28 Although ethnicity, language and religion are topics of very considerable significance in a demographic, cultural, economic and political sense in most countries, only a minority of censuses ask questions on any of them. In some countries there are statutory inhibitions on collecting information on such topics; for example, the French law of 1978 ('Informatique et libertés') forbids the collection of information on the racial origins, the political, philosophical or religious opinions or the trade union membership of identified persons, except when authorised by a decree of the Conseil d'Etat on the advice of the data protection authority (the CNIL). To the sensitivity of the topics and any legal inhibitions can be added the difficulties of framing suitable questions.

3.29 In the United States the 1980 census asked three detailed questions on race and ancestry - of which two were seen as so fundamental that they were among the seven personal questions on the short form. Questions on race in the US census can be traced back to the first census of 1790 which required the count to distinguish 'free whites, other free persons and slaves'. The long form of the US census of 1980 also asked a question on language. The Canadian census of 1981 asked a question on ethnicity and three questions on language; of these, one of the language questions ("What is the language you first learned in childhood and still understand?") was important enough to be one of the six personal questions on the short form. These questions were repeated with modifications in the 1986 census in Canada; the portion of the ethnic question dealing with the aboriginal peoples was promoted to appear on the short form.

3.30 However in Europe such questions are uncommon, even though the topic is important in some of the countries. In Ireland and in regions of the UK (Scotland and Wales) questions are asked about particular vernacular languages that are spoken by a minority of the population (Gaelic and Welsh). As a result of the large-scale

immigration into the UK from countries in the British Commonwealth and Pakistan, there is Parliamentary pressure to ask a question on ethnicity in the UK census. But an ethnic question asked in a voluntary pretest in North London in 1979 caused controversy and the question was omitted from the 1981 census; at the same time the related question on parents' countries of birth that had been asked in the preceding census of 1971 was dropped. Study of the form that an ethnic question might take in the UK census of 1991 continues.

3.31 Questions on religion are becoming less widely acceptable to public opinion. The question asked in the Luxembourgish census of 1970 was dropped from its 1981 census on grounds of privacy. In Ireland there was a greater level of non-response to the (compulsory) question on religion in the 1981 census than in previous censuses. In the Portuguese census of 1981, 80 per cent of the population responded to a voluntary question on religion. The planned 1987 census in the Federal Republic of Germany retains the question on religious affiliation provided for in the Constitution and requested by the Churches, but in the public debate doubts were expressed about the propriety of the question.

3.32 None of the topics of ethnicity, language and religion is suited to the register-based census.

Marital and childbearing history

3.33 Census questions addressed to women concerning their marital and childbearing history have been an important source of information for demographers because the responses can be related to other social and economic variables in the census. The topic is retained in the censuses of most countries in Europe and North America but has been displaced from some. Thus, the topic was dropped from the 1981 censuses in Italy and the UK and from the 1983 (now 1987) census in Germany. On the advice of a

commission concerned with privacy, the questions were greatly simplified in the 1981 census in Luxembourg. In France the topic has been dealt with in 1975 and 1982 through a separate questionnaire addressed to a 2 per cent sample of women and linked to the census. In the 1971 census in Greece the questions on marital and childbearing history were also addressed only to women in a sample of households; but the topic was dropped from the 1981 census.

3.34 There is difficulty in deciding whether to address the questions on childbearing to married women or to all women, and in the 1981 census in Luxembourg there were protests that the question was restricted to married women. The Belgian census of 1981 skilfully avoided the difficulty by addressing the question to "all women who have had one or more children".

3.35 Marital and childbearing history is a good example of a topic for which it is better to use existing data from registers than to ask for the information afresh from the public - provided that these data can be linked to data on other social and economic topics (taken perhaps from a conventional census questionnaire).

Education and training

3.36 Education and training, whether completed or currently being received, is a key topic socially and economically. But suitable questions can be difficult to draft and may involve lengthy definitions. Qualifications and courses are rarely comparable over time (that is, over the half century or more to which the responses relate) or space (that is, between one country and another). The topic is sensitive to some of those with few qualifications and seemingly irrelevant to the old (who may also find it difficult to remember events of long ago). Moreover the coding of responses can be expensive. Questions on education and training are asked in most countries' censuses but in some

countries there has been a reaction from the over-elaboration of the subject in the 1970 round of censuses. Thus, fewer questions have been included in the 1983 (now 1987) census in Germany - four questions in place of the eight asked in the long form of the previous census of 1970; and the 1981 census in the UK asked one question in place of the two asked previously. The Swedish census of 1970 had been dominated by detailed questions on education - they had taken up 23 columns of the census form out of a total of 40 columns concerned with personal characteristics; after this the topic was dropped from the 1975, 1980 and 1985 censuses. It was also omitted from the 1981 census in Luxembourg (as it had been from the previous 1970 census) following pretests in which the questions were poorly answered and on the advice of the commission concerned with privacy.

3.37 Data on a person's completed education and training can be taken from registers of qualifications gained and courses attended, though an elaborate system of reporting by educational institutions is needed to provide comprehensive data. Such a register system has been set up in Denmark, using the 1970 census returns as a starting point, and a similar system is being constructed in Sweden (with completion expected in 1987). Data on a person's current activity as a student might, in principle, also be taken from registers of enrolments at educational institutions.

Income

3.38 Income is another important statistic socially and economically, but there is a marked difference between North America and Europe in public sensitivity to it - at least as regards its inclusion in the census. The fact that the definition of income is complex and that many people would have to consult their records in order to give reliable information has not prevented detailed questions on income from becoming an established part of censuses in the United States and Canada: in the US a question was first asked in 1940. However in the European countries studied, there have been fewer

questions on income and in less detail: indeed, in some countries the view is taken that a question on income would put public support for the census in jeopardy. The 1971 census in the Netherlands, which was not received favourably by some sections of the public, had asked three questions on each person's income: one question sought to identify the person's main source of livelihood (economic activity, property, pension, benefit or assistance, support by the family) and a second question asked about the person's total gross income (to be assigned to one of several ranges). In the 1970 census in the Federal Republic of Germany the long form asked two questions on each person's income - on the main source of livelihood and on the net income from economic activity (again in ranges); the short form asked only the question on the main source of livelihood. The latter is the only question on income that has been retained in the German census of 1987. A question to identify each person's main source of income or support was also asked in the 1981 censuses in Luxembourg and Portugal, and had been asked in the earlier 1971 census in Greece.

3.39 From a statistical point of view, figures of income held by tax authorities have deficiencies: the figures reflect administrative definitions (which are liable to arbitrary change) rather than desirable statistical definitions and they do not cover income below tax thresholds or undisclosed income. Nevertheless tax registers - supplemented by social security registers to cover some of those with incomes below the tax threshold - may be a more satisfactory source of income data than the responses to an income question in the census. Data on income taken from tax registers were used in the Swedish censuses of 1970, 1975 and 1985 and in the Danish register-based censuses. Indeed it is more than 50 years since Denmark first linked data on income extracted from manual tax registers to the data from conventional censuses; income was never a topic in a Danish census questionnaire.

Disability

3.40 Concern about the numbers and circumstances of the disabled has led to demands for a question on disability in the census, despite the difficulties of definition. A question was asked in the Dutch census of 1971 and in the US censuses of 1970 and 1980. In Canada a question on disability introduced into the 1986 census is intended mainly as a screening question for a post-censal survey. The questions in North America are an elaboration of a basic question that asks if the person is limited in the kind or amount of work (or activity) that he can do because of long-term disability (Yes/no). Some countries maintain registers of persons with certain kinds of disability.

Housing

3.41 There are wide variations between countries in the number of housing questions in the census and in the range of topics covered: the number of questions varied from four (UK 1981) to nearly thirty (US long form 1980). Much more information on the financial aspects of housing is asked for in North America than in Europe. In both Canada and the United States there are questions on rentals, mortgage payments and the cost of services; in addition, owner-occupiers are asked to put a value on their property - in the US census of 1980 this question even appeared as one of the nine housing questions on the short form. In the 1980 round of European censuses only the Portuguese census asked about mortgage payments, whilst the censuses of Ireland, Luxembourg and Portugal asked about rentals as will the 1987 census in the Federal Republic of Germany.

3.42 Interest in environmental issues is reflected in a question in the Belgian census of 1981 which asked if the household had the exclusive use of a garden (or other open space) of at least 50 m² and adjoining the house.

3.43 While registers of land and property exist in many countries, often for purposes

of taxation, rather few of the registers distinguish the separate housing units - an essential requirement if the registers are to be a source of housing data for the census of population. For a full register-based census each housing unit should have an identifier that also appears as part of the address information in the population register; this would enable data on housing characteristics to be linked to data on the occupants held in the population register. This is the system adopted in Denmark. A proposal on similar lines is currently being examined in Sweden, following the difficulties that were experienced in the 1980 census in linking the housing data - which for the first time were taken from administrative records - with the personal data (see Annex 13 paragraph 20). However Scandinavian experience is that the updating of housing records, whether from periodic declarations made by property owners for tax purposes or from municipal information on new developments, is not uniformly effective. This is one of the reasons why the Swedish census of 1985 reverted to the collection of housing information through the census questionnaire.

3.44 There is a further difficulty in relying on administrative records as a source of housing data. Conventional censuses cover a wide range of housing topics including details of the structure, rooms, services, facilities, status of occupants (owner, tenant, etc) and costs; this is a complex set of data, some of which refer to the building as a whole and some to the individual housing unit within the building, and administrative records are unlikely to cover more than a minority of these topics. Housing is undoubtedly one area of difficulty for a country that is proposing to move from a conventional census to a register-based census.

Geographical tools

3.45 Several countries are creating new geographical tools that have application at the stages of collection, processing and presentation of the results. These tools are directories or gazetteers that show the relationships between some or all of the

following units: addresses (distinguishing, if possible, individual housing units); streets or sections of streets; postcodes; areas used in the field operations or the analysis, such as city blocks or enumeration areas or administrative areas; and geographical coordinates (that is, data for mapping). Such a system may also set out the relationship between areas of different kinds (for example, between enumeration areas and administrative areas) and the classification of areas. In the more highly developed systems the maps required for the fieldwork and for the presentation of census results can be produced by computer. Data bases on these lines have been, or are being, constructed in Belgium, Canada, the Netherlands and the United States. The costs of constructing the data base, comprising the writing of software and the collection of the geographical data, are very substantial, but are considered to be justified by a more effective census operation.

3.46 To add geographical coordinates to individual census returns is expensive. But it permits a greater degree of geographical resolution in the automated mapping of census results and in the preparation of statistics for areas defined ad hoc; and it allows comparisons to be made between one census and the next that are not affected by changes in administrative boundaries. In the 1971 censuses in the Netherlands and the UK, statistics were prepared for grid squares formed by grid lines at intervals of 500 metres and 1 kilometre respectively. But the presentation of such statistics faces substantial statistical difficulties because of the highly-skewed distribution of the population counts in the grid squares, including problems of confidentiality where the population count is low. In neither country were grid square statistics prepared in 1981 - in the one case because there was no census and in the other case for lack of funds.

Census processing

3.47 Several new processing methodologies have been tried out and some have become established. Given the heavy costs of conventional data input by keying, some countries

have introduced optical mark reading (OMR) for the input of standardised responses, that is, entries in tick-boxes or equivalent. Censuses in the United States employ a method of this kind based on equipment constructed within the Bureau of the Census - FOSDIC (Film Optical Sensing Device for Input to Computer); the completed questionnaires are first photographed to microfilm, which is then read by the FOSDIC. The Canadian censuses also used FOSDIC equipment in 1971 and 1976, but changed to keying in 1981. The Dutch experience with OMR equipment was less fortunate in 1971: the results of the census were delayed by more than a year because a serious printing failure led to the reading of spurious marks. Censuses in the Federal Republic of Germany from 1970 onwards and in Sweden from 1975 introduced optical character recognition (OCR) equipment; this can read not only respondents' entries in boxes but also formalised characters entered by coding staff.

3.48 A system has been developed in France that combines the functions of data entry (keying) with the later functions of coding, editing and quality control. The system called COLIBRI (COdification en Ligne des Bulletins du Recensement des Individus) was first used in the 1975 census, and in the 1982 census has been used for the input of all variables for a 25 per cent sample of households. Each of some 400 keying stations is equipped with a visual display unit (VDU) and is connected on-line to the mainframe computer. For the simpler census variables the system performs editing checks. For the more complex and interrelated variables concerned with a person's economic activity - that is, name of firm, the address of the place of work, the branch of economic activity (industry) at the place of work and the occupation - COLIBRI provides a sophisticated coding procedure with the help of extensive directories held in the computer; there are separate directories of establishments and their addresses (with the industry assigned to each and its size in terms of number of staff), of industries, of occupations and of geographical locations (communes, quartiers, streets). The write-in responses are keyed in, and coding takes place in a conversational exchange between the operator and the computer. Main advantages are more accurate and consistent

coding and (possibly) cost savings. The disadvantage is the substantial capital cost of writing the computer software and constructing the directories. A system on similar lines was first introduced into the Swedish census in 1975. An interactive edit with VDUs has been used experimentally in Italy.

3.49 Automatic editing of inconsistent and incomplete responses by the 'hot-deck' method has been successfully introduced in many countries with benefits in speed and cost and in the consistency of the editing process.

3.50 If there is no sampling at the collection stage, sampling at the processing stage - that is, processing the responses to certain of the questions for only a sample of returns - can cut the costs of coding, data input, editing and analysis. For topics that are expensive to code, such as branch of economic activity (industry) and occupation, savings can be substantial. Countries that adopted this approach in the 1980 round of censuses included France, Greece, Spain and the UK; in Greece no personal characteristic, and in Spain only one personal characteristic (sex), was analysed using 100 per cent of the returns. But the saving is achieved at the expense of sampling errors in the results and so some countries have avoided sampling both at the collection and processing stages. In the 1980 round of censuses, countries in this category included Belgium, Ireland, Italy and Portugal except that, in one or two cases, some early and provisional results were produced on the basis of a sample analysis.

3.51 A lesson that in some cases has had to be learnt by hard experience is that the processing must be planned in detail well in advance and tested out fully before census day if the results of the census are to be available in a timely way. Failure to do this led to late results from the UK census of 1971 and the Belgian census of 1981. Shortages of funds have also contributed to delays in the publication of the results of some censuses (Belgium 1981, Greece 1981, Ireland 1981, USA 1980).

The measurement of census coverage and quality

3.52 Problems of coverage vary widely from country to country. Under-counting occurs most frequently among groups that are difficult to contact, live in adverse social conditions or are uncooperative: for example, the young mobile age-groups, ethnic minorities and immigrants and those living in congested city centres. Over-counting occurs when a person is counted as usually resident at two addresses (or at one address if he should more properly be treated as resident abroad): this happens most often when there is uncertainty in defining a person's place of usual residence (examples are given in paragraph 3.3).

3.53 Because the census itself is a counting instrument of high quality, it is a challenging task to devise a method of measuring that quality, and few countries would claim to be able to measure the net error in population counts better than as an order of magnitude. In a few countries with a population register of high quality to which the census is closely linked - for example Belgium and Sweden, coverage errors may be assumed to be so small as to ignore. Most countries cannot make that assumption.

3.54 Some countries have attempted to measure coverage by re-enumerating a sample of enumeration areas soon after the census using field personnel of higher quality than those employed in the census itself, and then matching the two sets of records. But movements of population in the interval between census day and the day of the re-enumeration creates problems; and, more generally, the re-enumeration suffers from the same shortcomings as the census and so is likely to understate the numbers missed in the census. A number of countries adopted this approach in the 1980 round of censuses; but Greece and the UK were perhaps the only ones to report a satisfactory outcome (though in both these cases attention was focussed on the count of persons present on census day).

3.55 Some of the most determined efforts to measure under-coverage have been made in North America. In the United States, where the under-count of minority groups has been substantial, an estimate of the gross under-count in the 1980 census was made by matching a sample of households that had been interviewed in the monthly Current Population Survey against the census returns; in a proportion of cases - those in which a match could not be made in the office (about 1 case in 5) - the household was interviewed afresh to establish the usual address as at census day. In Canada gross under-count is measured by the Reverse Record Check (RRC). In essence a sample of people who prima facie ought to be enumerated in the current census is drawn up; this is based on the records of the preceding census, administrative records of subsequent births and immigrants, and lists of persons missed from the preceding census (taken from the earlier RRC). For those in the sample who are not enumerated at the same address in the current census as in the preceding census, a current address is traced from administrative sources so far as possible; and, if the person is not found in the census records at that address, he is interviewed, wherever possible, to find out if he might have been enumerated elsewhere.

3.56 To measure gross over-coverage in the 1980 census in the United States, a sample of households recorded in the census were interviewed to find out whether there were other addresses at which they could possibly have been counted; office checks were then made to see whether in fact there were duplicate census records at these other addresses.

3.57 A radically different approach to the measurement of gross over-coverage has been applied in France and the UK. The census records of a sample of individuals, chosen not at random but because their birthdays fall on certain dates in the year, have been matched against a central population register, so identifying duplicated census records. (See Annex 4, paragraph 21, which describes the French Panel Démographique, and Annex 14, paragraphs 22-23, which describes the UK's Longitudinal Study.)

3.58 The United States provides examples of other approaches to the measurement of census coverage. One method of measuring undercount is to match the names of persons listed in administrative records against the census record. A pioneering exercise of this kind took place in New York City following the 1980 census. A sample of names of people living in selected enumeration districts in the city (the "megalist") was drawn from ten local lists (with procedures to avoid duplication) and was then matched against the census records; census officials found that 7 per cent of the persons on the list had certainly been omitted from the census count. But there is difficulty in interpreting this result because, for a further 17 per cent of the persons on the list, no decision was reached on whether or not they had been included in the census count (see Annex 15 paragraph 19). This kind of uncertainty is a feature of all of the micro methods of measuring under-coverage described in the preceding paragraphs: that is, the numbers of persons identified as missed from the census count are equalled, or exceeded by, the numbers of persons for whom a decision on inclusion in or exclusion from the census count cannot be made because of unresolved cases of matching or because of non-response to surveys.

3.59 A quite different, macro, approach to the measurement of census coverage known as demographic analysis has played an important part in the United States. In this method, the census counts at the national level are compared, by sex, age and race groups, with estimates of the total resident population based on sources independent of the current census; the sources are annual figures of births, deaths and migration, figures of enrolments in the medical care scheme for those aged 65 and over and figures from previous censuses for some age-groups under 65. The uncertainties in this approach concern the quality of the statistics on migration, particularly numbers of illegal immigrants, and the quality of the figures taken from previous censuses.

3.60 Several countries carried out sample interview surveys to measure the quality of the responses to the personal and housing questions in their 1981 censuses (Italy,

Portugal, Spain and the UK). The survey results showed that substantial errors were present for some topics, for example occupation and number of rooms.

Adjustment of the census counts

3.61 In the United States, the Bureau of the Census has come under considerable pressure to make adjustments to the census counts to allow for the net undercount. This raises legal and political issues, issues of public relations and, of course, the prior technical issue of feasibility. Feasibility depends, first, on the ability to measure coverage reliably and within an acceptable timescale and, second, on the ability to construct a valid statistical model which would enable the coverage estimates to be carried down from large geographical areas and broad demographic groups to the block level. The present (mid-1986) intention of the Bureau of the Census is to make a decision in 1987 on the feasibility of adjustment and, if positive, to put the machinery for making adjustments into position for the 1990 census. But the decision on whether adjusted census counts or unadjusted census counts were to be designated as the official census results would not be made until both sets of figures were available and their quality had been appraised (see Annex 15 paragraph 30). The Bureau of the Census does not regard adjustment as a substitute for an effective coverage improvement program.

The release of microdata

3.62 This report does not explore methods of disseminating census results. But dissemination by microdata, or public use tapes as they are termed in North America, raises issues of confidentiality, public relations and law which deserve some discussion here; and the annexes to the report describe the practices followed in different countries. Microdata are individual data relating to persons, households and/or housing units that have been anonymised. The microdata released to users outside the census agency may refer to a sample of the population or in some cases to the whole

population. Anonymisation to ensure that an individual or household cannot in practice be identified is achieved by removing direct identifying information, notably name and address, by not identifying geographical areas with a population under a chosen threshold, by collapsing values for some variables into broad categories (for example age bands) and omitting other variables entirely. It is impossible for the census agency to give an absolute guarantee that no one can be identified or, more relevantly, that no information can be learned concerning an individual who has been identified. From the users' point of view, microdata have the merit, as compared with other methods of data dissemination, that they provide greater flexibility of analysis than aggregate statistics do.

3.63 In Canada and the United States public use tapes relating to samples of the population are released with minimum restrictions. At the other extreme are countries, including Belgium, Greece, Ireland and the UK, which do not release microdata. The reasons given are: that the law inhibits, or is thought to inhibit, such release; that the release would threaten confidentiality and lessen public trust in the census; and that it is technically difficult to design a set of microdata which on the one hand preserves confidentiality and on the other hand gives users the depth of analysis that they demand (this applies particularly in the case of users who are interested only in a limited geographical area).

3.64 In between these extremes are countries which release microdata under certain conditions or to particular classes of user. Researchers in Denmark and Sweden may receive microdata for specific purposes. Microdata are made available to local government at all levels in Italy, to the regional governments in Spain and to some government departments in Luxembourg. In France microdata are released at sample levels from 0.1 per cent to 25 per cent, as well as at the 100 per cent level with more restricted content; the communes are important users. In the Federal Republic of

Germany the Act governing the 1987 census lays down that the statistical offices of the Federal Republic and the Länder may pass on individual data without names and addresses only to the statistical departments of the communities (Gemeinden) and only for statistical analysis; the condition is laid down that the law of the Land must provide the same protection to data held in the statistical departments of the communities as to data held in the statistical offices of the Federal Republic and the Länder.

The use of administrative records to support the conventional census

3.65 Population registers and other administrative records can support the conventional census of population in two main ways: first, to secure full coverage at the collection stage or to measure coverage and, second, as a source of data about persons (or housing) that contribute to the census results or supplement them. The first of these has been explored earlier in this section, and it is sufficient here to list the methods with references:

- 1) Use of population registers and other administrative records to extend the coverage of persons or housing units (paragraphs 3.15-16).
- 2) Use of population registers to preprint names and addresses and other data on questionnaires prior to delivery or mail-out (paragraph 3.14).
- 3) Matching the census returns to a central population register to eliminate duplication (paragraph 3.7).
- 4) Use of administrative records to measure coverage. Examples are the Reverse Record Check (paragraph 3.55), matching against a central population register (paragraph 3.57) and matching against administrative records (paragraph 3.58).

3.66 Administrative registers provide a different kind of support to the census if the data that they contain are linked to the data collected in a conventional census enumeration in order to enrich the topic content of the census. This may be a 'half-way house' to a full register-based census, and the Swedish censuses from 1970 onwards are the main example (see details in paragraphs 5.13-14). The census-based Longitudinal Study in the UK and the Panel Démographique in France are other examples, though both these studies are restricted to a 1 per cent sample of the population and so do not provide statistics for small geographic areas or small groups of the population. The UK Longitudinal Study has linked a person's record in the 1971 census to his record in the 1981 census and also to administrative records concerning mainly fertility, mortality and morbidity. The French Panel Démographique has involved linkages of a similar kind.

3.67 Registers provide support of a different kind if data from them are used to carry forward the census 'benchmark' statistics through the postcensal period. The most common example is the construction of intercensal population estimates (numbers by sex, age, marital status, etc) at municipal or other geographical levels; the data on changes since census day may be taken either from the population registers or from registers of births, deaths, etc and registers that provide evidence on migration. In Canada a program has begun to develop intercensal small area statistics using administrative files in conjunction with census benchmarks: in one of the first experiments income tax records have been the basis of annual statistics of migration, the labour force and personal income.

IV THE ROLE OF SAMPLE SURVEYS

When is the size of a sample adequate?

4.1 By definition a census aims to obtain a response from every unit in the population and a sample survey aims to obtain a response from only a proportion of the units. It follows that a sample survey cannot take the place of a census if separate statistics are needed for each of the small groups that make up the national total, for example the populations of small geographical areas or small populations defined by demographic, social or economic characteristics: for such small populations the sampling errors are likely to be unacceptably large. The magnitude of the sampling errors depends on the sampling fraction, the sample design, the size of the small populations and the frequency with which the characteristics under study occur. With a sampling fraction of 1 per cent, the annual microcensus in the Federal Republic of Germany provides results for areas with a population of $\frac{1}{2}$ million or more. Even with sampling fractions as large as those of the extended labour force surveys taken in Belgium in 1977 ($7\frac{1}{2}$ per cent of households) and in the Netherlands in 1981 (5 per cent of households), reliable statistics are provided only for geographical areas with populations of the order of 50,000 or more. To meet the increasing demands for information about much smaller populations, a record in respect of every member of the population is needed through a census or a register.

4.2 But even here sample surveys may have a part to play. Techniques have been developed by which complete counts for a small population taken from a census (or register) can be extended in terms of detail or timeliness by combining the counts with sample survey data referring to a wider population. Some of the methods are reviewed in an article by Purcell and Kish (1980).

Sample surveys compared with censuses

4.3 Leaving aside the inability of sample surveys by themselves to give reliable

figures for small populations, surveys have many advantages over censuses and at least one important disadvantage: poorer coverage leading to bias in the results. It is rare for a sample survey to achieve the high level of coverage of a census. A sample survey will not be accompanied by the publicity that surrounds the census; and some of the coverage improvement programs in the census cannot be applied to a sample survey - to give a simple example, an appeal by the census-takers to the public to "let us know if you have not been counted". An important factor is that response to the census is obligatory, an obligation that all but a very small minority of the population respect; on the other hand response to most sample surveys is voluntary, and then the level of response is likely to be affected by the degree of interest in the topic and by the length and complexity of the questionnaire. The microcensus in the Federal Republic of Germany is a notable example of a survey to which response is obligatory; levels of response exceeding 99 per cent are achieved. For voluntary surveys response rates of 85 per cent are generally regarded as good, and lower rates are common. Because non-response rates vary between different sections of the population, bias is introduced into the survey results. It is sometimes feasible to obtain a measure of this bias by comparing census data for the survey non-respondents with census data for the survey respondents - a procedure that involves matching.

4.4 We may identify five respects in which sample surveys have advantages over censuses. First, a much wider range of questions can be asked, especially in the hands of a skilled interviewer, and a greater number of questions can be asked of one respondent. Second, a more accurate response may be obtained through the use of skilled interviewers and, given the smaller numbers of respondents, through greater attention to editing and coding. Third, sample surveys are less costly than censuses (even though costs per person are much greater); and, in principle, surveys can be processed more quickly. Fourth, because of the much smaller number of respondents, the fact that in most cases response is voluntary and a lack of interest by the media,

sample surveys rarely generate public hostility. Fifth, because of their lower costs and the favourable public reception, sample surveys can be conducted more frequently than censuses, for example annually or even continuously.

Some rôles for samples

4.5 The experience of every country demonstrates that sample surveys have an increasing rôle to play in providing statistics at national level and, with greater margins of error, at regional level too, but not for small areas. Surveys provide greater topic detail and more frequent results than censuses. An important example is the introduction in most countries of a regular labour force survey, including the EEC Labour Force Survey. The General Household Survey in the United Kingdom is a noteworthy example of a general purpose survey that examines a range of social and economic topics in some depth; it is continuous and is addressed to about 12,500 households a year.

4.6 Sample surveys and sampling techniques can also be employed in direct support of a conventional census. First, sampling may be introduced into the collection stage through use of long and short forms (paragraphs 3.10-3.12). Second, coverage improvement programmes may be carried out on a sample basis (paragraph 3.17). Third, many of the methods of measuring the coverage of the census and the quality of the responses are based on samples ("micro" methods), for example post-enumeration surveys, matching with administrative records and the reverse record check (paragraphs 3.54-3.60). Fourth, sampling may be introduced at the processing stage to reduce costs or to give early provisional results (paragraph 3.50). A number of possibilities of this kind have been reviewed by Kish (1979).

4.7 Some of the important ways in which censuses support sample surveys were mentioned briefly in paragraph 2.2.

Essential features of a register-based census

5.1 A register-based census involves the collation of data that refer to a particular member of the population and that are extracted from a variety of registers. While some of the data may be extracted from registers held only for statistical purposes, it is the essence of the register approach to censuses that most, if not all, of the data are extracted from registers that are maintained primarily for administrative purposes. The task of collation requires records to be matched by the use of unique reference numbers assigned to each member of the population or the use of other identifiers such as name, date of birth and place of birth. In principle all the records refer to the same date, so that the information assembled about each member of the population is similar to the information entered on a census questionnaire.

5.2 A census of population and housing deals with several kinds of units. The main ones are persons, households, housing units (as defined in the footnote on page 10) and establishments (that is, the economic or institutional units within which people work or study). The family is another unit that is identified during the processing of some censuses. A register-based census, like a conventional census, assembles information on the characteristics of each unit of the different kinds. But it must also link particular units of one kind with particular units of another kind. Thus, it is necessary to identify the housing unit in which a particular person lives in order to associate the housing characteristics with the record of the person and to give a geographical analysis of the population by place of residence. Similarly it is necessary to identify the establishment in which the person works in order to associate the characteristics of the establishment (for example the branch of economic activity (industry)) with the person's record, to identify the journey to work in spatial terms and to give a geographical analysis of the population by place of work. As papers by Poul Jensen (1982) and

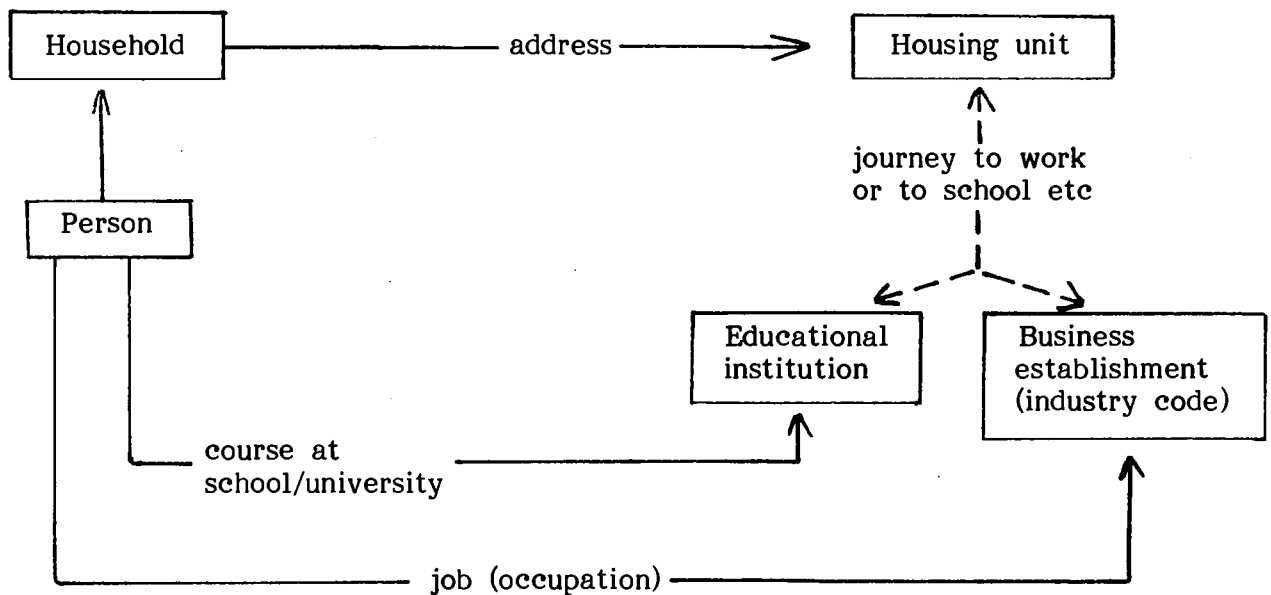
Danmarks Statistik (1982) explain, the four links that are needed between the four main kinds of unit (person, household, housing unit and establishment) are:

- 1) person - household
- 2) person - housing unit
- 3) household - housing unit
- 4) person - establishment

(In fact, links 1 and 2 imply link 3, so that we may omit link 3 from the list.)

5.3 Diagram 1 shows the units and their relationship; it is a variant of schematic diagrams presented by Danish statisticians.

DIAGRAM 1. Schematic of the register system for a census of population and housing.



Within each box in the diagram is a population of units which changes relatively slowly; thus, the population of persons changes only as a result of births and deaths (both of which are registered events) and cross-frontier migration (about which there

is much less information - illegal immigration is unrecorded and emigration is often unrecorded). Change in the stock of housing units is slower still, while households and business establishments change more rapidly. The links between the different kinds of units are shown by the arrows - for example, a person's address, his job or his journey to work. It is the links that change most rapidly. To the extent that the individual units (persons, housing units, etc) and their inter-relationships are recorded in administrative registers that are reliable and regularly updated, the essential data for a register-based census exist.

The household as a unit in a register system

5.4 The place of the household as a distinctive unit in a register-based census must be questioned. A household is usually defined in conventional censuses as a group of persons living and keeping house together. Two or more households may occupy a single housing unit: this is not uncommon in a large older house that has not been divided into structurally distinguishable units of accommodation. However, even in a conventional census some countries define the household differently, namely as all the occupants of the housing unit (for example, in France and Canada); and so one kind of unit - the household - disappears from the system as a distinctive entity and is replaced by (the occupants of) the housing unit. With a register approach there is still greater reason for doing this. Although tax and social security registers may record dependent children and some other dependents, the household - defined as the group of persons living and keeping house together - has little administrative significance, as distinct from social significance, and is unlikely to be recorded in any administrative register. The Danish register-based system accepts this by defining the household as all the persons resident in the housing unit; the composition of the household is established by matching the population register (which identifies the housing unit in which each person lives) with the register of housing units. Sweden envisaged considerable complications in trying to construct a register of households on the statistically desirable definition of

persons who live and keep house together (see paragraph 3.23). The household as a unit distinct from the occupants of the housing unit does not fit comfortably into a register-based census.

The wide range of registers that exist in every country

5.5 Leaving aside the household as a unit, governments in virtually every country have administrative records of the other units needed for a register-based census - people, houses and business establishments - and of relationships between them. This is true whether or not the country has a formal population register. Thus, there are likely to be records of vital events (births, deaths, marriages and divorces), immigration and naturalisation, health services, social security (contributors and beneficiaries such as the unemployed, pensioners and children), personal taxation, the issue of passports, electoral registration, ownership of cars and licences to drive cars. Records of land and buildings are kept for purposes of local planning and building control, registration of ownership and property taxation. Records of enterprises and establishments are held in connection with business registration, value-added tax, and health and safety regulations, as well as for statistical purposes. These records will include information on the two most important links in Diagram 1: the address at which a person lives and his job. However employment records available to the government may show only the enterprise for which the person works and not the establishment and therefore the place of work.

Uncoordinated systems of administrative registers

5.6 The differences between one country and another are not so much differences in the range and content of the records as differences in the extent to which the separate files have been coordinated and form a coherent whole. At one end of the spectrum are countries which lack a system of population registration to record a person's change of address and an associated set of personal reference numbers; the administrative

files are dispersed and unrelated and, in consequence, of inferior quality. (In this report a record system of this kind is termed uncoordinated.) Records relating to an individual person appear many times in the files of administrative agencies but without any consistency in the information content or in the timing of updates. Even identifiers such as personal names are not reported and recorded in a consistent way so that duplicates exist within a single file; moreover names change (for example on marriage). Each person is assigned a variety of personal reference numbers for use in the different administrative schemes, but, because of the profusion of numbers and the relatively infrequent (and sometimes optional) usage, few people can quote any of their personal numbers reliably. Another feature of an uncoordinated system is that the data are not accessible at a central point for statistical use.

5.7 Such a decentralised and dispersed record system may accord with political thought and public opinion: national temperament may prefer a system in which bureaucracy is held in check by weaknesses in the administrative machine. But there is a big price to be paid, I believe, in terms of higher costs, reduced effectiveness, greater opportunities for crime and fewer policy options available to government; this wider subject is touched on in Section VI. The purely statistical penalties which stem from a failure to develop a coordinated and coherent record system are on a lesser scale but still significant: in particular it is very doubtful whether it would be practicable and economic to extract and assemble the data needed for a register-based census of population.

Coordinated systems of administrative registers

5.8 At the other end of the spectrum are the systems found in Scandinavia in which the different administrative registers, particularly those relating to persons, are made consistent and coherent, and so are of higher quality. The registers themselves are not merged to create "dossiers", though for purely statistical purposes data from different registers are merged ad hoc, for example in a census of population. The

essential mechanisms in a fully-developed system of personal records are as follows:

- 1) Records of each person's usual address are held in local population registers maintained by the municipalities. An obligation is laid on the citizen to notify a change of address.
- 2) A unique and permanent personal reference number (with a check digit) is assigned to each person at birth or, in the case of immigrants, on arrival in the country. There is a 1:1 correspondence between the individuals in the population and the identifiers in the register; that is, two people never share the same identifier and no person has more than one identifier.
- 3) The personal reference numbers are held in a central population register, which, through its links with the local population registers, also holds the information on addresses; the personal reference numbers are also held in the local population registers. The central population regulates the working of the local population registers, for example by eliminating duplication.
- 4) The personal reference numbers are carried into other administrative registers. Details of changes in personal particulars (change of address, marriage, death, etc) are passed to these registers from the central population register.

5.9 In the Scandinavian countries population registration and the associated personal reference numbers play a significant rôle in many schemes of public administration that impinge on the public; and so there is a high level of compliance on the part of the citizen in informing the registration authorities promptly of changes of address and in quoting his personal reference number in his day-to-day dealings with officials. A system like this appears to lay additional burdens on the public. But this view is questioned in paragraph 6.4.

5.10 There are important statistical spin-offs in the Scandinavian system. One is the availability of regular and reliable statistics of the population of each area, with an analysis by sex, age and any other characteristics recorded in the population register. A second is the feasibility of introducing a register-based census. The heart of the register-based census is the central population register and the basic demographic details that it contains. Other personal characteristics are taken from administrative registers and linked by means of the personal reference numbers; legislation must authorise access to these data and the linkage, and must set out the safeguards. However some additions have to be made to the data system wholly or partly for statistical purposes. Two of the important additions are: first, employers' returns to government must distinguish the establishment at which each employee works (see paragraph 3.25); second, the register of land and property must distinguish the separate housing units and give to each an identifier which is also carried into the address information in the population registers (see paragraph 3.43).

The censuses in Denmark and Sweden

5.11 Of the countries in this study, only Denmark has introduced a full register-based census. An automated central population register, linked to the local registers, together with unique personal reference numbers for each person were introduced in 1968. The last conventional census was taken in 1970, and was followed by the first register-based census of population (but not housing) in 1976 and the first register-based census of population and housing in 1981. The transition was therefore made in no more than a decade. To do this, employers' returns to government were extended to show each employee's workplace; a central register of buildings and dwellings was created in 1977, mainly for administrative purposes but with the statistically desirable feature that housing units are identified in the same way as in the population registers (where they are an element in a person's address); and a register of educational achievements was created starting from the data collected in the 1970 census. The changes have been greatly helped by the legislative framework within which Denmark's

Statistik (DS) has operated since 1966; this is discussed later (paragraph 5.39).

5.12 The main problems of the register-based census concern the quality and timeliness of some of the data; these are dependent on the effectiveness of administrative procedures. For example, DS does not expect to be able to prepare labour force statistics based on tax files in less than a year from the end of the reference period to which the statistics relate. Quality is a concern particularly for data which, though extracted from administrative returns, have little or no direct administrative application, for example data on occupation and place of work.

5.13 In Sweden the quinquennial census is now based mainly on information extracted from registers and in part on responses to a conventional questionnaire. From 1970 onwards the questionnaire has become progressively shorter as more and more information has been taken from administrative sources; the data are linked by means of the personal reference number (which is one of the entries on the census questionnaire). From 1975 personal questionnaires have been mailed out to each individual aged 16 or over or to each married couple, using the population register as the mailing list; names and personal reference numbers are preprinted on the forms.

5.14 In 1983 proposals were considered for making the 1985 Swedish census wholly register-based by eliminating the questionnaire. To do this, it was proposed to extend the register system: information on each employee's place of work and on his hours of work would be added to the employers' returns to the tax authorities; new registers would be created of household composition and of buildings that contained housing units, with corresponding extensions to the population register; and a new register of educational achievements would be created. But, mainly because of doubts about the likely quality of register information on occupation, household composition and housing, the decision was taken to retain a questionnaire in the 1985 census. This asked for information only on whether a person was economically active in a specified

week and, if so, the occupation, and on household composition and housing. But action has been taken on some of the 1983 proposals: information on each employee's place of work (but not hours of work) has been added to the employers' returns to the tax authorities; and a register of educational achievements is under construction using the data collected in the 1970 census as the starting point. In summary, the Swedish census has changed over a period of two decades from a conventional census to a census that relies largely, but not wholly, on registers. A conventional questionnaire is retained; but it is mailed out on the basis of the information in the population register and plays a supporting rôle. Details are given in Annex 13.

The advantages of a register-based census

5.15 In principle registers include everyone. So, like conventional censuses, they provide statistics for small geographical areas and other small groups of the population. But registers have both advantages and disadvantages compared with conventional censuses. The first advantage is that statistics can be extracted from registers more frequently than at the 5-year or, more usually, 10-year intervals of the conventional census: they can be extracted as often as the registers are updated and the resources for analysis are available, perhaps annually. In particular, registers of population can provide the annual counts of local populations analysed by basic demographic characteristics (age and sex, say) that are needed for planning and financial purposes.

5.16 The second advantage is that registers are well suited to longitudinal studies, that is, studies involving a time dimension. Migration and a woman's marital and childbearing history were mentioned earlier as examples of topics with a time dimension that are more suited to a register-based census than to a conventional census. But, in addition, registers that are regularly updated can provide measures of transitions through time that are beyond the reach of a conventional census: for example, transitions in economic activity.

5.17 The third advantage of the register approach is that it places little burden on the public, because most of the data have been assembled as part of the routine operation of administrative schemes. However this advantage is reduced if the contents of the registers have to be supplemented for statistical purposes by means of special collection exercises. In a fully developed register-based census there is no occasion every five or ten years - Census Day - when a large and seemingly inquisitive questionnaire arrives in every household, so providing opportunity for protest.

5.18 The fourth advantage of the register approach is lower costs. The registers exist primarily for administrative purposes and so the cost of the register-based census is only the marginal cost of gaining access to, and linking, the records and of extracting the statistics. In a conventional census up to a half of the costs are for fieldwork - despatching and receiving back the questionnaires; these costs are avoided in the register approach. But savings are reduced if additional data have to be collected for statistical purposes.

The disadvantages of a register-based census and the obstacles to introducing one

5.19 The fact that few countries outside Scandinavia have shown a positive interest in moving to a register-based census demonstrates that the method is seen to have serious disadvantages and difficulties that must be set against the advantages. They are of several kinds. First, there are disadvantages of a technical character that are inherent in the method and that apply even in the near-optimum conditions of Scandinavia. Second, there are difficulties if the quality of a country's record system is poor, and particularly if the system is uncoordinated and therefore lacks a central population register and personal reference numbers as coordinating mechanisms. Third, feasibility is affected by the institutional and legislative framework within which statistical agencies operate. Fourth, political and public opinion is seen as an obstacle to the introduction of the mechanisms needed for a register-based census, namely, the obligation to report changes of address, the wide use of personal reference numbers

and record linkage. These topics are discussed in turn.

Disadvantages that are inherent in a register-based census

5.20 Registers are a potentially good source of data on basic demographic topics (including family relationships and a woman's marital and childbearing history), and, with reservations, on educational attainments, income and some aspects of a person's economic activity. Indeed, for some topics, for example income, registers are often a better source than a conventional census. But they are not a source of reliable data on household composition, ethnic origin and languages, occupation, hours of work, mode of travel to work and many housing characteristics - essentially because there is little or no administrative need for information on these topics. There is a temptation to fill one or two of the gaps by adding to, or amending, the questions in administrative returns, but this course will be equally unpopular with the formfiller and with the administrative authority that handles the form - neither of whom may show much interest in the quality of data collected only for statistical purposes. The difficulties experienced in Denmark in obtaining reliable information on a person's occupation from administrative sources illustrate these points; similar difficulties were anticipated in Sweden (paragraph 3.25). Lars Thygesen (1983) makes the point that data from administrative registers must be controlled and validated before use in statistical applications, especially if the data are not used systematically in administration.

5.21 A second criticism of registers is that they lack the flexibility of conventional censuses. Whereas the question content and definitions of a conventional census can be changed relatively easily, the registers' contents and definitions are tied to the administrative systems that they serve. Definitions may differ significantly from desirable statistical definitions and, moreover, may change, perhaps as a result of legislation, so introducing discontinuities. An example of this is the data on income

in registers maintained by the tax authorities. On the other hand it is claimed that statistics conforming to administrative definitions are more likely to be consistent with short-term indicators than statistics from a conventional census would be.

5.22 Though register-based censuses can be taken more frequently than conventional censuses, they suffer from two weaknesses in relation to timing that conventional censuses are free from. First, whereas the conventional census can specify exactly the time period or point of time to which each question refers - and so ensure that the data conform to a common timing, the register-based census must accept the timings to which the data in the registers refer. For example, a conventional census can ask about a person's employment "last week", but the corresponding data taken from a tax register might refer to the whole of the previous tax year. Second, whilst all the responses to a conventional census may be available for processing within a few weeks of census day, the speed with which the data for a register-based census become available is dependent on the speed of the administrative process and the speed with which the machine-readable record is then updated. The data on employment in the Danish census of 1981 illustrate both these points: the data were taken from annual returns made by employers to the tax authorities, and slowness in compiling the authorities' files delayed the census results (paragraph 5.12).

5.23 The use of administrative records in a census has been criticised from a different viewpoint. It is argued that registers are too blunt an instrument to measure the complexities and informalities of present-day lifestyles: for example, the growth of second residences, part-time education, part-time jobs and the "black economy"; and looser family and household ties. Moreover, the individual's responses to administrative enquiries may be biased by self-interest. A conventional census is a better instrument; thus, there is at least a possibility that a job in the black economy will be reported on a census form. But for probing these topics in depth a sample survey is even better.

5.24 In the Scandinavian situation in which administrative record systems are coordinated through an effective central population register and personal reference numbers, the advantages of a register-based census - more frequent statistics, a lesser burden on the public and lower costs - are felt to outweigh the disadvantages, particularly the lower quality of register data on some topics such as occupation and the elimination from the census of other topics. In Sweden the disadvantages have been minimised by retaining a short census questionnaire and linking the responses to the register data. The problems may also be eased if statistical needs are taken into account in the design of the administrative record system, as would happen under the institutional arrangements in Denmark (paragraph 5.39).

5.25 Sample surveys may be employed to test the coverage and quality of data from registers, and to translate register statistics based on administrative definitions into estimates on alternative statistically-desirable definitions. And direct comparisons may be made on a sample basis between the data from a conventional census and the data from registers in order to measure the discontinuity if a switch were made from one to the other (see Thygesen (1983)).

Is a register-based census feasible in a country whose registers are uncoordinated?

5.26 The Scandinavian register-based censuses are built around the central register of population (which records current addresses) and the personal reference numbers. Is a register-based census technically feasible in a country which lacks a system of population registration and personal reference numbers - the uncoordinated system described in paragraphs 5.6-7? It would be feasible only if (1) the administrative files to be used for the census, taken in combination, provided good coverage of the resident population, (2) effective methods could be devised for extracting information on each person's current address, and (3) effective methods could be devised for linking together the records relating to the same individual. These tasks were considered in the 1983 Report (section V). On item (1) it was suggested that from among the wide range

of administrative files held in a country - see the list in paragraph 5.5 - a subset might be chosen which, taken together, gave comprehensive coverage; it was argued that almost everyone is caught up in one or more of the administrative schemes and that the few who evade virtually all the schemes might well be missed by a conventional census. On item (2) the 1983 Report suggested that the great majority of people do report their changes of address to a number of administrative agencies, so that address information might be extracted from one or other of these agencies' files. But it was recognised that some addresses would be out-of-date, some might be mailing addresses different from the place of residence, and some would not distinguish the apartments within a building; and that the coding of addresses to small areas was costly, though the use of postcodes could help. On item (3) the 1983 Report discussed the possibility of using names, dates of birth and perhaps another readily available item as identifiers for matching, on the lines already adopted in studies in France (Echantillon démographique permanent) and the UK (Longitudinal Study); both these studies refer to a 1 per cent sample of the population and both use a central population register that does not record a person's current address to check identities (see Annex 4, paragraph 21, and Annex 14, paragraph 23).

5.27 These suggestions from the 1983 Report on how a register-based census might be devised in a country whose data systems were uncoordinated bore some resemblance to a proposal made by Alvey and Scheuren (1982) for what they termed an Administrative Record Census in the United States. However their scheme made considerable use of a personal identifier, the Social Security Number (SSN), which is recorded in a number of major administrative files, both federal and State. I now question the feasibility of the propositions set out in Section V of the 1983 Report and summarised in the preceding paragraph. In particular, the quality of the information on addresses would be uncertain; and, more importantly, without an identifier that is more reliable than a person's name and date of birth, the costs of linking records would be too heavy and the errors of linking too great. These errors would consist of failures to make a match

and incorrect matches; both would lower the quality of the census statistics. The objective of moving to a register-based census is still a good one, I believe, but the route put forward in a speculative way in the 1983 Report is probably not the right route. Instead of relying on the increasing power of computers to extract meaningful statistical information from an uncoordinated record system (that is, a system with a high level of "noise"), it would be better to put right the weaknesses of the record system: in other words, adopt the coordinated record system of the Scandinavian kind. It is doubtful whether anything less than the mechanisms of population registration and personal reference numbers described in paragraph 5.8 would provide the starting point for a register-based census. There are indeed strong administrative and policy reasons for taking that course that are discussed in Section VI.

Population registers and personal numbering systems, comparisons between countries

5.28 Table 2 shows, for each of the 15 countries in this study, whether the country has local population registers, a central population register and a system of personal reference numbers, and whether data from the census of population are used to update the local population registers. The situation varies widely and the countries have been divided into five groups labelled A to E. In addition to Denmark and Sweden, two countries outside Scandinavia have the full coordinating mechanisms of a central population register linked to the local registers and personal reference numbers that are used in the files of some government agencies: these are Belgium and Luxembourg (group A). A second distinct group (C) are the countries which have local population registers but no coordinating mechanism in the form of a central population register and personal reference numbers. The Federal Republic of Germany, Greece and Italy belong to this group. For a number of reasons including the absence of a central population register, the quality of the information in the local registers in these three countries is unsatisfactory (see the annexes).

Table 2. Table showing (with the symbol x) the countries that have population registers and personal numbering systems.

Country	Local population registers(1)	Central population register		Personal reference numbers	Data from the census (1980 round) used to update population registers
		With current addresses	Without current addresses		
A. With central population register and personal numbers on Scandinavian model					
Belgium	x	x	.	x	x
Denmark	x	x	.	x	.
Luxembourg	x	x	.	x	x(2)
Sweden	x	x	.	x	x
B. Intermediate group					
Netherlands	x	.(3)	.	.(3)	.(4)
Portugal	.	x(5)	.	x(5)	.
Spain	x	x(6)	.	.(7)	x
C. With local population registers only					
Federal Rep of Germany	x	.	.	.	.(8)
Greece	x	.	.	.	.
Italy	x	.	.	.	x
D. With a central population register without addresses					
France	.	.	x	x	.
United Kingdom	.	.	x	x(9)	.
E. Without population registers					
Canada	.	.	.	x(10)	.
Ireland	.	.	.	.	.
United States	.	.	.	x(11)	.

Notes

- (1) This column takes no account of electoral registers that depend on a person applying for voting rights.
- (2) The practice was followed in some places.
- (3) A proposal for interlinking local population registers is before Parliament. Personal reference numbers have been assigned to about 70 per cent of the population and are held in the municipal population registers; numbers will be assigned to the remainder later.
- (4) The practice was followed in 1971.
- (5) Refers to the register maintained in connection with the central issue of identity cards and personal numbers to those aged 10 and over.
- (6) Refers to the register of those aged 16 and over who have, or will have, the right to vote.
- (7) Personal numbers appear on identity cards issued centrally at age 16, but are not carried into some of the local population registers or, at present, into the central register referred to in note 6. The numbers are being revised.
- (8) The practice was adopted in previous censuses but in 1983 was ruled to be unconstitutional.
- (9) The personal numbers used in the National Health Service Central Register have only limited use outside the National Health Service.
- (10) The Social Insurance Number is recorded in a number of major administrative files (for example, tax files).
- (11) The Social Security Number issued by the Social Security Administration is recorded in several major administrative files, both federal and State.

5.29 Occupying an intermediate position between the countries with Scandinavian-style systems and the countries that have population registers only at the local level are three countries (group B) each in a rather different position: the Netherlands, Portugal and Spain. In the Netherlands the quality of the municipal population registers is high because they play a part in the operation of a wide range of administrative functions, but there is no central register. However, proposals for a system of automated and interlinked regional population registers have been put before Parliament. In addition, personal reference numbers in a standard format with a check digit have already been assigned to people living in municipalities whose population registers have been automated (about 70 per cent of the population), and will be assigned to the rest of the population later; these numbers are used in the files of municipal agencies and may at a later date be used in the files of central government agencies. In Portugal there are no local registers of population apart from the electoral registers compiled from the applications of eligible voters. But there is a partially computerised register maintained centrally in connection with the issue of identity cards to everyone at age 10; the identity cards carry unique personal reference numbers which are also used in the files of some administrative agencies. However some of the information in the register is out-of-date because people are slow to get the details shown on their identity cards updated, for example a change of address. The same problem of out-of-date information affects the register systems in Spain. Here the local population registers are increasingly being coordinated through the operations of a computerised central register of those aged 16 and over who are (or will shortly become) eligible to vote; this register is maintained by the central statistical office (INE). Personal reference numbers appear on the identity cards which the Spanish Ministry of the Interior issues to everyone at age 16; the numbers are recorded in the population registers of some of the larger municipalities, and their introduction into the central register of electors is planned.

5.30 In the remaining five countries, Canada, France, Ireland, the UK and the US, there are no population registers that record current addresses either at the local

or central levels, again leaving aside electoral registers compiled from the applications of eligible voters. However France and the UK maintain central population registers that do not record current addresses (group D). Both countries' registers are constructed mainly from the registration of births and deaths and, in the case of persons arriving from abroad, notifications from the administrative agencies that make use of the registers' services. The French central register, the Répertoire National d'Identification des Personnes Physiques, is computerised and holds personal reference numbers which are used by several administrative agencies. The uses of the UK's central population register, the National Health Service Central Register, and of the associated personal numbers have been limited mainly to the administration of the health services. The register is in manual form, though computers are now being introduced, and it contains a significant amount of 'dead wood' (inflation).

5.31 Though personal numbering systems have not been explicitly introduced in Canada and the United States, the sets of personal numbers used by the respective social security agencies have come to be used by other agencies and to be recorded in their files. Thus, in the United States the Social Security Number (SSN) is issued to contributors to and beneficiaries of schemes administered by the Social Security Administration, though coverage excludes children who have not yet applied for a record card and adults who have never worked or applied for a card and are not yet eligible for Medicare. The SSN is recorded on the files of other federal government agencies such as the Internal Revenue Service (the taxation administration) and on death certificates in all States, and this has enabled some major linkage exercises to be undertaken for statistical purposes. An example is the 1973 Exact Match Study in which the responses to the March 1973 Current Population Survey for over 100,000 persons were linked to earnings and benefit information from the records of the Social Security Administration and to tax information from the Internal Revenue Service.

Prospects for a register-based census outside Scandinavia

5.32 Given that a system of population registration and personal reference numbers on Scandinavian lines is needed as a starting point for a register-based census, it would seem from Table 2 and the accompanying text that, outside Scandinavia, only the three Benelux countries are likely to be in a position to take a register-based census in the short term. But, quite apart from possible political reservations, changes of a technical kind would be needed in all three countries. In the case of the Netherlands, the population registers would have to be interlinked, perhaps on the lines of the proposals now before Parliament, and the use of the personal reference numbers would have to extend to the files of central government agencies. In Belgium and Luxembourg the personal reference numbers would have to come into day-to-day use by the public, as occurs in Scandinavia; in neither country are the numbers entered on the identity cards and a citizen may not even know his number. In Luxembourg the numbers would have to be carried into the communal population registers. However, all three Benelux countries have, or have the prospect of, the necessary data infrastructure and, because the population registers play a part in a range of administrative functions, the quality of the registers is relatively good.

5.33 Outside the Scandinavian and Benelux countries a register-based census would be feasible only if a great deal of work were done to extend the register systems and improve the quality of the information that they contain. This work should be done primarily for administrative and policy reasons, as explained in Section VI. In some cases a whole new system of population registration and personal reference numbers would be needed. There is rather little recent experience of attempting that, because most of the existing local population registers originated more than half a century ago - long before the computer age. Indeed the Swedish parish registers go back to the 17th century. The local registers in Belgium, Italy and the Netherlands all date from the middle of the 19th century, in Germany from 1875 and in Luxembourg from the early years of the 20th century. The Danish local registers were introduced in

1924. It was not however until 1952 that an effective country-wide system of local registers existed in Spain. On the other hand the introduction of central population registers and personal numbering systems has taken place since the end of the Second World War, and, in the case of Belgium and Luxembourg, in the last decade.

The quality of the information in population registers

5.34 The quality of the information in population registers is unsatisfactory in many countries. Among the main shortcomings are, first, failures and delays on the part of the public in reporting events, particularly changes of address, second, failure to remove from the registers the names of people who have emigrated, and third, duplicate registrations. These shortcomings are examined in the following paragraphs.

5.35 Failure to report events promptly can arise if the public do not see sufficient reason for doing so, or even see some personal disadvantage. This is more likely to happen if the population register serves only one or two administrative uses or if the uses of the register in dealings between the citizen and public authorities are infrequent. As an example, a single-purpose electoral register that is dependent on the individual's initiative in registering on reaching a given age and in re-registering at a new address can be notably deficient in coverage (especially among the younger age-groups) and out-of-date, as experience in France and the UK shows; in both countries registration is nominally compulsory. Conversely, if the population register is integrated into a wide range of administrative activities, there will be a correspondingly strong incentive for the citizen to report events promptly. This is a main factor in the contrast between the high quality of the registers in the Scandinavian and Benelux countries and the poorer quality of the registers in the countries of Southern Europe.

5.36 Most countries report that a main weakness in their population registers is the retention of the names of people who have emigrated. The disappearance of a name from the annual updating of files on, for example, income and social security

might offer prima facie evidence of emigration. A conventional census enumeration is an alternative instrument for detecting what has happened. (But even the census will fail to recognise that a person has emigrated if he is returned by his family at home as "resident here but temporarily absent abroad".)

5.37 Duplicate registrations occur when a person moves to a new address and is registered there without the registration at his former address being deleted. Duplication can also occur in any of the circumstances in which a person may be enumerated in the census as resident at two addresses (paragraph 3.3). Procedures built into the registration system should avoid most of these duplications; an interesting example of how this may be done is seen in the Portuguese electoral system even though registration is only at the local level using manual records (Annex 11 paragraph 26). The creation of a computerised central register is the best method of eliminating duplicate registrations. This is the means employed in France and Spain to avoid duplicates in the local electoral registers.

5.38 Responsibility for errors in the population registers cannot be blamed solely on the public. The municipalities which maintain the local registers have a financial interest in the population counts whether derived from the registers or from the census of population: for example, the formula for funding from central government may include a population component. So the municipalities may err on the side of retaining names in the register when they should be removed, in the same way as they may err on the side of an over-count in the census.

The institutional and legislative framework, the Danish example

5.39 A register-based census requires a legal and administrative framework that enables statisticians to have access to administrative files and to link them for statistical purposes. It also requires a regulatory régime and institutional arrangements that give confidence to the public. The pioneering work done in Denmark had its

origins in the Act of 1966 under which the Danish central statistical office, Danmarks Statistik (DS), was reorganised. Three key features of the Act are to be noted. First, DS was given an independent status under a Board of seven, appointed by the Minister for Economic Affairs and chaired by the National Statistician. Final authority for the programme of work rests with the Board, but responsibility for budget and personnel lies with the Minister. Second, DS was given powers to demand, and to use for statistical purposes, data that were held by public authorities for administrative purposes and to participate in the construction of registers containing such data. Third, the passage of identifiable data from DS to other bodies was restricted. Further legislation on the automated handling of personal data was enacted in the Public Authorities' Registers Act of 1978. However the Act made certain exemptions for registers used solely for statistical purposes (for example the registers of personal data created within DS from administrative registers held outside DS); thus a citizen does not have a right of access to information about himself held in such a file, and the linkage of such files does not have to be notified to the Data Surveillance Authority set up under the Act. The following paragraphs consider the situation of other countries in regard to these three features.

(1) A statistical agency independent of government?

5.40 The first feature of the Danish situation is the degree of independence from the central government that DS enjoys. This may reassure the public that privacy and confidentiality will be protected and may make the principle of record linkage more acceptable. The statistical offices in some other countries also enjoy a measure of independence of the central government, though wholly dependent on it for funds and personnel. The Central Bureau of Statistics in the Netherlands is an example. The more usual pattern is that the statistical office is an integral part of central government machinery directly responsible to Ministers, as in the United Kingdom and the United States. Even then, a consultative council on statistics, such as exists in Belgium, may be helpful in increasing public confidence if the council is sufficiently weighty.

(2) Access to administrative files for statistical purposes?

5.41 The second key feature in Denmark is the legal provision which gives DS the right of access for statistical purposes to the data in administrative files and gives statisticians a voice in the development of administrative data systems. The absence of any constraint on the use, for statistical purposes, of data from administrative files would, however, be controversial in many countries. Thus, in other European countries where the linkage of data from administrative files is technically feasible through the use of personal reference numbers (Belgium, France, Luxembourg and Sweden), a project for linking files even for purely statistical purposes would have to be approved by the data protection authority. In some countries linkage for statistical purposes may be frustrated by the existence of legal and administrative barriers that prevent the passage of the individual data to some common point. Thus, in the UK the linking of data from the census of population with income data from tax records has not yet been possible.

5.42 In the Federal Republic of Germany new restrictions on the transfer of identifiable data were imposed by the rulings of the Constitutional Court in 1983: neither the transfer of such data to another agency for statistical purposes nor the linking of data for statistical purposes can take place unless authorised by the laws governing the collection of the data. More generally, the Court introduced the principle that the methods used to collect information should represent the least burden on the respondent and the least intrusion into his privacy; and, in examining whether there was a more acceptable alternative to a conventional census enumeration, the Court ruled out a register-based census.

5.43 In the decentralised statistical system in the United States, proposals were developed in the late 1970s for the freer movement, for statistical purposes, of data held in administrative files. Selected statistical agencies would be given legal status as 'protected statistical centers (or enclaves)'. Data from administrative files in identifiable form would be able to flow into these enclaves and to be transferred from

one enclave to another for statistical purposes. Once inside the enclaves, data would have statutory protection from any disclosure for non-statistical purposes. This is the "one-way street". The Office of Management and Budget made legislative proposals on these lines in 1983. But opponents feared that the public might perceive a two-way street, with possible adverse effects on the response to surveys and censuses, and, following attacks in the press, the proposals were dropped.

(3) Legislation on data protection

5.44 The third feature of the Danish legislation is data protection. Legislation governing the automated handling of personal data already exists in many of the countries in this study but not in all. Generally the legislation is seen as helpful in protecting privacy and confidentiality and in reassuring the public; but it has placed an additional administrative burden on statistical agencies. In some cases the data protection authority set up under the legislation has refused to authorise a project involving the use of administrative files for statistical purposes that had not been made known when the data were collected (see paragraph 2.20).

5.45 Most of the data protection legislation is on the lines of the Council of Europe's 1981 Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data. The UK's Data Protection Act of 1984 was modelled on the Convention but the legislation in several countries pre-dates the Convention: Luxembourg 1979, Denmark and France 1978, the Federal Republic of Germany 1977 and the earliest in Sweden 1973. The French law of 1978 'Informatique et Libertés' set up a body independent of the executive, the Commission Nationale de l'Informatique et des Libertés (CNIL), one of whose duties was to give an opinion on the automated handling of personal data in the public sector prior to the passing of necessary regulations and laws. In the Federal Republic of Germany the Federal Data Protection Act of 1977 created an independent Federal Data Protection Commissioner to ensure observance of the Act's provisions, and each of the Länder has also appointed its own

data protection commissioner; but the ruling of the Federal Constitutional Court in December 1983 has introduced new constraints on the methods and procedures to be used in censuses and surveys (see details in Annex 5, paragraphs 24-28). The Swedish Data Act of 1973 was a pioneer in its field; it set up the Data Inspection Board whose permission is required before new files of personal data can be created or files can be linked. It is noteworthy that in these three early laws, in Sweden, Germany and France, the right of a person to have access to his data and to have them corrected applies equally to data collected for statistical purposes and to data in administrative files. However, in all three countries there is recognition, sometimes in the law and certainly in its implementation, that a less onerous régime may be appropriate for statistical and research projects.

5.46 In Belgium, Italy, Portugal and the Netherlands, draft legislation on data protection has been put before Parliament. However, Belgium enacted legislation in 1983 to regulate the operations of its central population register and the associated personal numbering system, including access and use by other administrative agencies; the Act created an advisory body, the Commission Consultative pour la Protection de la Vie Privée.

The public acceptability of a register-based census

5.47 Because information is power, the linking of registers is an emotive subject in the debate on the relationship between the State and the individual citizen. Critics may claim that a register-based census accumulates data about an individual in one place in the form of a dossier. This point has been put by the Federal Constitutional Court in Germany in a way that may seem exaggerated: "the individual citizen's entire personality would be registered and catalogued". There may also be opposition to the notion that a census is being taken by the authorities in secret instead of in the open manner of the conventional census.

5.48 On the other hand, people complain at census time that the authorities already have much of the information that the questionnaire asks for – so why ask again? This is a substantial argument. Governments seeking to reduce public expenditure and the burden on the public ought indeed to maximise the use of the data they already hold rather than approach the public in a costly, burdensome and (one might now add) risky census of the conventional kind.

5.49 Earlier in this section (paragraph 5.27) it was argued that a register-based census would be feasible only in a country having a coordinated record system of the Scandinavian kind as described in paragraph 5.8; in such a system there is an obligation on the citizen to register changes of address and to quote a personal reference number in his day-to-day dealings with public authorities. At first sight it might seem that the imposition of new duties on the citizen, or better compliance in carrying out existing duties, would be a major obstacle to a register-based census in many countries. That argument would probably be conclusive if the census or statistics were the primary reason for the new duties. But the primary reasons for a coordinated record system are essentially political; they are outlined in Section VI. The argument advanced here is that, if for these political reasons a country's record system were improved through population registration and personal numbering to the quality achieved in Scandinavia, then better statistics would be a by-product and these could include a register-based census.

5.50 Given that a register-based census is technically feasible in terms of a country's data infrastructure, its acceptability will depend on the institutional and legislative framework within which linking takes place. First, the government statistical organisation should have built up an unassailable record of integrity, particularly in the matter of safeguarding confidentiality; and in this respect the public may see a clear advantage in a statistical organisation that is in a significant degree independent of the government rather than a statistical organisation that is a direct agent of the

government. Second, privacy and confidentiality should be protected by statutory rules for handling personal data, with an independent data protection authority to supervise their implementation. These matters were discussed in paragraphs 5.40 and 5.44-46.

5.51 Technical steps can be taken to allay public concern about the linkage of data. For example, instead of linking registers together into a permanent merged file, it is preferable to hold the registers separately and to link them together ad hoc only when the need for statistical analysis arises. Procedures may also be devised that exclude explicit identifiers (such as names) from any linked data.

5.52 Despite the difficulty of obtaining views directly from the public on a subject like record linkage, a survey of attitudes to a register-based census was carried out by Statistics Sweden in 1981-82. Before being questioned, each person taking part in the survey was presented with the data about himself, extracted from administrative sources, that would be used in a register-based census. Respondents who said that they preferred the register approach outnumbered those who said that they preferred a conventional census in the ratio of 2:1. It is difficult to judge whether the survey's findings would apply in other countries with different traditions. Details of the survey are given in Annex 13, paragraph 35.

5.53 Important statistical projects involving linkage have been successfully undertaken in countries where doubts on propriety might be thought to be strongest. In both France and the UK, census data have been linked to data from administrative files in the Panel Démographique and the Longitudinal Survey respectively (paragraph 3.66), and an example of a major linkage exercise in the United States was given in paragraph 5.31. It may be argued that schemes that are politically acceptable when only a relatively small sample of the population are included (as in the examples mentioned) may no longer be acceptable if extended to the whole population. Moreover in the Longitudinal Study in the UK data do not cross departmental boundaries.

5.54 Statisticians in many of the statistical agencies take a cautious view of the wisdom of undertaking large-scale record linkage projects. They fear that public confidence in the ability to protect personal data, built up over a long period, could be undermined.

VI THE ADMINISTRATIVE AND POLICY REASONS FOR IMPROVING REGISTERS

6.1 The previous section of this report concluded that, for most countries outside Scandinavia, a prerequisite for a register-based census would be a major improvement in the record system. What is needed is a record system that is coordinated by means of a reliable population register and a set of personal reference numbers, as described in paragraph 5.8; and this implies an obligation on the citizen to notify changes of address (and to do so promptly) and to quote a personal reference number in day-to-day dealings with public authorities. Politicians and the public will not be persuaded that new obligations of this kind, or better compliance with existing obligations, can be justified on statistical grounds including the desire to take a register-based census.

6.2 But there are important political reasons for developing a coordinated record system - reasons that concern administration and policy. This is a topic that lies outside the census and statistics, but it is outlined here because of its relevance, because it deserves wider discussion and because statisticians are well placed to play a part in new developments.

6.3 When a country's record systems are not coordinated into a coherent whole - and in particular when individuals are not reliably identified and addresses are not accurate and up-to-date, a number of undesirable consequences result. First, the costs of administration are increased. Second, administration is less effective. Because of duplicate entries in files and the limited ability to link an entry in one file to a related entry in another file, privileges and benefits are given to those not entitled to them, and duties and taxes fall on those who should not have to carry them. The system is therefore less fair than it ought to be. Third, the opportunities for tax evasion, fraudulent claims and crime are increased. Fourth, without a reliable population register the policy options available to government are reduced. To give examples of this in the United Kingdom, the absence of local population registers limits

the ways in which local taxation could be reformed; it makes the control of immigration more dependent on frontier controls than on control on residence; and it inhibits attempts to improve the quality of the electoral register by eliminating duplication or increasing the coverage of the younger age-groups.

6.4 There are thus cogent political reasons for a coordinated system of records. But an obligation to notify changes of address and to use personal reference numbers in dealings with authority would be seen by some as an additional burden on the public and an unacceptable infringement of personal liberty. The first of these two objections is of doubtful validity: it is in fact a smaller burden to notify a change of address to just one registration authority (which communicates the change to other authorities) than to notify the change separately to half a dozen or more authorities. And it is no more onerous to quote a personal reference number that serves on all occasions than to quote other identifiers such as date of birth and place of birth or perhaps one of the several reference numbers that have been assigned to serve different schemes.

6.5 Those people whose dealings are less than completely honest are the ones most likely to complain about unacceptable infringements of personal liberty. The way to deal with the fears associated with an efficient register system is not to deny oneself the benefits that it brings but to provide the safeguards that can reduce (if not eliminate) the risk of abuse – in particular, legislation on data protection (see paragraphs 5.44–46 and 5.51).

6.6 In some people's minds population registration is associated with identity cards. Thus in Belgium the two are closely associated. But there is no necessary connection. For example, in Denmark the system of population registration operates effectively and there are no identity cards.

6.7 In weighing up the feasibility of introducing population registers or of improving

existing registers, account has to be taken of the differences between one country and another in the willingness of the public to conform to the bureaucratic procedures that are needed to keep registers accurate and up-to-date: differences in the public's sense of civic duty and in attitudes towards authority. This may help to explain why some countries are able to maintain registers of high quality when other countries are unable to do so or doubt the feasibility of making the attempt.

6.8 To sum up, the case for a register-based census is just one aspect of a much bigger issue: the case for a more effective – and consequently fairer – system of public administration. It is not essentially a question of creating new record systems: they already exist in some form because every country has systems of vital registration, personal taxation, social security, property registration/taxation and so on. It is a question of organising these records in a consistent and coherent way that makes the best use of information technology.

6.9 The statistician's primary task in all this is to ensure that changes serve statistical as well as administrative ends. But in addition he may be in a position to see the record system as a whole in a way that administrators working in particular agencies cannot do, and therefore be able to make a more general contribution to the system's development.

6.10 These wider issues deserve to have a full public discussion starting from a basis of fact. Too often, I believe, the subject is dismissed by reference to political axioms and there is no opportunity for rational debate.

VII SUMMING UP

7.1 In the countries included in this study the biggest problems in the 1980 round of censuses have been concerned with logistics and public relations rather than with strictly technical matters. Several countries have reported difficulties in recruiting a sufficient number of enumerators of suitable quality and in securing suitably close collaboration with the municipalities. In some cases the effectiveness of the census has been reduced by a failure to plan the operation well in advance or by inadequate funding.

7.2 Public relations have been helped by restricting the length of census questionnaires, by measures to safeguard confidentiality and by well-prepared publicity campaigns. The converse situation has led to difficulties in some countries - for example in the Federal Republic of Germany where the arrangements for safeguarding confidentiality were held to be insufficient.

7.3 The main disadvantages of the conventional census are, therefore, its cost (which is highly-peaked), the burden on the public (though this is moderate if the question content is restrained) and nowadays the risk that the census will be damaged by an unpredictable public protest, as happened in Germany and the Netherlands. In addition the ten-year interval between censuses in most countries is too long to meet the needs of many users of census statistics.

7.4 The technical elements of the conventional census continue to be developed. Automation is being more widely applied in areas such as data input, coding and geography. In some countries considerable effort is being devoted to the measurement of coverage error, more especially in North America; in the United States the feasibility of adjusting the census results for coverage error has become a live issue.

7.5 Sample surveys and sampling techniques can be employed in many ways in direct

support of a census. Sample surveys complement the results of the census by providing greater topic detail at national and regional levels and more frequent statistics; labour force surveys are an important example of this. But sample surveys cannot, by themselves, be a substitute for the census by providing statistics for small areas and for other small groups in the population.

7.6 The register-based census as developed in Denmark avoids many of the difficulties of the conventional census. By making use of data already held by administrative agencies, it saves the cost and burden on the public of a conventional enumeration; it can produce more frequent statistics; and it is less vulnerable to a sudden wave of public protest.

7.7 But some census topics are not found in administrative registers, for example, method of travel to work, some housing characteristics and household composition (if defined as a group of persons living and keeping house together). Some topics, such as place of work, can be added to administrative returns, though this increases the burden on administrative agencies and on formfillers. And some topics, notably occupation, may appear on administrative returns but be of unsatisfactory quality. Other weaknesses of data from registers are that the definitions will be administrative rather than statistically desirable and that delays in updating registers can slow census processing.

7.8 The Danish view is that the disadvantages of the register-based census are outweighed by the advantages. Sweden's census is now essentially register-based; but the loss of reliable data on a small number of topics has been avoided by supplementing the data from registers with a short conventional questionnaire. This may represent an optimum solution.

7.9 The study concludes that a register-based census is feasible only in a country whose record systems are coordinated, as in Scandinavia, by the mechanisms of a reliable

population register and personal reference numbers; these mechanisms imply an obligation on the citizen to notify changes of address and to use the personal number in day-to-day dealings with public authorities. Outside Scandinavia, the only countries in the study which are in or near that situation are the Benelux countries. Other countries that wished to take a register-based census would need to improve, extend or indeed introduce local population registers and the associated central population register and personal reference numbers. They would have to rectify weaknesses in existing population registers due, in particular, to three factors: the public's slowness in notifying changes of address; the registration of a person at two addresses (that is, duplication); and the retention in the register of people who have emigrated.

7.10 New obligations placed on the citizen (to notify changes of address and to use a personal number in dealings with public authorities) together with linkage of records on a large scale (even if only for statistical purposes) might seem insurmountable political obstacles to a register-based census in some countries. But objections to record linkage for statistical purposes should be met by legislation on data protection with a data protection authority to supervise its implementation, and perhaps also by giving the statistical agency a degree of independence from government.

7.11 It is very doubtful whether any argument about statistics would be enough to persuade the public to accept new obligations or to comply more conscientiously with existing obligations. However there are strong reasons concerned with administration and policy for coordinating a country's record systems through the mechanisms of population registration and personal numbering. The reasons are: to make administration more cost-effective; to promote a fairer distribution of duties and benefits; to reduce the opportunities for tax evasion, fraudulent claims and crime; and to extend the range of policy options open to government.

7.12 New obligations to notify changes of address and to use personal numbers will

be seen by some vocal opponents as an extra burden on the public and an infringement of personal liberty. But it is doubtful whether the Scandinavian ways of reporting are more onerous than the haphazard ways that prevail in other countries. And it may be questioned whether the honest citizen would find his liberty infringed in any way by a better record system, though the dishonest citizen would be constrained. But it has to be recognised that national temperament and political thinking may inhibit the development of coordinated record systems and the imposition of the obligations that go with them. These are important issues that go far beyond statistics. They deserve to be widely discussed rather than dismissed by reference to political axioms. Statisticians should play a part in these discussions and, later, in the technical work of improving record systems.

7.13 In the 1950s and 1960s record systems in Scandinavia were being coordinated through better systems of population registration; and similar developments are now taking place in the Benelux countries helped by legislation on data protection. Information technology is opening up new possibilities while costs of data handling are falling. As the wider issues discussed in the two previous paragraphs are resolved, it seems likely that more countries will follow the Scandinavian example. If they do so, better statistics will be a by-product, including the technical capability of taking a register-based census. The economies to be secured by recycling data already held by government will encourage them to adopt this method of census-taking. But, like Sweden, they may retain a short conventional questionnaire (either on a 100 per cent or sample basis) to avoid the loss of information on a few key topics.

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THE CENSUS OF POPULATION IN BELGIUM

Summary

1. The Belgian census of population is closely linked to the system of population registration. The local population registers date back to the last century and soon all of them will be computerised; they are linked to a computerised central register. Identity cards play a part in many aspects of everyday life of the citizen, and the information that he provides to the authorities on, for example, change of residence serves to update both his identity card and the population register.
2. A personal reference number is issued to each person at birth and is recorded in the population registers. The possibility is seen of using this number as a mechanism for linking files for statistical purposes, and, in the longer term, such linkage may replace the census of population as a source of statistics on some topics.
3. The forms filled in at the decennial census of population and housing include, in addition to the forms destined only for statistical analysis, a form with limited question content that is retained by the communes for checking, and as necessary correcting, the population registers. Further, in the 1981 census names, addresses and basic demographic information held in the population registers were preprinted onto the census forms, so that for these topics the public had only to check or correct the preprinted entries. The coverage of the census/population registers is of a high order of accuracy, though there is a small degree of inflation in the registers that comes to light only at the census - demonstrating the value of a census in providing a periodic check on register accuracy.
4. Despite the overall effectiveness of this integrated system of population registers and census, the 1981 census encountered substantial difficulties that were

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unconnected with either public reaction (which was generally favourable) or with strictly technical matters: the difficulties were essential administrative and logistical concerning the recruitment of enumerators, the collaboration of the communes and, above all, a lack of resources - all of which seriously delayed the publication of the census results.

5. As a consequence of this experience and continuing restrictions on resources, a study is being made of a number of options for the next census in 1991 and beyond, including:

To transfer responsibility for managing the local census fieldwork from the communes to the centre.

To use sampling at the collection or processing stages.

To use mail-out and mail-back in conjunction with the preprinting (as in 1981) of names, addresses, etc from the population registers.

To construct a register of housing units that could be linked to the register of population.

Organisation

6. The statistical service in Belgium is centralised in the Institut National de Statistique (INS) which is a part of the Ministère des Affaires Economiques. INS organises the censuses of population and housing with the collaboration of the communes which manage the local fieldwork. The work of the INS is overseen by the Conseil Supérieur de Statistique, a consultative body whose advice is generally followed. The council is made up of representatives of government departments, local administrations, employers, trade unions and universities.

The objectives of the census: its frequency

7. The legal basis of the census of population is laid down in the law of 1856. The first main objective of the census is to determine the official population of administrative areas - to be done within six months of census day. The Constitution requires that the distribution of seats in the Chambre des Représentants is to be made on the basis of the census figures of population. The figures are also used to determine representation in provincial and communal councils and to calculate certain payments from central government to local government.

8. A second main objective of the census stems directly from the law of 1856: the law provides for the maintenance of local population registers and for the use of the census data to correct the registers. The third main objective is to provide statistics of population, including its demographic, social and socio-economic characteristics, and of housing at all geographical levels from the nation to the individual quartier - the smallest areal unit in the analysis with an average population of 500.

9. The Constitution requires a decennial census of population. The most recent was taken at 1 March 1981; this was the first census of population and housing to be taken separately from a census of industry and commerce.

The census fieldwork: the rôle of the communes

10. The fieldwork of the Belgian census is managed by the communes under the direction of INS. It is on conventional lines: a census enumerator visits all housing units (and buildings which could serve as such) in the circonscription (enumeration area) assigned to him, delivers the census forms and collects them when they have been completed. In recruiting enumerators, the communes give priority to communal employees and the communal police because of their local knowledge and their

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understanding of the system of population registration. But in 1981 these sources did not yield the numbers of enumerators required - in part because of the level of pay and also fears expressed about the personal risks of enumerating in some city centres. Subsequent attempts to recruit from among the unemployed were seen in retrospect as a failure: those recruited lacked training and motivation. In all only about 12,000 enumerators were recruited (of whom 1 in 6 were from the unemployed) against the 15,000 needed.

11. The slowness in recruiting enumerators together with inadequate support from some of the communal administrations led to delays in the fieldwork with some unfortunate consequences: enumerators who were late in delivering the census forms found that the census-day occupants had removed and that the messages of the publicity campaign had been forgotten. This was the first of a number of logistical factors that delayed the 1981 census results.

12. An important and successful innovation was introduced in 1981 into the household forms that were distributed in the majority of communes: some basic information about each of the members of the household was preprinted directly from the national population register. Thus the public had only to check and, as necessary, correct and complete these data, which covered name, sex, date of birth, nationality, marital status and relationship to head of household. This procedure not only reduced the demands on the public but also the later task of data input to the computer. The experience showed up the need to improve the quality of the information in the population register and to minimise the interval between the date when data were extracted from the register and census day, so as to reduce the number of changes that the public had to record.

13. Sampling has not so far been used in the Belgian census either at the collection or processing stages. The feasibility of mail-out and mail-back was however tested

in 1979 but less than half of the forms were completed correctly and mailed back without reminders. The method was rejected for the 1981 census because of the poor results of the test and because of the perceived need for enumerators to visit each housing unit in order to track down anyone not recorded in the population register and to make returns in respect of unoccupied houses and second residences.

14. The communes check the completed census forms handed in by the enumerators and compare the entries with the data in the local population registers - both to update the registers and to complete a census form for anyone known to be resident whom the enumerator has been unable to contact. In 1981 some communes were unable to provide sufficient resources for this work and the final batch of completed census returns reached INS ten months later than planned.

The census questionnaires: the population base

15. The household is defined as one or more persons living together en commun; the housing unit (logement) is defined as the accommodation they occupy. Thus, apart from vacant houses, second homes, etc, there is a 1:1 correspondence between households and housing units. The population base is the usually resident population. In the 1981 census the household form (C1) asked for basic demographic information on the members of the household usually resident, whether present or absent on census day, but, as already noted, it had in most cases been completed before delivery by preprinting from the national population register; form C1 contains the information required to determine the official population of each area. In addition, an individual form (B) for each member of the household asked for further details including whether or not he was present on census day and, if not, his whereabouts and the reason for temporary absence.

16. A distinctive individual form (B bis) asked for details of any person present on census day but not usually resident at the address. When completed this form was

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passed back to the commune in which the person was usually resident. If a person was returned on form B as 'temporarily absent on census day' and the commune did not receive a form B bis from some other commune in which he was present, there was prima facie evidence that the person had been counted as usually resident in two communes and further investigation followed; double counting occurred most often in such cases as persons living in homes for the aged, married couples living apart and persons with second residences. Consideration is also given to the case of a person returned on form B as 'temporarily absent abroad' to decide whether he should be treated as resident in Belgium or as an emigrant.

17. The individual forms in 1981 (B and B bis) asked questions on duration of residence at the present place of residence, economic activity, education and training, travel to work or to study, and, for women, marital and childbearing history (the latter to be completed by "all women who have had one or more children") - 21 questions in all. The Belgian census has never asked questions on ethnicity, language, religion or income. A form (C2) on the accommodation occupied asked a further 19 questions: these included questions on heating and heating insulation, cars, a garden or other surrounding area available exclusively to the household, and the occupation of a second residence or holiday home located elsewhere.

18. In addition to receiving the three standard types of form destined for statistical analysis by INS (C1, C2 and B), each household received a further household form (A) that was destined for the use (and retention) by the commune in correcting the population register. This form covered in respect of each person usually resident the basic demographic information (as on form C1) and certain other details including names of spouse and of parents and occupation.

Census processing and dissemination

19. The processing and publication of the results of the 1981 census were seriously delayed first by the late receipt of the completed forms from the communes, already referred to, and, second, by the acute budgetary and recruiting constraints in INS. In addition, new computer equipment had not been installed or tested before census day and technical support for it was inadequate. As a result, the official population figures were published some 16 months after census day (that is 10 months late) and the analysis of population characteristics (form B) will not be completed until the second half of 1986.

20. A geographical tool first introduced in 1981 is seen as a significant methodological advance though costly to construct. Addresses (though not names) were fed in to the computer and the associated census data were automatically assigned to a quartier using a directory that defined each quartier in terms of the streets (or sections of streets) that it contained.

21. Anonymous individual census data ('microdata') are not released. The law does not permit this.

Census coverage and quality

22. No surveys of census coverage and quality have been made. But, given the crosschecks between the census and the population registers, there is little doubt that coverage is virtually complete. There could however be some under-enumeration of foreigners illegally living in the big cities.

The cost of the census

23. The cost of the collection stage of the 1981 census is put at 500 million Belgian francs, that is some 50 Belgian francs per person.

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The public's response to the census

24. The public generally responded well to the 1981 census. Though there was some evidence of a growing reluctance to respond, refusals were few. The concept of 'head of household' embodied in the census form was attacked by some including organisations representing women's rights, and will be replaced in the next census by the term "the reference person". A major publicity campaign was undertaken for the first time in 1981, but lack of funds prevented it from being carried on radio and television - a gap that INS feels should be filled in a future census.

Registers of the resident population

25. Almost all of the communal registers of the resident population are now computerised. In addition, from 1968 onwards the Ministère de la Fonction Publique has built up a computerised central population register that draws information from the local registers. The national population register records each person's name, sex, date of birth, place of birth, marital status, nationality, occupation and main place of residence together with an 11-digit personal reference number given when the person is first entered in the register (- this reference number has also been carried into the local population registers). Records are grouped by household. The operations of the national register are now regulated by a law enacted in 1983.

26. Associated with population registration is the system of personal identity cards. This is a well-established feature of everyday life in Belgium. Apart from their use in many dealings between the citizen and public authorities, identity cards are used in non-public contexts: for example, the citizen may need to present his card in a bank or cinema. Cards are issued at birth. They are updated - for example to record a change of residence - when a person registers the change at the communal office responsible for the local population register. Distribution has begun of a new design

of identity card which carries a magnetic imprint but will not carry the personal reference number in either magnetic or visual form - indeed, though a person may ask for his reference number, most people do not know their own number.

27. Because identity cards have such wide-ranging uses, the coverage of the population registers is reckoned to be virtually complete. But there is some inflation; this occurs when a person changing his residence fails to inform the commune of his departure including, in particular, the case of a person who leaves the country without notifying the commune. Paragraph 16 describes the census procedures for detecting persons who have been duplicated in the census returns and persons who have been included in the census returns though they have emigrated. At the same point in the census cycle, the checks between the census returns and the population registers lead to deletions from the registers: in 1981 about 13,400 persons were deleted (0.14 per cent of the population) compared with 40,000 in 1970. The majority of the deletions refer to emigrants. Progressively, as the newly-designed identity cards are distributed, the national population register is detecting cases of duplication in the registers and is initiating corrective action.

28. The 1983 Act contains provisions under which the 11-digit personal reference numbers may be carried into the records of government departments, and certain public bodies may have access to the data in the national population register. The personal reference number can therefore be used as a means of linking files (including the national population register itself) for statistical or administrative purposes. But before Ministers can authorise a new use of the personal reference numbers or of the data in the national population register - for example in a linkage project - they have to seek the opinion of an advisory committee for the protection of privacy set up under the 1983 Act - the Commission Consultative pour la Protection de la Vie Privée. Linkage of records is a sensitive political issue but INS believes that it will be able to

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get approval for linkages made solely for statistical purposes; no such linkages have been made so far.

29. Reference has been made to the 1983 Act governing the operations of the national population register. However there is as yet no general legislation on data protection, though late in 1983 the Minister of Justice submitted to Parliament a Bill drawn up on the lines of the Council of Europe's 1981 convention on data protection.

Intercensal population estimates

30. The intercensal population estimates at all administrative levels down to the commune are the counts from the previous census updated by the changes recorded in the national population register. The estimates become increasingly inflated as the interval since the previous census lengthens (as explained in paragraph 27); but the extent of the inflation is small.

Sample surveys

31. The Labour Force Survey (LFS) has been taken biennially on lines proposed by Eurostat. The sample size has varied from year to year between 16,000 and 50,000 households (0.4 to 1.4 per cent of all households) and uses the population registers as the sampling frame. The country is divided into 36 strata and, within each stratum, a one-stage sample is drawn in urban communes and a two-stage sample in rural communes. A response rate of about 75 per cent is achieved on average, around 70 per cent in the big cities.

32. The 1977 LFS was extended by interviewing a sample of 200,000 households (6 per cent of the population) in addition to the 48,000 households (1.4 per cent) required for the LFS proper. A main aim of this enlarged sample ($7\frac{1}{2}$ per cent of all households)

was to update the results of the 1970 census of population by using a set of questions on population and housing based on those asked in the census.

The future of the census of population

33. Two main factors are causing INS to reconsider the methods for the next census of population in 1991: the inexorable pressure on costs; and the difficulties in the fieldwork, particularly in recruiting enumerators. A number of possibilities may be studied:

- (a) Responsibility for managing the local fieldwork might be taken directly by INS rather than devolved on the communes as hitherto, so as to avoid the difficulties encountered in 1981 (paragraphs 10, 11 and 14). A cadre of field personnel directly responsible to INS could be employed in other major surveys.
- (b) Cost savings could be achieved by sampling at the processing stage. But more substantial savings of both cost and burden on the public would result from sampling at the collection stage. One possibility would be to rely on the population registers for basic demographic information and to collect more detailed information including housing information through one or more sample surveys. The surveys would use the population registers as a sampling frame and could perhaps examine some topics in depth using a permanent corps of interviewers. With a sample size similar to that of the 1977 extended LFS (7½ per cent), acceptable figures could be produced for areas containing a population of 40,000 or more. A disadvantage of this approach would be the absence of the decennial census check on the contents of the population registers.
- (c) A less radical way of introducing sampling at the collection stage would be to carry out a complete census enumeration that collected the basic demographic

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data from everyone with only a sample of households giving the more detailed information including housing information. One version of this approach is the short form/ long form method and, for that, mail-out/ mail-back might be used at least for the short forms. Another version is a basic census enumeration, perhaps using mail-out/ mail-back, followed by a separate sample survey linked to it.

- (d) The schemes of sampling at the collection stage as set out in (c) would continue one of the methodologies successfully pioneered in the 1981 census: the preprinting from the national population register to the census forms of names, addresses and basic demographic data. This will require that the information extracted from the register should be of higher quality (for example on address and household composition) and more up-to-date. And, as already noted, the schemes at (c) might use mail-out/ mail-back. Although the 1979 pretest of a mail system gave poor results, the view has been expressed that a much higher percentage of forms would be correctly completed and mailed back in the real census than in a pretest.
- (e) The creation of a register of housing units would be a major step forward, though it may not be capable of realisation by 1991; at present there exists only a register of land and property. Providing the housing register and the population registers specified an address in identical terms, housing details from the housing register could be linked to personal characteristics from the population registers. Moreover information from the housing register could take the place of the surveys of unoccupied houses and second residences which at present are a part of the census enumeration but which would disappear from a mailed census. Indeed a housing register could improve the precision and reliability of the census as a whole.

34. The Conseil Supérieur de Statistique will be invited to study which of these propositions should be pursued for the 1991 census. In the longer term there is the possibility that some statistical information, at present collected from the public through the census, can be drawn from administrative files using the national population register and the personal reference numbers as the mechanism for linkage.

THE CENSUS OF POPULATION IN CANADA

Summary

1. Canadian censuses of population and housing are now taken every five years. Delivery of forms is made by census representatives and in the urban areas the forms are mailed back. A long form is delivered to a sample of households selected during the enumeration routine and a short form is delivered to all other households. The 1981 census was regarded as an unprecedented success in terms of both the public's response to the census and the rapid processing of the results - they became available a year ahead of the corresponding 1971 schedule. The gross rate of undercount in 1981 was estimated from the Reverse Record Check to be 2.0 per cent.

2. The recent census taken on 3 June 1986 follows closely the methodology of the 1981 census, though with a somewhat reduced number of questions in the long form. The collection process was successfully completed without any controversy. The costs of the census over the five-year census cycle are expected to be held, in real terms, at or below those of the previous census of 1981.

3. In 1983 Statistics Canada completed a study into the possibility of using data from administrative files as a replacement, in part or in whole, for the census. The study concluded that administrative files complemented rather than replaced the census as a source of statistics. Approval was given to a program of development of small area statistics for intercensal years: these statistics were to be derived from administrative files but would also depend on the census as a bench-mark for calibration to statistically-desirable definitions and coverage.

4. Thus, in the Canadian view, the future of the census of population lies in the further development of conventional methodology building on the success of recent

censuses. With only a five-year interval between censuses, the planning of the next census scheduled for 1991 is beginning at the moment when the collection stage of its predecessor is being completed.

Organisation

5. Statistics Canada is the statistical agency of the federal government responsible for the production of most of Canada's statistics. It reports to Parliament through the Minister of Supply and Services. Its remit is to provide for the statistical needs of all levels of government and the general public, and it coordinates the statistical activities of other federal and provincial departments. It exercises responsibility for its choice of programs after considering the needs of users. Professional advisory committees bring in outside experts to monitor the statistical programs and to suggest improvements in their scope and content.

Objectives of the census: frequency

6. Under the British North America Act of 1867 a decennial census is required for the purpose of redistributing the representation of the provinces in the House of Commons, and it is the decennial census figures that are used to determine the boundaries of electoral districts. Under current legislation a census has to be taken at five-yearly intervals in years ending in 1 and 6; the first national quinquennial census was taken in 1956 (prior to that, quinquennial censuses were taken only in the Prairie Provinces) and the most recent was on 3 June 1986.

7. Fiscal transfers between the federal government and the provinces and between the provinces and the municipalities are calculated by reference to the annual population estimates, which are based on the periodic census counts. Implementation of the programs under the Official Languages Act depends on census statistics of mother tongue. Among the many other uses of census statistics in government and business, particular

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importance is attached to their use in studies of the labour market, for example in occupational forecasting.

The census fieldwork

8. The fieldwork of the census of population and housing is combined with that of the census of agriculture, and a temporary field force is recruited to take the two censuses. In 1986 the field force numbered about 41,000, of whom about 38,000 were in the basic grade of census representative employed for a period of some 5½ weeks around census day; to relieve youth unemployment, it was the aim to recruit young people to about half of these jobs using funds from the federal government's youth employment program Challenge '86.

9. The census representative is the local field officer responsible for listing the housing units within the enumeration area assigned to him, for delivering a census questionnaire to each household, for scrutinising the completed questionnaires and for following up non-respondents. Mail-back, first introduced in 1971, is employed in the urban areas. In the rural areas, however, farm operators also have to complete the separate questionnaire of the census of agriculture, and so the census representatives collect the completed questionnaires for both censuses. But the use of mail-back in rural areas is being extended. Mail-back is seen as an important aid to confidentiality because many census representatives live in the areas which they enumerate. In the Indian reserves and in Northern and remote areas (with 2 per cent of the population), the census representative makes a single visit and conducts a personal interview; prior to the 1971 census, interviewing was the standard method of enumeration in Canadian censuses.

10. Sampling at the collection stage by means of a long form addressed to a sample of private households and a short form addressed to the remaining private households has become a standard feature of Canadian censuses, though the sampling fraction and

other details have varied from census to census since sampling was first introduced in 1941. In the 1981 census 1 in 5 households received the long form; and, although the case for adopting a 1 in 7 or 1 in 10 sampling fraction in the 1986 census was examined in terms of savings in costs and respondent burden, a 1 in 5 sample was retained in 1986 in the interests of data quality. In the remote areas all households are asked the questions on the long form.

11. The selection of the sample is a part of the census representative's delivery routine. The census representative compiles a record of the private dwellings enumerated in his area in a document (the Visitation Record), and long forms are delivered to dwellings entered on every fifth line of the document (which is distinctively shaded). To avoid the risk of bias in the sample selection, the census representative has to pre-plan his delivery route following certain rules about the order in which city blocks and rural roads and the dwellings within them are to be enumerated. Routes are checked by census supervisors; and at the processing stage statistical checks are made to ensure that the differences between the sampled households in an area and all the households in the area (in terms of topics that appear on both the long and short forms) are within acceptable error limits.

12. A number of special programs have been introduced to ensure a high level of census coverage. First, coverage in urban areas is improved by comparing the lists of housing units that have been prepared by census representatives before census day with Post Office lists; in 1981 this check led to an addition to the population count of about 0.1 per cent. Second, a check is made of the extent to which persons temporarily away from their homes on census day have been included in the counts of residents at their home addresses (see details in next paragraph). In 1981 the check was carried out for a 2 per cent sample of people enumerated away from their homes; of the sampled persons 23 per cent had been missed in the counts at their home addresses. This check led to an addition to the count of the total population resident in Canada

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in 1981 of some 120,000 (0.5 per cent of the total). Third, specially trained enumerators re-enumerated dwellings that had been classified during the main enumeration as "unoccupied". In 1981 the check was carried out in a sample of about 1,250 enumeration areas. The results showed that nearly 20 per cent of the unoccupied dwellings had been misclassified, of which about half were in fact occupied and about half were not habitable (for example being renovated). This led to an addition to the population count of some 80,000 (0.3 per cent of the total). The additions to the count resulting from the second and third of the checks, both of which were done on a sample basis, were carried down to the micro level (the individual person, household and dwelling) by imputation, that is, by duplicating some census records.

The census questionnaire: the population base

13. The population base is the usually resident population, so that the household questionnaires ask for a return of "all persons who usually live here". But, in addition, a person staying at or visiting an address temporarily (as of census day) and having a usual home elsewhere in Canada has to complete an individual form which asks the address of usual residence. The aim of this is to provide a check that the person has not been missed from the enumeration of usual residents at his home address, though, as explained in paragraph 12, the check is in fact carried out only on a sample basis.

14. A housing unit (termed a "dwelling") is defined as a separate set of living quarters with a private entrance from the outside or from a common hallway or staircase inside the building, the entrance not being through someone else's living quarters. The household comprises the people usually living in the dwelling; thus the household is not defined in terms of the people who share common housekeeping or a similar concept.

15. The long form in the 1971 decennial census was the longest ever in Canada.

It asked 69 questions and was addressed to a sample of 1 in 3 households. The long form for the mid-decade census of 1976 was of a much more modest length: only 19 questions, of which 13 also appeared on the short form. In the following decennial census of 1981 respondent burden and costs were cut, as compared with 1971, through reductions both in the length of the questionnaires - the long form asked 46 questions - and in the sampling fraction which became 1 in 5.

16. The 1981 short form asked 12 questions in all: six questions about each person in the household, of which five were demographic (sex, date of birth, etc) and the sixth language first learned in childhood; two housing questions; and four 'housekeeping' questions designed to ensure a full and accurate response. The long form asked 46 questions in all: 30 questions about each person in the household, 12 housing questions and the four housekeeping questions. The questions about each person - additional to those on the short form - asked about place of birth, citizenship, year of immigration, ethnic group, religion, languages, address five years previously, date of marriage, fertility (for married women) and income, as well as a range of questions on education and economic activity.

17. In planning the 1986 census, users of census statistics were consulted on the topics to be included. The topics asked for followed closely the topics that appeared in the 1981 census, with particular emphasis on statistics of the labour force - including industry, occupation, income and educational achievements - followed by information on language, the native peoples, the disabled and housing. The actual design of the 1986 forms reflects these demands as well as a desire to make savings in costs and respondent burden in the mid-decade enumeration. The 1986 short form asked an extra question compared with 1981 for each person ("Do you consider yourself an aboriginal person or a native Indian of North America?"), but dropped a question on type of dwelling. In addition, the long form asked new questions on a person's main field of study in his highest post-secondary qualification and on disability. The latter was designed as a screening question for a follow-up survey. But several of the questions on the 1981

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long form were dropped from the 1986 long form: the questions on date of marriage, fertility, religion and recent attendance at an educational institution as well as some of the housing questions.

Census processing and dissemination

18. Following checking by the census representatives, the completed census forms go to regional processing offices for manual editing and the coding of write-in responses. The data are then keyed into the computer using spare keying capacity elsewhere in the federal government. However in two earlier censuses, those of 1971 and 1976, the pencilled entries on the forms (together with the codes in respect of the write-in responses) were microfilmed and then read into the computer by the use of the optical sensing equipment named FOSDIC that had been developed for the United States census by the US Bureau of the Census. Following data entry to the computer, there is a stage of structural editing of the data carried out in batch mode and then a hot deck system of auto-edit to edit questionnaires containing incomplete or inconsistent responses.

19. Statistics Canada has had an automated geographical database since 1971. It is in two parts, each of which holds the geographical coordinates and associated information needed for the production of maps by computer (type of area, area names, area codes). The first part, the Area Master File (AMF), is very similar to the United States GBF Dime files, and in general covers major urban areas with a population over 50,000. The AMF describes the complete street network in coordinate form and includes such information as street names, the range of addresses for each block-face (a block-face being one side of a street between two streets that intersect it) and a centroid for each block face. AMFs, in conjunction with a second file which cross-references households in the census database to the block-face centroids, were designed to facilitate the preparation of census statistics for non-standard geographical areas defined by customers in terms of geographical coordinates. Starting with the 1981 census, the AMFs have also been used to produce automatically the base maps used in the census

field operation; by 1991 60 per cent of the maps should be produced in this way. The second part of the database, the Census Geographic Master File, holds information for the standard geographic areas for which Statistics Canada disseminates data. For each such area the file contains the information needed to facilitate publication: relationship to other standard geographic areas, official (legal) name, codes, land area and population. The file also contains boundaries in digital form for the standard areas (but not for enumeration areas for which the file contains geographic centroids). Beginning with the 1981 census, reference maps have been produced from this file.

20. Public use tapes, that is, tapes containing anonymised records of a sample of individual units, are one of the means by which the results of the census are disseminated. There are separate tapes for persons, for families and for households, each covering a 1 per cent sample and distinguishing the provinces and metropolitan areas.

Coverage evaluation

21. A method known as the Reverse Record Check (RRC) has been employed to measure the gross undercount in every census since 1966. In 1981 the RRC started from a sample of individuals enumerated in the preceding census of 1976 together with parallel samples of individuals who would not have been enumerated in 1976, namely, samples of post-1976 births and immigrants (selected from administrative records) and a sample of persons missed from the 1976 census (taken from the 1976 RRC). The aim was to determine how many of the 30,000 people in this combined sample had been enumerated in the 1981 census and how many missed. If a person in the sample had not been enumerated in the 1981 census at the same address as in the 1976 census, his usual address at Census Day 1981 was traced, wherever possible, from a wide variety of administrative sources, including telephone directories and records held by the agencies responsible for employment, tax, health and welfare. Then, if the person had not been enumerated in 1981 at this traced address, he was interviewed, wherever possible, to find out his characteristics (as asked in the census) and whether he might have been

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enumerated elsewhere. Of the 30,000 in the combined sample, 4.4 per cent had died or emigrated before Census Day 1981, 89.1 per cent had been enumerated in the census, 3.1 per cent had been missed from the census and the whereabouts at Census Day 1981 of the remaining 3.4 per cent could not be traced.

22. But adjustments have to be made to the crude rate of undercount as measured in the RRC. This is because additions are made to the census counts following two coverage improvement programs that are carried out only on a sample basis (see the check on persons enumerated away from their homes and the check on dwellings initially classified as unoccupied described in paragraph 12): the micro-level matches of the RRC can be carried out only before the census records are extended by the addition of the imputed records resulting from these two checks. After adjustment, the rate of undercount in the 1981 RRC was estimated to be 2.0 per cent, almost the same figure as in 1976. The rate varies between different groups: thus, for the 20-24 age-group it was 6.0 per cent for males and 5.0 per cent for females. The RRC is a refined method of measuring the undercount: it gives separate figures for each province and it also gives a statistical profile of the persons and households missed, so throwing light on weaknesses in the enumeration procedures. However it has shortcomings, notably the existence of the "not traced" category (which is larger than the measured undercount). Moreover there is at present no corresponding measure of the overcount. Statistics Canada is now addressing these shortcomings.

The cost of the census

23. Expenditure on the 1981 census was within the approved budget provision; the overall cost was Can \$131 million (at 1983 price levels) or Can \$5.4 per person.

24. The 1986 census was planned on the assumption that methods and specifications would be changed as little as possible from 1981, so minimising developmental costs; and the pressure to cut costs was reinforced by the new Administration when it took

office in 1984. The cost of the 1986 census is expected to total about \$150 million over the five-year census cycle, a slightly lower figure in real terms than the cost of the 1981 census. But, taking account of the increase in the number of households between the two censuses (about 13 per cent), costs per household will be reduced more substantially. Apart from the lower developmental costs for the 1986 census already referred to, savings in costs have been achieved in several ways including: the funding of young people employed as census representatives from the Challenge '86 program; a shortened questionnaire for the long form; a higher level of charges levied on the purchasers of statistical products; and more automation.

The public's response: overall assessment of recent censuses

25. The 1981 census has been described as an unprecedented success. The public responded well, though there were problems in enumerating inner city areas and some institutional populations as well as ethnic groups and the native populations. The census results became available a year ahead of the corresponding 1971 schedule.

26. Public response to the 1986 census has been as good as or better than to the 1981 census, except in some Indian reserves where political leaders, for unclear reasons, have refused to allow the enumeration to proceed. At the time of writing this report that issue remained unresolved.

The possibility of using administrative files as a source of statistics

27. At the time that the plans for the 1981 census were approved the federal government asked Statistics Canada to study the use of administrative files as a source of statistics that might replace, in whole or in part, the statistics collected in the census of population. A report was issued in 1983. The study concluded that data from administrative files could not replace the census. If the Scandinavian approach to censuses were to be followed, it would be necessary to set up a population register and

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to introduce a statutory requirement to report all changes of address; this was regarded as politically unacceptable in North America. An alternative way of creating a file covering the whole population would be to merge existing files on taxpayers, family allowances, pensioners, etc. But, apart from doubts about the political acceptability of such a large-scale linkage exercise and concern about the possible unfavourable effect on public cooperation in surveys, such as a merged file would not meet census needs in several respects: coverage would be deficient for some groups within the population such as the aged, the poor and the native peoples; the file would contain only a limited range of characteristics; there would be no information which would enable individuals to be grouped together into families; and, to the extent that addresses failed to distinguish the separate housing units, individuals could not be grouped together into households or associated with the characteristics of the housing units that they occupied.

28. However, the study also concluded that administrative files could complement the census of population by providing small area statistics in intercensal years - if coverage of the relevant population was adequate and if the records on the files contained sufficiently precise geographic identifiers. But, because the concepts, definitions and coverage of the administrative data conform to administrative requirements, such intercensal statistics would need to be calibrated by reference to benchmark data from the census in order to bring them into line with statistically-desirable definitions and coverage. Moreover it is only the census that can provide a cross-classification with variables that are not recorded in administrative files.

29. Approval was given to a program of development of small area statistics that would use the census of population and administrative files as complementary sources. Income tax records have been used experimentally to produce annual small area statistics on migration and on the labour force as well as on total personal income and the various components of income - with analyses by sex and age; but these statistics become available only after a time-lag of about 18 months from the end of the reference year.

30. The key importance of reliable annual statistics of migration is evident from their use, in conjunction with annual data on births and deaths, in the preparation of the annual population estimates at provincial and municipal levels - which, in turn, determine the distribution of large sums of public money between the provinces and, within a province, between the municipalities (paragraph 7).

The future of the census of population

31. The 1983 study having established the role of administrative registers as complementary to, rather than a substitute for, the conventional census, Statistics Canada looks to the further evolution of the methodologies that have been successfully applied in recent censuses.

32. With a census every five years, the planning of the next census overlaps with analysis and evaluation of a census just taken; and each census is, potentially, a test bed for the next. So work on planning for the next census in June 1991 is just beginning, and one of the first tasks is to identify aspects of the census that deserve priority for research and development. Among possible candidates for study are: the extension of mail-back to more rural areas; computer-assisted coding of write-in responses; the automation of other census procedures including management information systems; the measurement of gross over-coverage in the census; and the possibility of adjusting the census results for net under-coverage.

THE CENSUS OF POPULATION IN DENMARK

Summary

1. Denmark has been the pioneer in developing a register-based census. Statistics for small areas of the kind generated by a conventional census are obtained regularly (in principle annually) by linking data from a set of registers. Fundamental to the new system are the automated Central Population Register (CPR) that uses a unique personal reference number for each person and the Central Register of Buildings and Dwellings (BBR). Danmarks Statistik (DS) now operates some 37 registers of personal data for statistical purposes; most of the registers have been created within DS from administrative registers held outside DS. The last conventional census was taken in 1970 and the first full register-based census of population and housing referred to 1 January 1981.

2. The register approach to censuses has important strengths: more frequent statistics (though budgetary constraints and practical considerations limit the frequency of full census-scale analyses), reduced costs and a reduced burden on the public. But there are weaknesses too. Further remains to be done to improve the quality of the data and their timeliness, both of which are dependent on the efficiency of administrative procedures. These problems are greatest for data which have little or no direct administrative application and which may have to be added to administrative returns mainly for statistical purposes; examples are data on occupation and place of work.

3. DS believes that it has taken the right course in introducing this radical and bold change into its census methodology. The change has been greatly facilitated by the Act which reorganised Danmarks Statistik in 1966. The Act gave DS a measure of independence of the central government and powers to demand, and to use for statistical purposes, data held by administrative agencies.

The development of population registers in Denmark

4. Local population registers to be used for a variety of administrative purposes were first instituted in 1924. The existence of these municipally-maintained registers has provided the foundation of the Danish system. However it was not until the 1960s that important steps were taken to develop statistical uses of registers. In the first half of the 1960s Nordbotten of Norway and Ohlsson of Sweden wrote papers describing the possibilities of using automated registers for generating statistics. Then in 1966 an Act reorganised the Danish central statistical office. Renamed Danmarks Statistik, it was given an autonomous status under a Board of seven, chaired by the National Statistician. DS was given powers to demand, and to use for statistical purposes, data that were held by public authorities for administrative purposes, and to participate in the construction of registers containing such data; but the passage of identifiable data from DS to other bodies was restricted. Even at this stage the development of the register system and the demise of the traditional census had been foreseen.

5. In 1968 an automated Central Population Register mirroring the local registers was created in the Ministry of the Interior and a unique personal reference number for each person was introduced. The case for this development had been argued on the grounds that it would facilitate administrative functions such as the introduction of a system of taxation at source (pay-as-you-earn). From 1970 the CPR became the source of annual population and vital statistics at all areal levels. The quality of the data in the CPR is very high. This is because information from the CPR is used by public agencies working in many fields relating to the individual citizen, and so there are plenty of opportunities to identify and correct errors. There is however little incentive for a person who emigrates to have his name removed from the register.

6. Personal identity cards are not issued to the general public in Denmark.

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The last conventional census of 1970

7. In November 1970 the last conventional census of population and housing was taken. The fieldwork was carried out by the municipalities, which also compared the returns received with the local population registers and made corrections to the one or the other as necessary.

8. The questionnaire was relatively short compared with those of many countries: there were 13 questions in respect of each person resident at the address, of which the first two questions were name and personal reference number (which embodies date of birth), and 13 questions on housing. Questions on place of birth, nationality and address at a previous point of time (migration) did not appear on the questionnaire because data on these topics could be extracted from the population register and linked to the census responses (though, in the event, they never were). The 1970 census did not cover the topics of ethnicity, languages, income, means of travel to work or (in the case of women) marital and childbearing history.

Further steps towards a register system

9. In the mid-70s DS considered whether to take a conventional mid-decade census or whether to rely on registers. The weight of opinion favoured the latter course. What were then missing from the registers were mainly:

a) information identifying the establishment (as distinct from the enterprise) at which a person worked. Thus, the person's place of work and his commuting journey were not known, and the available data on the industry in which he was employed referred to the industry of the enterprise (and not that of the establishment).

b) information on housing characteristics.

One of the conclusions reached was that the final abandonment of the traditional census of population and housing would require the creation of a register of buildings and dwellings.

10. In 1976 the first register-based census of population was taken; it did not cover housing. DS describes this as 'the point of no return'. The developments so far had not generated much public controversy but in 1977, for the first time, a heated public debate took place on the subject of the use of registers for statistical purposes - rather than, as might have been expected, on the use of registers for administrative purposes. It was precipitated by a demand made by DS on the municipalities, in accordance with the 1966 Act, to provide information on identified recipients of social security benefits. DS eventually won its case on this in the courts, and since then there has been little public debate on the issues.

11. Mainly as a result of the decision not to conduct a conventional census of population and housing in 1975-76, a Central Register of Buildings and Dwellings was created in 1977, to be used essentially for administrative purposes. The basis was declarations made by property owners for the purposes of assessing tax. The BBR is updated by the 275 municipalities from the declarations made every fourth year and from information on new developments, though the updating is not uniformly effective. The register is organised hierarchically in three levels: property (that is, parcel of land); building within the property; and housing unit or other unit within the building. The housing units are given addresses in a format that has now been carried into the Central Population Register, namely:

- municipality (code)
- name of street (code)
- number in street
- floor number (if applicable)
- location on floor (if applicable).

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It is through addresses coded in this way that a linkage can be made between the housing characteristics in the BBR and the personal details in the CPR. Because of failures to match, housing information could not be accessed from the BBR at 1 January 1984 in respect of only 1.0 per cent of the population, compared with 4.0 per cent at 1 July 1979. From 1980 annual housing statistics and quarterly construction statistics have been compiled from the data in the BBR.

A Data Surveillance Authority

12. In 1971 the Government appointed a committee to consider the safeguards for individuals against possible abuse through the use of registers, and in 1978 the Public Authorities' Registers Act laid down rules for public authorities on the handling of personal data by computer. A Data Surveillance Authority was set up to ensure compliance with the Act. The Act follows the broad lines of the Council of Europe's Convention of 1981. It places no restriction on linking data from different registers (whether administrative or statistical) if this is done solely for statistical purposes. DS has commented that the Act, whilst not impeding its work, has added to its administrative burden.

The register-based census of population and housing of 1981

13. Following the creation of the Central Register of Buildings and Dwellings in 1977, one further significant innovation was needed to enable a full scale register-based census to be taken. This was to provide a link between an employed person and his workplace or establishment, so identifying the industry in which he is employed. In the case of private employers with only one establishment the link was provided by the form that they submit annually to the tax authorities recording the wages and salaries paid to each employee. But in the case of private employers with more than one establishment this administrative form was extended in 1979-80 by asking for an item

of information required only for statistical purposes: a code to indicate the workplace of each employee. DS reports some continuing failure on the part of smaller employers to record the workplace code, and the task of filling these gaps in the data adds considerably to DS's burden.

14. The 1981 register-based census referred to 1 January 1981 or, for some topics, to calendar year 1980. It drew mainly on the following registers:

- a) The Central Population Register (CPR).
- b) The Central Register of Buildings and Dwellings (BBR).
- c) Registers of wages and salaries paid to each employee as returned by employers to the tax authorities.
- d) Registers of income as returned by individuals to the tax authorities.
- e) Registers of employment insurance and unemployment benefit (Ministry of Labour).
- f) The Central Register of Enterprises and Establishments.
- g) A register of educational achievements, held by DS and used for statistical purposes only. This was created initially from the 1970 census returns.
- h) Geographical files classifying addresses to various geographical units, including urban and rural categories.

The advantages and disadvantages of the register approach

15. The register approach to census-taking offers major advantages. First, statistics can be extracted more frequently than from conventional censuses - in principle annually. Thus DS provides annual data on population, employment, commuting, income and housing at the level of the municipalities and in some cases for

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smaller areas; the data are disseminated through publications and also to individual order (on repayment). But a full analysis on the scale of a conventional census is made less frequently. A second advantage of the register approach is that costs are substantially reduced. Third, the burden on the public is much less; indeed, the view was expressed that the public would be unwilling to provide information that they knew was already held by the Government. Fourth, the new method offers the possibility of including topics available from registers but not well suited to a conventional census: income is perhaps the most clear-cut example - it was included in the Danish register-based censuses of 1976 and 1981 but never included in a conventional census questionnaire.

16. Another advantage is the potential to make longitudinal analyses by linking events in a person's life by means of the personal reference number - for example, studies of occupational mortality. DS made the comment that the Danish register-based system was similar in principle to the United Kingdom's Longitudinal Study and to the French Echantillon démographique permanent ("Panel"), though the Danish system covered 100 per cent of persons rather than the 1 per cent sample of the British and French systems. In fact DS had itself introduced a "Mini-population register" in 1971 as a testbed of register methods; for this purpose the responses given in labour force surveys by a 1.6 per cent sample of the population were linked to their administrative records.

17. Whilst the use of data from administrative registers may improve comparability with short-term statistics, a census that depends on such registers is limited to topics recorded there and must accept the administrative definitions used, including any changes in definitions resulting from, for example, legislation. Thus, the register-based census in Denmark defines the household as all those resident in the housing unit, rather than, for example, those who share common housekeeping. Whilst some items of information needed only for statistical purposes can, with some difficulty, be added to

administrative registers - as place of work has been added in Denmark - other topics have no place in an administrative register: for example, means of travel to work.

18. DS has had particular difficulty in getting reliable data on occupation. Each person completing his annual tax return is asked to update the information on occupation but he has little incentive to do so. Other sources that provide incomplete information on occupation, or just clues, are: the returns made by private employers to the tax authorities in respect of each employee (from which the industry in which the person is employed can be derived); wage records in the public sector (which record occupation); and the registers of employment insurance and unemployment benefits.

19. Timeliness of the data from some of the registers is another problem. Detailed statistics of population in each municipality (by sex, age and marital status) become available only two months after the date to which they refer. By contrast, the slowness in compiling the tax authorities' files - which provide the data on industry, occupation, journey to work and income - delayed analysis of these topics in the 1981 census until summer 1983. Contrary to earlier hopes, the preparation of data on the labour force continues to lag about a year and a half behind the reference period to which the data relate, and at best the lag can be reduced to about one year. But DS points out that problems of timeliness are not confined to register-based statistics: the experience of many countries shows that the results of conventional censuses may also be seriously delayed by, for example, technical difficulties in processing or lack of resources.

Data tapes

20. The release of tapes containing unidentified individual data ("public use tapes") is not one of the methods employed for the general dissemination of census results. Such a release might be seized on by critics as a threat to confidentiality. However, tapes are provided for specific purposes, such as model-building, to public authorities and to researchers.

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The rôle of sample surveys

21. Sample surveys complement the register system: by providing additional topic detail; by providing data referring to a specific date rather than to a 12 months period (as some of the registers do); and by offering a means of checking the quality of the register data. But sample surveys do not provide statistics for small areas.

22. The Labour Force Survey is now made annually in Denmark and is addressed to a sample of about 18,000 households (a 1 per cent sample). To limit costs, the survey is carried out by telephone interview. Response to the survey is voluntary; non-response is about 20 per cent. However, from 1980 the more important annual statistics on the labour force have been taken from registers rather than from the Labour Force Survey.

The future of the register-based system

23. The transition from a conventional census of population to a register-based census has been completed in Denmark and is unlikely to be reversed. The main problems now to be faced concern the quality and timeliness of some of the data; these are dependent on the effectiveness of administrative procedures. The problems are greatest for data which have little or no direct administrative application, such as place of work and occupation.

24. Analysis of the data held in the register system is carried out annually at the level of the municipalities and even smaller areas. For budgetary reasons no census-scale analysis will be made in 1986, and for 1991 a decision has not yet been made whether to carry out a census on the scale of 1981 or to make a more restricted analysis to cover, inter alia, the needs of the EEC.

THE CENSUS OF POPULATION IN FRANCE

Summary

1. The French census of 4 March 1982 was successfully taken despite local difficulties in a very small number of cities. There is no system of population registration in France that provides up-to-date statistics of population in each area and that might form the basis for a fundamentally different approach to the census. So France will continue to rely on the conventional census mechanism to give benchmark data on the population and its social and economic characteristics and on housing at all geographical levels. The next census is foreseen in 1990, and a number of improvements in methodology are being sought within overall constraints imposed by the budget.

Organisation

2. Responsibility for the census of population rests with the Institut National de la Statistique et des Etudes Economiques (INSEE). This is a central statistical department within the Ministère de l'Economie et des Finances. Besides conducting major censuses and surveys of persons and businesses INSEE coordinates the work of the decentralised statistical services located in other government departments. Consultation between the users of statistics and the producers in government is provided by the Conseil National de l'Information Statistique. The Council is chaired by the Minister of Finance and it formally prepares annual programmes for government statistical work. Represented on the Council are a wide range of interests including government departments, employers' organisations, trade unions and academics.

Objectives of the census: frequency

3. The census serves two main purposes: first, to determine the population légale of each commune and other administrative area and, second, to provide information

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on the demographic, economic and social characteristics of the population and on housing at all geographical levels down to îlot. (The îlots in a large town are the blocks defined by the mesh of streets and other physical features.)

4. A wide range of representational, regulatory and administrative matters depend on the population légale including: representation in the Parliament and at regional and local levels; the organisation of communal administration (which may depend on the population in relation to specified thresholds); and the distribution of some 70 billion francs annually from central government to the communes (la dotation globale de fonctionnement). In the years between the national censuses an individual commune may ask for an extra census (recensement complémentaire) in order to update the population légale if it believes that this has increased by at least 15 per cent; only increases of 15 per cent or more can be authorised. Several hundred of the 36,000 communes ask for an extra census in some years.

5. Censuses of population since the Second World War have taken place at intervals of between six and eight years, the most recent being in March 1982. Timing is chosen to avoid years in which there are Presidential, Parliamentary or local elections. The next census is expected to be in 1990.

The census fieldwork: the rôle of the local administrations

6. The field force of enumerators (agents recenseurs), of whom there were 110,000 in 1982, is employed by the local administrations (mairies) which recruit them. In addition in 1982 INSEE recruited some 2,800 délégués for a period of three months to train the enumerators and to supervise the enumeration; their rôle is essentially advisory. The staff of INSEE provided technical assistance at the level of région and département. Though the arrangements for recruiting enumerators were strengthened in 1982, particularly in the towns, there were considerable difficulties, as in 1975, in enumerating

some groups of people: the old and those who were absent from home, both of whom were difficult to contact, young people living in hostels and foreign workers. For the latter group persons speaking the languages concerned were appointed to liaise with the leaders of the foreign communities.

The census questionnaire: the population base

7. The French census is conducted using three main forms: a form for the immeuble (building) which is filled in by the enumerator; a form for each logement (housing unit) within the immeuble; and a separate form for each individual usually resident in the logement. An instruction on the form stated that each person was to be returned in the census only once - that is, at his principal residence - but it was impracticable to check that this rule was always followed. Thus, the existence of so many second residences (there are 2.3 million in France) resulted in some double counting; there is a local self-interest in increasing the figure for the population.

8. The 1982 questionnaires were broadly of the same length as in the previous census of 1975. The number of questions referring to the individual is fewer than in many other countries; there are no questions on ethnicity, language, income or journey to work. On the other hand there are relatively many questions on housing divided between the form for the immeuble and the form for the logement. In 1982, as in 1975, there was a supplementary enquiry addressed to a 2 per cent area sample of women aged 18 to 64 concerning their marital and childbearing histories.

Census processing

9. The compilation of figures for the population légale of each administrative area, essentially by clerical means, precedes the computer processing. But not all the information collected from the public in 1982 was processed. For 75 per cent of the census forms only basic demographic information was extracted; the task of keying

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was performed in this case by outside contractors. For the remaining 25 per cent of forms - an initial 5 per cent sample followed by a further 20 per cent - all topics were processed.

10. Input of the data for the 25 per cent sample was effected within INSEE by means of the COLIBRI system (CODification en Ligne des Bulletins du Recensement des Individus). The system was first developed by INSEE for the 1975 census and performs the functions of data entry (keying), coding, editing and quality control. Some 400 terminals each equipped with keyboard and VDU (visual display unit) are connected to a central computer. The operator keys in the responses and editing and coding take place immediately in an on-line conversational mode. COLIBRI has been developed particularly for handling the responses to open-ended questions such as place of residence at the time of the previous census and the inter-related set of questions concerning a person's economic activity: place of work, economic activity of the establishment (industry) and occupation. For handling these topics the computer holds directories of occupations, industries etc and also a directory of establishments in the private sector and, to some extent, the public sector: this latter directory contains details of each establishment's location, size (number of staff) and economic activity (industry) and in 1982 was able to provide codes for about 70 per cent of economically active persons. Following the input by COLIBRI, the data are further edited for missing and inconsistent answers by an auto-edit of the 'hot deck' type. The COLIBRI system requires complex and expensive computer programs and directories, but, as compared with the former manual coding, it provides greater consistency of coding and, in its 1982 version, lower levels of coding error as well as some staff savings. There was thought to be some economic saving, overall, through the use of COLIBRI in 1982.

11. Anonymous individual data (microdata) on persons or households/housing units are released from the 1982 census to users outside INSEE in the form of tapes that refer to a sample of the population (25, 5, 1 or 0.1 per cent) or to the whole population

(100 per cent). The user undertakes not to pass on the tape to others. The data are made anonymous by deleting identifying information, by restricting information on the area of residence and by omitting or restricting other elements of the data. For example, the tapes from the 1982 census that are made available to the communes for statistical analysis omit names and addresses, a person's month, day and commune of birth, and the name and address of the employer; in addition, the data on a person's relationship to the reference person on the census form are restricted to two categories (reference person, other) and occupational details are restricted to a two-digit code; finally, information on place of residence and on place of work is not provided in greater detail than district de recensement (enumeration area).

Checks on census coverage

12. Plans were made to improve the coverage of the 1982 census by checking the addresses enumerated against the files of the taxe d'habitation. But the Commission Nationale de l'Informatique et des Libertés (CNIL), the commission appointed by the government to regulate the use of computers for handling personal data, refused to authorise the project on the ground that this use of the files was not among the purposes for which the files were created.

13. The simple demographic check of comparing the 1982 census count for the country as a whole with the estimate carried forward from the previous census in 1975 and adjusted by births, deaths and migration showed an excess in the numbers enumerated of about 250,000; this was attributed to deficiencies in the estimate of the balance of international migration in the intercensal period 1975-82. A check on the coverage of the 1982 census and on the quality of the information collected was made on a sample basis by comparing census data with the data collected in the labour force survey (Enquête sur l'Emploi) some two months later. This difference of timing complicated the comparison and analysis of the results is still continuing. Checks made in two regions

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by means of the Panel Démographique (see paragraph 21 below) suggested that some 0.8 per cent of the population had been counted twice in the census.

The cost of the census

14. The cost of the 1982 census is estimated at 427 million FF, or about 8 FF per person, of which two-thirds was the cost of enumeration. However, the estimate does not include the expenses within INSEE for the checking, entry and processing of the data.

The public's response to the census

15. There was better publicity in 1982, particularly on television, and the press was less critical than in 1975. The public's response was generally good, though there was some hostility from a minority concerned with privacy.

The rôle of population registers

16. There is no obligation on a French citizen to notify a change of residence to any public authority. Hence there is no up-to-date record of the residents in each commune, either held locally at the mairie or held centrally. Though the identity cards used in some countries are associated with systems of population registration, the cartes d'identité in France are not. A citizen is not obliged to have a carte d'identité. If he does have one, there is no obligation on him to have the address that it bears updated during the 10-year period of validity of the carte.

17. The mairies do however maintain registers of electors which are updated annually. But the registers do not cover those under the age of 18 and those of foreign nationality. A person wishing to have his name placed on the electoral list has to apply at the mairie and, although inscription in the list is formally obligatory, a survey in 1982 found that some 11 per cent of eligible persons failed to have their names inscribed; in the youngest

eligible age-group, the 18 year olds, the rate of omission reached 33 per cent. Moreover there can be a timelag of years between a person moving to a different commune and his inscription in the electoral list in that commune.

18. INSEE maintains two computerised national registers of persons, the Répertoire National d'Identification des Personnes Physiques (RNIPP) and the Fichier Général des Electeurs and des Electrices (FGEE). The RNIPP is a register of all persons born in metropolitan France together with those persons born elsewhere for whom the administrative departments (such as the departments concerned with social security and taxes) have asked for a personal reference number - in practice this includes most people born abroad who have resided in France. The register contains information on name, sex, date and place of birth and (when known) the date and place of death, and it assigns to each person a reference number (the Numéro d'Inscription au Répertoire or NIR). It does not contain information on nationality, marriage, address or emigration from France. The purposes of the RNIPP are: first, to act as a point of reference for departments which wish to check the personal details of an individual (name, sex and date and place of birth) and/or to obtain the personal reference number (NIR); and, second, to communicate to departments the information that a person has died. A number of major departments use the NIR as a key for managing their own records. It is therefore possible in principle for the records of an individual held by different departments to be linked for statistical purposes using the NIR as the key for linking providing the Conseil d'Etat gave authority for this on the advice of the Commission Nationale de l'Informatique et des Libertés (CNIL) (see paragraph 20 below).

19. The central register of electors (FGEE) records the commune in which each person is currently registered as an elector and also the elector's personal reference number (NIR) which INSEE extracts from the RNIPP. The FGEE is updated mainly from information on new electoral inscriptions and deletions provided by the communes and from death registrations. It has the function of ensuring that no one is registered

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in two communes, that no one is registered if barred from voting and that a deceased person's name is removed from the registers.

20. A law on the automatic processing of personal data was enacted in 1978, usually referred to as the law on 'Informatique et Libertés'. The law sets out principles for the protection of personal data that were later embodied in the Council of Europe's 1981 Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data. However, unlike the Convention, the law does not allow any exemptions for data collected for statistical purposes, so that a person has a right of access to data concerning him that have been collected in a statistical enquiry and also a right to have erroneous data corrected. A body independent of the executive was set up to administer the law, the Commission Nationale de l'Informatique et des Libertés (CNIL). The CNIL ensures that the principles and procedures laid down in the law are respected; maintains a register of registers containing personal data; and delivers opinions on the automated handling of personal data in the public sector prior to the passing of necessary regulations or laws.

Le Panel Démographique

21. The Panel Démographique is essentially a data set referring to a sample of the population and drawn from a number of sources. It serves purely statistical objectives. The sample consists of all persons whose birthdays fall on any one of four dates in October of any year, and so is approximately 1 per cent of the population, that is over half a million people. The sample is self-renewing. The data sources include successive censuses of population from 1968 and records of vital events - birth, marriage and death and the birth of children to sample members. The statistical analysis of the data set has the aims, inter alia, of (1) studying demographic events (births, marriages and deaths) in relation to characteristics recorded in the census of population, (2) measuring changes in an individual's situation (transitions) between the dates of one census and the next census and (3) studying the quality of census data. To do this,

a sample member's records in the different data sources are linked by using the RNIPP as a reference point; it is from the RNIPP that a person's reference number (NIR) can be established. But wrong dates of birth recorded in the census of population result in loss of data from the Panel.

22. Although the Panel Démographique has now existed for more than a decade, the analysis of its contents has been slow to materialise because of the greater priority given by INSEE to other activities. There is a close resemblance between the French Panel and the United Kingdom's Longitudinal Study in concepts and methodology.

Intercensal population estimates

23. In the absence of a system of population registration, estimates of the net movement of population are of uncertain reliability at any geographic level. Because of their shortcomings, at least from the statistical point of view, the electoral lists are not used as a source of migration statistics.

24. At the level of the 22 régions and the 96 départements, annual intercensal population estimates are carried forward from year to year starting from the preceding census by adding births and an estimate of net (inward) migration and then deducting deaths; the estimate of migration is based on figures of migration in the period between the last two censuses, modified, as necessary, in the light of figures of housebuilding and of changes in the level of employment. At other areal levels such as the commune, direct estimates of the population in intercensal years may be made by estimating, first, the number of principal residences (using as indicators of change the numbers of domestic electricity supply connections or of assessments to taxe d'habitation) and, second, the average number of occupants per housing unit (by extrapolating figures from the most recent censuses). (These estimates are, of course, corrected if a recensement complémentaire is taken at the request of the Maire.)

25. As noted earlier (paragraph 4), the distribution of funds from central government to the communes is based on the population légale established at the time of the most recent national census (or of a recensement complémentaire in a commune that has requested one). The Ministry of the Interior has been considering whether the distribution of certain funds could be based on the intercensal population estimates if the reliability of the estimates could be improved.

The rôle of sample surveys

26. Although sample surveys of persons and households play a major rôle in the French statistical system, they are seen as complementing the census of population which provides the benchmark data particularly for small areas.

27. The Labour Force Survey (Enquête sur l'Emploi) now takes place annually in March. Interviewers visit an area sample of about 70,000 housing units (logements): a sampling proportion of 0.3 per cent. Two-thirds of those interviewed in any one enquiry were interviewed in the enquiry that took place twelve months previously, so that an area is retained in the sample for three years. This system of overlapping samples reduces the variability of measurements of change. Though the response to sample surveys in France is formally obligatory, in practice there is non-response due both to non-contact and to refusal. Thus, in the Enquête sur l'Emploi of March 1985 non-response was 7.3 per cent in total.

Future censuses

28. France does not have a population register of a kind that could support the census of population or could take its place, and so the next census is seen as a development of the methods successfully employed in 1982. Over the last three or four years consideration has been given to a number of possible new methods: the use of sampling at collection - the long form/short form approach, the use of mail-back

(and possibly mail-out) for the short form and optical reading of the short form. However these proposals seem likely to be dropped in favour of a more traditional approach. Thus, a test of the files of the taxe d'habitation showed that in their present form they would not be a satisfactory basis for constructing a mailing list for the census. But INSEE still hopes that it may prove possible to use administrative lists in a programme to improve the coverage of the census provided the CNIL gives its agreement. An alternative to the use of the files of the taxe d'habitation for this purpose (as had been proposed for the 1982 census - see paragraph 12) might be to use telephone directories. Some 90 per cent of the population now have a 'phone and so this medium might also be used for the follow-up of missing returns.

29. For the next census more attention will need to be devoted to the selection and training of enumerators. The numbers of supervisory délégués should be increased and they should be employed for a longer period and be given a greater rôle in the recruitment of enumerators. Relatively more resources are needed in the difficult areas, for example areas with many foreign workers. Other aspects of the census which are being studied include: the definition of residence and the problems of enumerating people living in institutions; and the development of automated cartography for use both at the collection stage of the census and for the dissemination of results.

30. Overall a main aim of the next census in 1990 will be to produce the results more quickly than before, particularly the statistics for key demographic variables for small areas, within a budget that is similar in real terms to that of 1982.

THE CENSUS OF POPULATION IN THE FEDERAL REPUBLIC OF GERMANY

Summary

1. The census in the Federal Republic of Germany that formed a part of the community-wide census programme was scheduled for 27 April 1983. The census form asked many fewer questions about each person than were asked in the previous census in 1970. Some two months before Census Day politically-motivated groups in some cities fomented a vociferous boycott campaign that played on the public's fears concerning privacy and confidentiality. The campaign drew particular attention to the (long-standing) practice by which some data from the census were used to correct the local registers of population and therefore served administrative purposes. The protests became linked with extraneous issues.

2. A case to test whether the census violated individual rights was brought before the Constitutional Court. The Court ruled that the census should be postponed pending a full hearing. In its final judgement, the Court accepted the case for a compulsory census of population conducted on conventional lines; but it demanded an end to the practice of using census data to update the local population registers and called for tighter procedures to safeguard confidentiality. A census that conforms to the Court's rulings is to be taken on 25 May 1987. The Court laid down principles that have wide implications for federal statistics concerning the choice of methodology for censuses and surveys; the separation of statistical functions from administrative functions; and the conditions under which individual data may be used, transferred to another agency or linked.

3. The Federal Republic has developed its own distinctive form of annual large-scale sample survey of households and of persons in institutions - the 1 per cent Mikrozensus. This provides regular information on the demographic, social and

economic characteristics of the population to complement the much-less-frequent information from the census, but does not give the small area detail needed by the Länder and local communities.

4. Population registers are maintained by the local communities but are inflated to a substantial extent as a result of failure to delete names. Proposals made in the 1970s to improve the quality of the data in the registers through the centralised issue of personal reference numbers and the interlinking of local population registers were shelved because of concern on privacy; and, in the light of the Constitutional Court's rulings on the issues surrounding the census, the proposals seem unlikely to be revived in the near future. In present circumstances, therefore, there seems little prospect of developing an alternative to the conventional census of population through the linkage of personal data held in registers.

Organisation

5. The Statistisches Bundesamt (SB), or Federal Statistical Office, is responsible for the overall administration and planning of federal statistics. But, in general, the collection and processing of data are carried out by the statistical offices of the 11 Länder (provinces), which, in turn, may employ the services of municipal statistical offices (as in the case of the census of population). The SB's responsibilities therefore cover methodology and technical matters, standards, coordination, the compilation of the statistical material that has been prepared in the offices of the Länder, and the presentation of results for the Federal Republic. The SB is an independent central statistical office within the federal Ministry of the Interior, and its work programme is formulated in response to the needs of the various federal departments which, in turn, take into account the needs of the Länder and of other interested parties. Methodological and technical questions concerning the work programme are discussed by an advisory committee which includes representatives of federal departments, the statis-

tical offices of the Länder, users of the statistics and respondents. The advisory committee usually meets annually, but it sets up expert committees, which meet as required, to deal with special questions.

The census of population

6. Post-war censuses in the Federal Republic have been taken in 1950, 1961 and 1970, but the next census, originally planned for 1983, has been postponed to 1987.

7. The census of population asks for a return of the persons resident in the household, defined as persons living and keeping house together. A person with more than one place of residence must make a return at each place. Double counting is avoided by means of the answers to a filter question; in the 1987 census the question for married persons who are not permanently living separate is "Is this dwelling here the one which is predominantly used by the family?" and the question for all other persons is "Is this dwelling here the one which is predominantly used?".

8. The previous practice was to take censuses of housing separately from censuses of population. Thus, the 1970 census of population was preceded in 1968 by a census of buildings and houses. But in 1987 the two censuses will be combined for the first time since the 1950 census.

9. The local communities - the Gemeinden - play a major rôle in the fieldwork. They recruit and train the enumerators. They check the census returns received; and in previous censuses, that is up to 1970, they compared certain of the census data with the particulars in the local population registers, correcting the one or the other as necessary. But following the Constitutional Court's rulings on the planned 1983 census, the use of the individual census data has been restricted and the data will not be used in 1987 to update the local population registers.

10. Census forms are destroyed after the data have been analysed; and the magnetic tapes do not record names.

The 1970 census of population

11. In the censuses of 1950 and 1961 sampling had been employed only at the processing stage. But in 1970 sampling was introduced in the fieldwork: a long form was used in a 10 per cent stratified sample of enumeration districts (EDs, the small areal units into which the fieldwork is divided, each containing 30 to 50 households) and a short form was used in the remaining 90 per cent of EDs. (Sampling at the field stage was feasible because an up-to-date sampling frame was available from the 1968 census of housing.) This was one of a number of innovations - both in the fieldwork and processing stages - that distinguished the 1970 census from previous censuses.

12. The preceding census of 1961 had asked a substantially greater number of questions than earlier censuses, and the introduction of a long form in 1970 enabled still more questions to be asked. The list of questions in the long form of 1970 was, therefore, the longest ever asked in a German census - making it comparable, in terms of the number of questions asked about each person, to the 1971 census in the Netherlands. Among the new questions in 1970 were two questions on vocational training (making seven in total on completed education and training); a question on net income from economic activity to supplement the existing question that asked the person to identify his main source of livelihood (economic activity, unemployment benefit, pension, support by parents or husband/wife, property, social assistance, etc); and, for women, a question on childbearing history. Topics that did not appear among the 39 questions included place of birth, ethnicity and language.

13. The 1970 enumeration was preceded by an active publicity campaign, particularly on television. In the event there was little public opposition to the census

and anxieties over issues of confidentiality were not widespread. The census form itself set out the obligations on secrecy and the conditions under which data on tape could be passed on to other agencies in an unnamed form. The form stated that the data on names, addresses and dates of birth might be used for correcting registration records. In practice a converse procedure was sometimes adopted as well: the population register was used to identify addresses or persons that had been missed from the enumeration and to construct census returns in respect of such persons if they lived predominantly in the particular community.

14. A technical innovation in 1970 was the use of document-reading machines. These read to magnetic tape the pencil marks that the public had written on the census forms as well as the handwritten codes entered on the forms by coders in the offices of the Länder. Another innovation on the processing side was a system of auto-edit of the "hot deck" type.

15. Two sample checks on under- and over-enumeration were carried out after the 1970 census. In the first a sample of EDs were re-enumerated. The second measured the extent of the double-counting and of the undercounting arising from the faulty working of the filter questions addressed to persons with more than one dwelling (Do you go to work or school/university from the other dwelling? Do you live most of the time in the other dwelling?). The results indicated that net under-enumeration was 0.9 per cent on average, but higher for some groups such as young people in the 20-24 year age-group and foreigners. In a third check the quality of the answers given in the census was assessed for a sample of households by comparing their census answers with the answers that they gave in a nearly-contemporaneous microcensus.

The census planned for April 1983

16. By the time that agreement had been reached between the Federal Government and the Länder on the financing of the census that was to be part of the 1981 EEC-

wide programme and the necessary legislation had been enacted, the date of the census had been deferred to April 1983. The plans provided for a number of important changes from the 1970 design. First, the census of population was combined with a census of housing. Second, the number of questions asked in respect of each person was substantially reduced, mainly to save cost. Third, the system of sampling in the field adopted in the 1970 census was dropped, because most of the questions asked of only 10 per cent of households in 1970 were omitted from the 1983 questionnaire and because no up-to-date sampling frame was available. So every household was to receive the same form in 1983.

17. The household form contained 12 questions on the accommodation occupied. One of the questions asked when the household moved into the accommodation (by reference to the member of the household who had lived there longest); migration did not feature elsewhere on the form because detailed migration statistics could be derived from the system of population registration. There were also four questions on the building in which the accommodation was situated, to be filled in if the respondent was the owner or caretaker.

18. The 1983 form asked 20 questions in respect of each person compared with 39 in the long form used in 1970. Among the questions dropped were those on the relationship to the head of the household, income from economic activity and (for women) marital and childbearing history. There were fewer questions on completed education and on economic activity. But the question on religious affiliation asked in previous censuses was retained on the basis of Article 140 in the basic law.

19. The census form set out in some detail: the persons on whom the responsibility for completing various parts of the form fell; the obligations of confidentiality; the circumstances in which other agencies might receive individual data without names but not otherwise anonymised; and the provisions under which certain of the data with

names could be used for correcting the population registers. (Arrangements were made to apply also a converse procedure: enumerators were to receive lists of names and addresses from the local population registers to ensure a high level of coverage.)

20. The cost of the census was expected to be about DM 370 million, or about DM 6 per person.

The postponement of the 1983 census

21. The Data Protection Commissioners, of whom there are 12, one for the Federal Republic and one for each of the 11 Länder, had been fully consulted during the planning of the census. Almost all of their recommendations were being taken into account in devising the census procedures. But one in particular of their recommendations had not been accepted in the framing of the 1982 law on the census: the recommendation that the individual data collected in the census should in no case be used for administrative purposes, and hence that there should be an end of the practice - that had been followed since the 1961 census - of using the data from the census to correct the local population registers. This was a point that featured strongly in the campaign against the census that erupted on television and in the press in February 1983. The opposition to the census concentrated on privacy and confidentiality and it projected the spectre of "1984" becoming a reality in 1983. For example, opponents of the census described the serial number preprinted on the questionnaire as a personal reference number.

22. Public objections to the 1983 census were not in general directed against the questions asked. But there were misunderstandings about the purpose of asking for the respondent's telephone number as well as his address, and doubts about the propriety of the question on religious affiliation (specifically provided for in the Constitution and requested by the Churches).

23. The press gave wide coverage to the protest campaign, but the ability of the

Statistical Offices to reply to the critics was hampered by the intervention of the Federal elections, by an inadequate initial financial provision for publicity and by the very limited time before Census Day. A case against the 1983 census was brought before the Constitutional Court by a group of private individuals on the grounds that the census violated the constitutional rights of the individual person. The Court ruled that the census should be postponed pending a full hearing later in 1983.

Legislation on data protection and the 1983 ruling of the Federal Constitutional Court

24. Provisions to safeguard the confidentiality of individual data were written into the Federal Statistics Act of 1953 and re-written into the later Act of 1980. In addition, the Federal Data Protection Act of 1977 laid down general rules for the protection of personal data held in registers. This Act gave an individual the right of access to data concerning himself and the right to have erroneous data corrected; and it created an independent Federal Data Protection Commissioner to ensure observance of the Act's provisions and to maintain a register of files containing personal data. Each of the Länder has also appointed its own data protection commissioner.

25. The 1980 Federal Statistics Act placed restrictions on the retention of identifying data (names and addresses etc): these were to be stored separately or entirely deleted when no longer required for statistical purposes. But the Act expressly permitted the transfer of individual data to other agencies for the purpose of compiling federal statistics and, if the data were suitably anonymised, to anyone.

26. In December 1983 the Federal Constitutional Court gave a ruling on the 1983 census that has wide implications for federal statistics and will require changes to the 1980 Federal Statistics Act. The Court recognised the existence of the individual's right to exercise control over the disclosure and use of information relating to himself. The Court distinguished between the use of data for statistical purposes and their use for administrative purposes, and this led the Court to two conclusions. First, it

expressed strong reservations on a "combined survey" (such as the planned 1983 census) which aimed both to collect information for statistical purposes and to collect data serving administrative ends (the updating of the local population registers); these objectives tended to be incompatible and "highly disconcerting for the individual citizen" and so, the Court argued, separate collection instruments should be employed. Second, separation should be made in a quite different sense: the part of an agency engaged in statistical work (for example the section within a Gemeinde engaged in the census fieldwork) should be separated off from the agency's administrative activities.

27. The Court's ruling also introduced the principle that the methods used to collect information should represent the least burden on the respondent and the least intrusion into his privacy. Thus, a sample survey was more acceptable than a 100 per cent survey, voluntary response to a survey was more acceptable than obligatory response and retention of anonymised data was more acceptable than retention of identifiable data. Failure to have regard to this could invalidate a survey. Moreover the Court took a more restrictive attitude than the 1980 Federal Statistics Act towards the transfer of identifiable data: neither the transfer of data to another agency for statistical purposes nor the linking of data for statistical purposes could take place unless authorised by the laws governing the collection of the data. However the Court confirmed the legality of passing suitably-anonymised individual data to anyone.

28. The Court accepted the case for a compulsory census of population conducted on conventional lines; it reached this conclusion after examining whether or not there was at present a more acceptable alternative to a full enumeration and rejecting, inter alia, a register-based census on the lines followed in Denmark. The Court placed restrictions on the uses which might be made of individual census data and demanded a tightening of the procedures for securing the confidentiality of the data. The Court's rulings have been embodied in a new law that provides for a census of population and housing to be taken on 25 May 1987.

The census planned for 1987

29. The main differences between the plans for the 1987 census and those for 1983 therefore concern access to census data and the protection of confidentiality. None of the named census data relating to individuals will be made available to the Gemeinden (communities) for updating the population registers; the registers will be less accurate as a result. But the population registers may continue to be used in support of the census collection: thus, a census return may be constructed from register data when the enumerator is unable to make contact. So a 'one-way street' in the 1987 census will replace the 'two-way street' in the abandoned 1983 census. Individual data without names and addresses may be passed to the statistical departments of the Gemeinden but only for statistical analysis and subject to stringent conditions on confidentiality.

30. To give greater protection to the data, the office handling the census within a Gemeinde must be separated off from the rest of the Gemeinde's activities. There will be stricter rules about the employment of enumerators in areas where they might be known, and there will be an option to return completed census forms by mail.

31. The question content of the 1987 census is only marginally different from that of the cancelled census of 1983, though a separate form is to be provided for each member of the household rather than a single form for all the members of the household. Instead of asking for the month and day of a person's birthday, the census will ask only whether the person's birthday was in the period 1 January-24 May or in the period 25 May-31 December. The questionnaire will provide a number of additional pre-printed responses on citizenship designed to distinguish the main countries of origin of Gastarbeiter etc. (The 1983 questionnaire provided only two responses - German and non-German; and there is no census question on place of birth.) The question on religious affiliation is retained, with an additional pre-printed response for the Islamic religion.

32. Plans are being made for a major publicity campaign in 1987, for which a budget of DM 16 million is provided.

Population registration

33. Registers of the population are maintained by the local communities (the Gemeinden). The main items of information are name, sex, date of birth, marital status, citizenship, religious affiliation, address and whether main or secondary residence. A person must register a change of address at both the place of departure and the place of arrival. The registers are also updated from data on vital events.

34. The population registers are however inflated - by as much as 9 per cent in some cases - for a number of reasons: there is failure to delete the names of some deceased persons and of some persons who have removed (for example, many Gastarbeiter fail to notify their departure from the country); and, as a person must register each of his addresses, there is difficulty in ensuring that he is counted only once in the statistics, that is at his main place of residence. A central register, or a system of interlinked local registers, is probably a necessary condition for controlling this inflation. In 1971 the Federal Ministry of the Interior submitted to Parliament a draft of a Federal Registration Law which would have provided inter alia for a system of unique personal reference numbers to be issued centrally and the maintenance of automated local population registers which would be linked within a Land but not between Lander; together these would have served a wide range of administrative purposes. But the proposals for personal reference numbers were criticised in Parliament on grounds of privacy and possible infringement of constitutional rights, and eventually were allowed to lapse.

35. The local population registers of most of the communities are already computerised. In a few of the Länder (Hamburg, Rheinland-Pfalz and Berlin (west)) there is one computerised central register. In each of the other Länder there are

several computer centres holding the registers for groups of communities. There are no plans at present to link the registers in one Land with the registers in another Land or to introduce personal reference numbers.

Intercensal population estimates

36. The intercensal estimates of local populations are important for the distribution of public monies between the Länder and authorities at the lower levels, for drawing electoral boundaries and for general planning purposes. But, because of the inflation in local population registers, the intercensal estimates cannot be simple counts of the numbers in the registers. Instead, the estimates are carried forward from year to year starting from the previous census count (of 1970), by adding births and in-migrants and subtracting deaths and out-migrants. The estimates of migration used for this purpose are taken from an analysis of the changes of address notified to the local communities. The intercensal population estimates tend to "drift" as the years pass and have to be corrected at the next census.

Sample surveys: the microcensus

37. Among the surveys for measuring the demographic, social and economic characteristics of the population and for monitoring trends, a pre-eminent position is occupied by the microcensus first introduced in 1957. It began as an annual 1 per cent sample survey taken in October supplemented by 0.1 per cent sample surveys taken in January, April and July of each year. But since 1963 the 1 per cent survey has been switched to April/May of each year, and since 1975 the three supplementary 0.1 per cent surveys have been dropped. The results from the microcensuses complement the census results by providing information annually and in greater subject detail than the census but, of course, not for small areas: results are available for areas with a population of the order of $\frac{1}{2}$ million including the individual Länder.

38. Many of the questions asked in the microcensus follow closely the questions

asked in the census, but the microcensus also covers topics that are unsuitable for self-enumeration in a census. Thus it includes a series of questions concerning the search for a job, participation in health insurance and pension schemes and income. Each year's microcensus also includes questions on a supplementary topic that varies from year to year (though a given topic may recur): examples are health, leisure, vocational training, housing, perception of the environment and social mobility.

39. The sampling scheme is, in principle, a single-stage area sample. Each sampling unit is an area containing some 20 to 30 households constructed from the results of the preceding census of population (at present the 1970 census) and from information on postcensal building development. The sample is stratified by Land, size of community, etc. There is a system of "rotation" under which a quarter of the areas are replaced by new areas at each microcensus: thus, a sampled household is interviewed on four occasions at annual intervals. The system of rotation results in a more accurate assessment of year-to-year trends. The sample results are grossed up to estimates of the population by area, by sex and by German/non-German.

40. The microcensus interview generally takes place with one member of the household, most often with the head of household or spouse. Participation in the survey is obligatory (apart from questions on health, holidays and recreation, travel and year of marriage) and the final non-response rate is very low, below 1 per cent. The field-work is carried out by a team of some 5,000 interviewers employed by the statistical offices of the Länder.

41. As a result of the Constitutional Court's hearings on the 1983 census and the uncertainty that these generated concerning the legality of census and survey procedures, the 1983 and 1984 microcensuses were cancelled; the survey was restarted in 1985. The Constitutional Court felt that there was a case for making participation in the microcensus voluntary rather than obligatory as in the past (though response to

questions on some topics in the interview was already voluntary). This proposition is being tested by supplementing the normal 1 per cent area sample taken annually in spring, for which response will remain obligatory, by an additional 0.25 per cent area sample taken in the autumn of three successive years beginning 1985 for which response will be voluntary. Response to the autumn 1985 voluntary survey was about 50 per cent - markedly lower than to the compulsory spring surveys. The test is being evaluated by independent experts.

The future of the census of population

42. The immediate objective of the Statistisches Bundesamt is to ensure the success of the census to be taken on 25 May 1987 and the continuing viability of the annual microcensus. Longer-term plans can be made only later.

43. In the 1970s and early 1980s proposals were made for the centralised issue of personal reference numbers and for a measure of interlinking of the local population registers. Implementation of the proposals would have improved the quality and accuracy of the register data and might have opened up the possibility, in the longer term, of replacing the conventional census by a census based in part or in whole on registers supplemented, if necessary, by sample surveys. But the proposals lapsed because of concern on privacy. The debate on the plans for the 1983 census and the subsequent hearings of the Constitutional Court have focussed further attention on these concerns. The Court has laid down guidelines on the methods to be followed in censuses and surveys and has defined the circumstances in which individual data may be used, transferred to another agency or linked. In the present climate the Statistisches Bundesamt sees no prospect of pursuing alternatives to a conventional census that depend on the linkage of registers.

THE CENSUS OF POPULATION IN GREECE

Summary

1. The census of population and housing in Greece is taken every ten years. The most recent was on 5 April 1981 (the census had been postponed from 15 March 1981 because of an earthquake in some areas). A census of buildings taken in the preceding months provides enumerators with lists of housing units. In turn the census of population provides lists of individuals who own agricultural or livestock holdings; they are approached for information in the census of agriculture that is taken in the following two months.

2. The census of population and housing follows conventional lines. Distinctive features are, first, that the local administrations play no part in the conduct of the census. Second, enumerators collect the information by interviewing the head of each household rather than by distributing a questionnaire for self-enumeration. Third, information is collected about those present at an address on census night (distinguishing members of the household from guests) and about members of the household temporarily absent on census night, but the published results have, so far, been in terms only of persons present in each area. Fourth, apart from the figures of total population and numbers of households in each area, all other analyses of data from the 1971 and 1981 censuses have been limited to a sample of returns: a 25 per cent sample in 1971 and a 10 per cent sample in 1981.

3. Registers could not contribute to the census of population because the information that they contain is deficient in coverage, accuracy and up-to-dateness. The next census in 1991 will therefore follow existing lines with the possible addition of further topics. More resources will be needed for processing if production of the results is to be speeded up and if a more detailed geographical analysis is to be carried out.

Organisation

4. The National Statistical Service of Greece (NSSG) is directly responsible to the Minister for the National Economy but is "an independent office" within his Ministry. The NSSG budget and personnel cover functions carried out by the central divisions in the Ministry, by the statistical services located in other ministries and by the statistical field offices in each of the 51 nomos (a nomos is equivalent to a county or département in other countries). A consultative council to bring together the users of statistics and the producers in government may be set up as part of a reorganisation of the NSSG now under discussion.

Objectives of the census: frequency

5. The census of population and housing has three main aims. First, it provides the official figures of population of administrative areas: that is, of each of about 5,800 communes and each of 256 municipalities (a municipality is essentially a large commune); and, at a higher level, of each of the 51 nomos. These figures have important administrative uses including the allocation of funds from the central government to local administrations. Second, the census serves the constitutional function of counting the numbers of persons registered as electors in each commune/municipality; these figures determine each area's representation in Parliament. Third, as in every other country the census provides statistics of the demographic, social and economic characteristics of the population and statistics of housing at national and local levels.

6. The census is taken decennially, most recently on 5 April 1981. The next census is envisaged in 1991.

The fieldwork of the census

7. The communes and municipalities play no part in the conduct of the census. The operation is directed centrally through census supervisors located in the NSSG offices

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in the 51 nomos. The local fieldwork is carried out by staff temporarily recruited by the NSSG. The chief enumerators (of whom there were some 5,000 to 6,000 in 1981) are employed for a few months and the enumerators (about 90,000 in 1981) for no more than a few days. Each enumerator deals with some 40 to 50 housing units.

8. As a base for the planning of the fieldwork of censuses from 1961 onwards, an aerial photographic survey of the country is made by the Greek Air Force. This yields maps on which are then delineated: first, the enumeration sectors, that is, the territories assigned to the chief enumerators; and, second, within each sector the enumeration districts, that is the territories assigned to the enumerators.

9. After the mapping stage a census of buildings is taken. This takes place in the three or four months prior to the census of population; the reference date for the most recent was 1 December 1980. In the census of buildings the chief enumerator surveys his sector and lists each building and, within a building, each housing unit (if any). In respect of each building, he collects information on the number of storeys, the use(s) of the building and the period of construction (age).

10. In the census of population and housing that follows, the enumerator updates the list of housing units that had been prepared during the census of buildings, and he completes a census questionnaire in respect of each household by means of an interview with the head of the household. Interview rather than self-enumeration is seen to give a more certain and reliable response given, inter alia, the extent of illiteracy (about 12 per cent of the population, mainly among the old). The census refers to the night of Saturday/Sunday and heads of households (or others standing in for them) are asked to stay at home on the Sunday morning until the enumerator has called. Sampling is not employed at the collection stage of the census except in limited cases (see paragraph 14 concerning the questions on a woman's date of marriage and the children born to her).

11. The enumerators ask in respect of each person whether he owns an agricultural or livestock holding. Among those who answer "Yes" to this question - some one million - the same enumerators conduct a separate census of agriculture during the following two months.

The census questionnaire: the population base

12. The household is defined as one or more persons living together and sharing daily meal(s). More than one household may occupy one housing unit.

13. The census is concerned primarily with the population present at each address on census night, as is the case in Ireland and was formerly the case in the United Kingdom. This approach avoids the problems of defining a person's place of usual residence. However the census asks that, among those present, household members should be distinguished from guests, and separate sections of the census form ask about members of the household temporarily absent (including reasons for absence) and about members of the household temporarily abroad (if they intend to return to Greece within two years of the census date). Thus, figures of the population usually resident in an area could, in principle, be compiled - though omitting households all of whose members are away from home on census night and from whom, therefore, no information is collected at their usual address. But all the published analyses refer to the population present on census night. One of the matters to be considered for future censuses is the possibility of switching the emphasis from statistics of the population present to statistics of the population usually resident.

14. The 1981 questionnaire was modest in terms of the extent of the information asked for. Apart from basic demographic questions, questions were asked in respect of each person concerning citizenship, the commune/municipality in which the person was living in December 1975 (migration), the level of education attained, details of economic activity and, for the constitutional purpose referred to in paragraph 5, the

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commune/municipality in which the person (if a Greek citizen) was registered as an elector. There were no questions on ethnicity, language or religion, nor on income. Questions on income are asked only in the family budget survey, though the previous census of 1971 had asked that the main source of livelihood of each person should be identified (for example, wages, pension, benefits, property or support from the family). Questions on journey to work have not been asked though this is a topic which may perhaps be added to the questionnaire in 1991. Questions on the children born to a married, widowed or divorced woman and on her date of marriage were asked in the 1971 census in respect of a 10 per cent sample of housing units; they were dropped from the 1981 census but may be reintroduced in 1991.

15. A main part of the questions on the housing unit concerned its facilities and amenities.

Census processing

16. In the 1971 and 1981 censuses analysis of 100 per cent of the returns was confined to the counts of population and households in each area and the count of persons registered as electors in each commune/municipality: these counts were compiled essentially by clerical means, with subsequent tabulation of the results by computer. Processing of all other topics was carried out by computer but only for a sample of returns: a 25 per cent sample in 1971 and a 10 per cent sample in 1981. Coding was performed clerically and input was direct to disc from a set of key stations.

17. Though counts of population and households are available for individuals blocks within the municipalities, the areal analysis of the full range of topics on the 10 per cent sample basis employed in the 1981 census has not been extended below the level of municipality. But municipalities vary widely in size of population from a thousand or so to about a million in the case of Athens, and so consideration is being given to the possibility of dividing a municipality into "census tracts" in respect of which analysis

of a full range of topics might be carried out; each tract would have a population of some 2,000 to 3,000 and its boundaries would, so far as practicable, remain unchanged from census to census.

18. The depleted level of resources available for analysing the 1981 returns has led to delays in publication of the results: the 10 per cent sample processing will not be completed until early 1987.

19. The NSSG does not release anonymised data relating to individual persons and households ('microdata').

Checks on census coverage

20. Staff of the NSSG re-enumerate a sample of areas about three days after the census to give a check on coverage. The results suggest that the gross undercount in 1981 was of the order of 0.9 per cent overall but occurred mainly in the urban areas.

The cost of the census

21. The 1981 census cost about one billion drachmae. This covers the costs of the censuses of buildings, population and housing and agriculture, including the aerial surveys but excluding costs falling within the normal NSSG budget (for example headquarters' salaries). This works out at about 100 drachmae per person.

The public's response to the census

22. The public's response to the census has been uniformly good, helped by a modest publicity campaign. No change in public attitudes is foreseen.

Registers of the population

23. The communes/municipalities keep registers of the resident population that

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contain basic demographic information. A main source of data is the registration of births, marriages and deaths. But, in the absence of any law regulating the maintenance of registers or of any obligation on the citizen to notify changes of residence, the local registers cannot be kept accurate and up-to-date.

24. The communes/municipalities also maintain registers of Greek citizens aged 18 and over who are eligible to vote. The registers show only name, date of birth and place of birth and are based on the applications made by the persons concerned when they first become eligible to vote in an area. But registration is not compulsory (though voting by those registered is compulsory with some exceptions - for example the aged).

25. Identity cards issued by the police must be obtained by those aged 14 and over and are needed, for example, when obtaining a passport, when registering to vote or for some banking transactions. But there is no obligation on a person to ensure that the details on the card, such as address, are kept continuously up-to-date.

26. The census of population is carried out completely independently of all administrative records. And, given the limitations of the records in terms of coverage, accuracy and up-to-dateness, there is no prospect at present of registers making any contribution to the census enumeration.

27. The draft of a law on the protection of personal data held in computers is being prepared for possible submission to Parliament later this year. The law may impose new constraints on the activities of the NSSG.

Intercensal population estimates

28. Estimates of the population in years between the decennial censuses are made only at national level, by carrying forward the figure from the most recent census by reference to statistics of births and deaths and an estimate of net migration abroad.

The figures are analysed by sex and age-group. The greatest element of uncertainty concerns the estimate of migration abroad, which is based on the trends revealed by the most recent census and on information from the Labour Force Survey.

Sample surveys

29. Annual information on the demographic, social and economic characteristics of the population comes mainly from the Labour Force Survey (LFS). The survey was extended to include the rural areas just before Greek accession to the EEC in 1981. It is carried out in April with a sample of about 45,000 households (1.5 per cent of all households).

The future of the census of population

30. The impracticability of making use of existing administrative records in support of the census of population has already been referred to. Progress in this direction would require major improvements to record systems including the obligatory registration of changes of address and the introduction of personal reference numbers. The Greek public would probably not support such changes.

31. The next census will be on conventional lines with possible extension of the question content to meet growing demands. The NSSG will seek adequate resources to speed up the production of the results, and it would like to revert to 100 per cent processing of all topics as in 1961 (rather than the processing of a 10 per cent sample as in 1981) in order to provide reliable statistics for small areas.

32. As a way of providing information for sub-national areas at mid-decade, the possibility of a microcensus (that is, a sample census) might be considered.

THE CENSUS OF POPULATION IN IRELAND

Summary

1. The conventional census of population taken in Ireland at intervals of five years has not so far led to any significant public controversy. Given this and the absence of administrative registers containing data of adequate range and quality to serve as a substitute, no move away from conventional census-taking is foreseen in Ireland. The most recent census was taken on 13 April 1986, and the next is planned for 1991.

Organisation

2. Responsibility for the census falls on the Central Statistics Office (CSO), which is a separate department of government with responsibility for most governmental statistics and reporting directly to the Taoiseach (Prime Minister).

The objectives of the census; its frequency

3. The census provides the statistics on the population and its demographic, social and economic characteristics and on housing that are needed for planning and decision taking at national, regional and local levels. In particular, the census gives local information on employment and unemployment and more reliable measures of net migration than any alternative source: figures of migration to and from the State are among the most important - and politically sensitive - indicators of the condition of the Irish economy. The census also gives an up-to-date framework for carrying out surveys such as the Labour Force Survey.

4. The census of population in Ireland has been taken every five years since 1946, with the exception of 1976 when the census that had been planned was cancelled as an economy measure. (However a census was taken in 1979 for the specific purpose of

redrawing the boundaries of parliamentary constituencies; it asked only six questions, all of a demographic character.)

The census fieldwork

5. The fieldwork of Irish censuses follows traditional lines: an enumerator is responsible for surveying an enumeration area assigned to him, listing the households located within it, delivering forms and, later, collecting them. There are about 3,300 enumeration areas, each containing on average some 300 households. The policy is to appoint an enumerator who lives within the area that he is to enumerate; he thus brings to his task valuable local knowledge, though some objections are made that he is personally known to the households that he enumerates. This practice is different from that adopted in, for example, Britain, where enumerators are assigned to areas at a distance from their homes where they are not likely to be known. The use of the mail in Ireland has been confined to postal return in cases where contact with the household after census day was impracticable. Sampling has not been employed at the collection stage.

6. Difficulties of enumerating the population have been mainly confined to inner city areas with a concentration of apartments; in such areas the number of households assigned to each enumerator has been much lower than elsewhere. There have been no postcensal surveys of coverage or of the quality of the information collected.

The census questionnaire: the population base

7. All Irish censuses have asked for a return of the persons present on census night in the household (the household being defined as one or more persons with common housekeeping arrangements occupying all or part of a private house or apartment). Analyses of almost all topics have therefore been made in terms of persons present in each area. However the 1971, 1981 and 1986 censuses asked a question on the address

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of usual residence of each person enumerated and the address of usual residence one year before the census day; this enables the population count to be analysed by area of usual residence cross-classified by area of usual residence one year earlier.

8. The 1981 census asked more questions than any previous census. There were 22 questions for each person present in the household: these covered demographic topics, address of usual residence both at census day and one year earlier (migration), education, economic activity, travel to work or school, marital and childbearing history (for married women), use of the Irish language and religion. The 1981 census form also asked eight questions about the accommodation occupied, one of which related to the type of heating - a new question in the Irish census. The census has never asked questions on income.

9. In the 1986 census the scope of the questions for persons was broadly similar to that in 1981. Among the differences were the inclusion of questions to establish, for residents who had lived abroad for one year or more, the year of taking up residence in Ireland and the country from which they came. The thrust of the question on marital status was significantly changed from the legal status to the present actual status, in particular to distinguish various categories under the heading "married but separated". As is customary for a mid-decade census in Ireland, the questions on religion and, for married women, on marital and childbearing history were dropped and only one question on housing was retained.

Census processing and dissemination

10. Sampling was used at the processing stage for the first time in 1981. So that an early analysis could be made in advance of the final figures covering all households, the responses to selected questions in respect of a 5 per cent sample of households were transcribed by enumerators to record sheets that were then processed separately. This

scheme had originally been devised to give statistics that would obviate the need to carry out a 1981 Labour Force Survey. Sample processing of the census returns will not be repeated in 1986 because results from the 1986 Labour Force Survey will be available quickly.

11. There has been a growing demand from local authorities and academics for census statistics for small areas: for wards in urban areas and for district electoral divisions (DEDs) in rural areas (- the average population is 1,000 but larger in cities than in rural areas). Microdata, that is, individual data suitably anonymised, have not been released; there is doubt whether release would be permitted by the legislation under which the census is taken - the 1926 Statistics Act, now sixty years old and drafted in an earlier technological era. Although the completed forms from each census taken under this Act have been kept, there is at present no statutory authority under which they might ultimately be released to the public for historical or genealogical purposes.

The cost of the census

12. The cost of the 1981 census is put at rather more than IR£1.50 per person. Cuts in the 1981 census budget have led to delays in the processing of the results: the publication programme is not now expected to be completed until the end of 1986, though, even so, this is quicker than the timetable achieved in the 1971 census. The cost of the 1986 census is estimated at about IR £2.50 per person.

The public's response to the census

13. The 1981 census was well received by the public. Most of the criticism was directed to specific questions. Thus, some people felt that the tick-box answers to the question on marital status should have provided for a de facto category of "separated" (compare paragraph 9); some respondents regarded the questions on educational

achievements as sensitive; and the number of persons who failed to respond to the (compulsory) question on religion was greater than in previous censuses.

14. The 1986 census was particularly well received. Fieldwork progressed smoothly at both the delivery and collection stages and there were no public controversies. The first census results have been published sooner than has ever previously been possible.

Administrative registers

15. There are no local registers of the resident population in Ireland. But there are, of course, a number of administrative registers containing personal data: for example, the local registers of electors (which contain only the names and addresses of persons eligible to vote), and the files of pay-related social insurance contributions (PRSI) referring to persons who are, or have been, in employment. However such registers are incomplete in coverage even within the fields that they aim to cover, and they contain duplicate registrations. The statisticians in the CSO take the view that registers would be a useful source of statistics only if major campaigns were undertaken to improve the quality of the data. That would require heavy expenditure as well as the cooperation of administrations that can have little interest in such statistical by-products.

16. No general legislation on data protection has yet been enacted in Ireland, although of course the confidentiality of the census data is protected absolutely by the Statistics Act 1926.

Intercensal population estimates

17. At the national level, intercensal population estimates are made by carrying forward the latest census count by reference to statistics of births, deaths and migration. The weak element in this calculation is the estimate of net migration, which

is based on a variety of sources including: the balance of passenger movements to and from the State; electoral registrations (for ages 18 and over); statistics of children's allowances (for ages up to 16); and figures of immigration in the previous year taken from the Labour Force Survey and of emigration to the United Kingdom in the previous year taken from the UK's Labour Force Survey. In addition, since 1985 the Irish Labour Force Survey has asked an additional question about any persons who have left the household and emigrated during the previous year. There is no formal system of preparing sub-national intercensal population estimates: the formula for distributing funds from the central government to local government does not contain such estimates.

Sample surveys

18. The biennial Labour Force Survey (LFS) was first taken in 1975 following Ireland's accession to the EEC. From 1983 the survey has been taken annually and has become an important national tool for the study of employment and unemployment. No survey was taken in 1981 on the grounds that an advance analysis of a 5 per cent sample of returns from the 1981 census would provide an acceptable substitute. However it was recognised that the results of the LFS and of the census would not be fully comparable because of differences of methodology: the LFS is by interview and is in respect of the persons usually resident in the household whilst the census is by self-enumeration and is in respect of the persons present in the household on census night. In 1986, for the first time, the LFS was taken in a year when a census with a detailed questionnaire was also taken, with LFS interviewing beginning about ten days after the census date.

19. The sample for the 1984 LFS was made up of about 45,500 households (excluding listings not containing households) together with a sample of persons in institutions. The response rate was 94 per cent, so that the achieved sample was 43,000 households covering some 154,000 persons, that is, in excess of 4 per cent of the

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population. The LFS employs a two-stage stratified sample; the primary sampling units in each of the strata are enumeration areas (or parts of such areas) taken from the most recent census. The LFS interviewers re-survey the selected enumeration areas, list all the housing units contained in these areas and then draw a sample of the housing units, at which they will carry out interviews. (A two-stage sampling scheme on these lines is the approach usually adopted by the CSO for interview surveys addressed to the whole population in the absence of an up-to-date list of addresses - or of households or persons - that might provide an alternative sampling frame.)

20. Another regular survey on an aspect of the labour force is the annual survey on the Economic Status of School-leavers (carried out by the Department of Labour). About 2,000 young people, out of a total of 60,000, are interviewed one year after they have left secondary education. They are asked about their careers - jobs, further education and training etc.

The future of the census of population

21. The view of the CSO is that administrative data offer no alternative, in whole or in part, for the conventional census of population for the reasons given in paragraph 15. The 1991 census is likely to follow the pattern of previous Irish censuses, with a question content somewhat more detailed than in 1986 particularly on housing. Field tests are planned to investigate the implications of changing the population base to enumerate the persons usually resident in the household rather than the persons present in the household on census night.

THE CENSUS OF POPULATION IN ITALY

Summary

1. The census of population and housing in Italy is taken decennially; the most recent was on 25 October 1981. The fieldwork is on conventional lines, but the enumerators engaged in this work deliver (and later collect) forms for the census of industry, commerce, services and handicrafts simultaneously with the forms for the census of population and housing: a shared field operation.
2. The communes manage the local fieldwork: they employ the enumerators, check the completed census forms, carry out some of the coding and, in some cities, key the data to magnetic tape. They also check certain of the census data against the communal population registers in order to update the registers or, if a person or household has been missed from the census enumeration, to provide information for the census; for this purpose the communes use (and retain) a tear-off page which is a part of the census questionnaire.
3. There has been no sampling at the collection stage of the Italian census, and in 1981 sampling at the processing stage was used only to give an early analysis of structural characteristics in advance of the later 100 per cent analysis.
4. Registers of the resident population are maintained by the communes. The registers are updated from registrations of births, marriages and deaths and from information provided by the public on, for example, changes of address. But there is no central register. Moreover the quality of the information in the registers is variable, reflecting the attitudes of both the public and the communal authorities. Thus, a person may delay notifying a change of address until he perceives a clear advantage to himself in doing so. A survey made after the 1981 census showed that in the larger

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cities a significant proportion of households as recorded in the census had not yet been entered in the population registers - as high as 17 per cent in Roma. Failure to notify the authorities that a person has emigrated is believed to be a main factor in the inflation of the numbers in the population registers.

5. In the longer term the population registers may provide the basis for a register-based census. But, to achieve this end, a great deal of work would be needed to make the population registers and other administrative files sufficiently accurate, up-to-date and accessible and to develop mechanisms for linkage. Proposals for a central population register and the linkage of files might also run into political difficulties.

6. The next census in 1991 will be a conventional census building on the success of the 1981 census. No great change is envisaged in its question content - which is modest. A main aim will be to improve the quality of the results through, for example, better fieldwork. The favourable way in which the public responded to the 1981 census is seen as an encouraging sign for the next census.

Organisation

7. Responsibility for the census rests on the Istituto Centrale di Statistica (ISTAT). This is a centralised governmental institution that reports directly to the Prime Minister. ISTAT is supported by an advisory council, the Consiglio Superiore di Statistica; the council includes representatives of government departments, the judiciary, employers' organisations and trade unions, universities and the statistical profession. Many of the census tasks are delegated through the 95 provinces to the communes which number more than 8,000. The communes manage the local fieldwork and some of the early stages of the processing.

Frequency of the census

8. The census of population that was taken in Italy on 25 October 1981 was the 12th in a decennial series that started in 1861. From 1951 a census of housing has been an integral part of every census.

The census fieldwork

9. The enumerators - numbering over 95,000 in 1981 (of whom a fifth were the employees of public bodies) - are responsible for surveying the enumeration areas assigned to them, listing the households and unoccupied housing units, delivering the census forms and collecting them when completed. Starting with the 1961 census, the enumerators engaged in the delivery/collection of the forms for the census of population and housing have simultaneously delivered/collected forms for the census of industry, commerce, services and handicrafts: thus the field operations of the two censuses have been shared.

The census questionnaire: the population base

10. The census questionnaire relates to a famiglia di censimento or household defined as one or more persons living together with common housekeeping; more than one household may occupy one housing unit. The main section of the census form refers to persons who are resident in the household; within this section one of the questions asks about each person's whereabouts on the census date. A supplementary section of the form asks about persons who are temporarily present in the household at census date. It is thus possible to compile population figures for each area on the basis of persons usually resident in the area or on the basis of persons present in the area on the census date; most of the published results are on a resident basis.

11. The 1981 census form asked the householder nine questions on housing and 12 questions about each person who was resident in the household; in addition the

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enumerator answered four questions about the housing unit and the building in which it was situated. The questions about each resident person covered basic demographic characteristics, place of residence five years earlier (migration), education, details of economic activity and of economic activity five years earlier and details of daily travel to work or to study. The 1981 census form was broadly of the same length as the 1971 form: some questions asked in 1971 were omitted in 1981 - notably the set of questions to married women on their marital and childbearing history; and some questions were extended in 1981 - for example, additional detail was asked about daily travel to work or to study. The census in Italy has never asked questions on income.

The rôle of the communes in census-taking

12. The communes play a major rôle at the local level. They employ the enumerators, check the completed forms for omissions and inconsistencies, carry out coding (which is subject to later checks by ISTAT) and, in most of the larger cities, key the data to magnetic tape.

13. The census form contains a tear-off page which is retained by the commune for the purpose of checking - and as necessary updating - the contents of the communal population register. The householder transcribes the following items of information about each resident person from the main part of the census form to the tear-off page:

name

relationship to head of household

sex

date of birth

place of birth

marital status

citizenship

educational qualifications

occupation or other activity (for example housewife, student, retired)

address of place of work or of study

whether present in the commune of usual residence at the date of the census.

With the exception of the last two items in this list, these are the items of information that are recorded in the population registers. The check between the census tear-off page and the population register also reveals households in the register that have been missed in the census enumeration; if the check is carried out promptly, information about such missed households can be added to the census returns.

Census processing and dissemination

14. Following the checking, the coding and, in some cases, the keying that is done in the communes, further checking and editing are carried out by ISTAT. The systems employed include, on an experimental basis, an interactive edit using visual display units (VDUs).

15. Sampling has never been employed in the Italian census at the collection stage - that is, the long form/short form approach as adopted in the USA. But sampling has been employed at the processing stage. Thus, in 1971 the responses to some of the questions, particularly responses that are difficult to code such as occupation, were excluded from the main processing run which included all households: for this 100 per cent processing, responses were first transcribed onto special sheets and then read optically. In addition, responses to all the questions were keyed and processed for a 20 per cent sample of households. In 1981 however pressures from users of the statistics led to the decision to process all the variables at the 100 per cent level; and, following tests in 1980, optical reading was abandoned in favour of keying the data. A scheme of sampling at the processing stage was, nonetheless, adopted in 1981 to give an early analysis of structural characteristics at the regional level in advance of the 100 per cent analysis which would follow; this advance analysis was based on a 2 per cent sample of households. The first 100 per cent results for the provinces were published in the period from mid-1983 to mid-1985.

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16. There is a trend away from printed volumes as the medium of dissemination. Most of the results of the census are made available in the form of aggregates. But, exceptionally, the law provides that local government at all levels (regions, provinces, communes) may obtain 'microdata' for their own areas - that is, data on individual persons and households that have been suitably anonymised - to help them in planning and related functions.

Sample checks on census coverage and quality

17. For the first time in 1981, ISTAT carried out sample surveys on census coverage and quality. In the survey on coverage, experienced enumerators re-enumerated a sample of enumeration areas containing about 120,000 households. But the results of the survey have proved difficult to interpret for a number of reasons: for example, movements of population between the date of the census and the date of the survey complicate the comparison of the successive enumerations; and it is difficult to ensure that the enumerators confine their re-enumerations to the sample areas assigned to them without straying over the boundaries into other areas. More generally, the survey method suffers from the same kinds of deficiencies as the census which is being evaluated, though ISTAT reckons that the coverage of the survey was slightly better than that of the census. No precise figure of census undercount can be deduced from the coverage survey.

18. For the quality survey, interviews were carried out by former enumerators in some 10,000 households, and the responses to the interview were compared with the census responses. For some "hard" variables, differences between the census and survey responses were confined to a small percentage of persons (for example, about 2 per cent in the case of age); whilst for variables such as education and occupation there were differences of response (in terms of the classifications used) for 10 to 15 per cent of persons.

The cost of the census

19. The cost of the census of population and housing cannot readily be distinguished from the cost of the census of industry and commerce etc, because the two censuses share a common field operation. The combined cost in 1981 was of the order of 120 billion lire or about 2,100 lire per person.

The public's response to the census

20. The 1981 census was favourably received by the public and the press; and the use of census data to update the local population registers did not lead to controversy, as it had done in some other countries. A publicity campaign in the press and on television contributed to this successful outcome; the campaign cost about 1 billion lire.

Registers of the resident population

21. Registers of the resident population, maintained by the communes, have existed since the Unification of Italy in 1861 and have become fully operational in the last thirty years. They are computerised in some of the bigger cities. There is no central register. The registers record each famiglia (household) and each person within the household; the topics recorded in respect of each person are listed in paragraph 13 above (first nine items). The registers are updated from registrations of births, marriages and deaths and from information provided by heads of households and by individuals, in particular when they move residence. Statistics from the registers are the basis of intercensal population estimates both at local and national levels.

22. The quality of the information in the registers varies. Some people are slow to register a change of residence; and the topics of educational qualifications and occupation are infrequently updated. Where there is no administrative use of an entry

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in the register, neither the individual nor the commune has an incentive to update it. Where there is an administrative use, the individual has an incentive to register a change if he is seeking some service or benefit that depends on registration - for example, sending a child to school or establishing the right to vote. But equally there may be a disincentive if he sees some disadvantage to himself as a consequence of registration. The case of a family that has a second residence illustrates the influences at work: there may be financial advantages in the wife registering herself as usually resident at the second residence whilst her husband registers at the main residence. (This phenomenon has contributed to the decline in recent years in the average size of household in Italy.) Apart from the influences that bear on the individual person or household, there may also be factors that encourage the commune to update the register or, alternatively, discourage it from doing so; one example stems from the fact that the administrative arrangements applicable to a commune change when the population count passes certain thresholds (for example, 5,000).

23. Arrangements are made to ensure that, when a person moves and his name is added to the register of his new commune, his name is deleted from the register of his former commune. But inflation in the registers occurs when the names of emigrants from Italy remain in the registers. Unrecorded emigration was thought to be the main reason why the 1981 census counted 800,000 ($1\frac{1}{2}$ per cent) fewer people than the 1981 estimate of population that had been carried forward from the 1971 census count by reference to numbers of births, deaths and net migration.

24. Following the decennial census enumeration, the communes are required by law to update the population registers on the basis of the census data returned on the tear-off page as described in paragraph 13. The task of reconciling the census data with the register data is slow and arduous. In some cases the census/register comparison may not succeed in its aim of updating the register; for example, an individual who has

failed to register his residence in the commune may enter himself on the census form in the section headed "persons temporarily present in the household". This example illustrates a general point: the use of data for administrative purposes may adversely affect the accuracy of the information collected.

25. A sample survey carried out in connection with the 1981 census of population examined the extent to which the information in the population registers differed from the information collected in the census. The survey was based on the census returns from 43,000 households in 99 communes - the chief communes of the 95 provinces and four other large communes. Of these households, 2.7 per cent were not recorded in the population registers and another 9.7 per cent exhibited differences in the composition of the household. Divergencies were greatest in the large cities; thus, in Roma 17 per cent of the sample households were missing from the population registers and in Milano 10 per cent. In the smaller and more rural communes not included in the survey, the divergencies would have been less than the survey figures. The results of the survey point to the need for more rapid and accurate updating of the registers, particularly in the large cities.

Sample surveys

26. Response to sample surveys of persons and households in Italy is voluntary. Surveys use the population registers as a sampling frame. A labour force survey has been carried out since 1959 and involves interviews with about 100,000 households each quarter; a third of the sample households are changed each quarter, so that each selected household is interviewed in three successive quarters. A survey of the structure and characteristics of the Italian household is examining inter alia the extent to which the de facto household composition differs from the composition recorded in the population registers; the first round of the survey was addressed to about 30,000 households in the autumn of 1983.

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The future of the census of population

27. The demand for the statistics that the census can provide grows with increasing regional devolution and greater public intervention in social and economic affairs. Statisticians in ISTAT recognise the cost of the conventional census and the burden that it places on the public. They see the potentiality and the merits of moving to a register-based census using the population registers as the base. Other administrative registers cover substantial sections of the Italian population and might be linked to the population registers for census purposes: for example, files of income are held by the Ministry of Finance and files of social security contributions are held by the INPS. But the statisticians also recognise the very substantial obstacles - both practical and political - that stand in the way of moves towards a register-based census.

28. On the practical side, the population registers would have to be significantly more accurate and up-to-date than they are today, and there would have to be a central register as well as the local registers. Other files would need extensive updating - which is expensive. It might prove impracticable to update some variables such as occupation. Mechanisms to link files would have to be developed: at present each citizen has a variety of personal numbers (for example, a population register number in his commune, a tax number).

29. Development of a central population register and linkage with other files, perhaps with a common personal reference number, could run into political difficulties. No proposals on these lines have been put to the politicians. Moreover there is as yet no general legislation on data protection though a number of Bills have been put before Parliament. On the other hand the favourable way in which the 1981 census was received by the Italian public is seen by ISTAT as a good omen for the future and offers the hope that technological progress will not be impeded by public resistance.

30. The next census - in 1991 - will be a conventional census but its shape is not yet determined. Sampling is thought unlikely, either at the collection stage (long/short forms) or at the processing stage; there is however the possibility of a sample survey linked to the census enumeration, perhaps on the lines of the 1 in 50 sample enquiry in the French census of 1982 addressed to women in certain age-groups. The use of mail-back (but not mail-out) may be considered because of the difficulties that enumerators experience in making contact with households, especially in the big cities; but mail-back would eliminate some of the help to householders and the checking of census forms that enumerators have traditionally carried out on the doorstep.

31. Containing or even reducing the number of questions in the census is seen more as a way to speed the results of the census than as a way of holding down costs or of reducing the burden on the public. The 1991 census may see the introduction of housing questions that bear on environmental issues; and of questions that can discriminate more effectively, in modern conditions, between good housing and poor housing.

32. A main aim in 1991 will be to improve the quality of the census results, through such measures as better training of enumerators, improved collaboration with the communes (including payments for their work on checking, coding and keying) and further post-censal sample checks on coverage and quality.

THE CENSUS OF POPULATION IN LUXEMBOURG

Summary

1. The census of population and housing is decennial. The most recent, on 31 March 1981, met with a favourable public response. There is also a tax census taken annually in October in connection with the system of tax deduction at source. The tax census asks about dependents and so its coverage is not substantially different from that of the census of population; some of the questions asked in the two censuses are similar.

2. Local population registers have been maintained in Luxembourg since the early years of this century, but their mode of operation is not standardised throughout the Grand Duchy. A computerised central population register became fully operational in 1984. There is inflation in the local registers, and so also in the central register, due in particular to the failure to eliminate the names of some emigrants from the country. A system of personal reference numbers is used in the central population register as well as in some government administrative files, for example files on social security and tax.

3. The communes act as agents of the government statistical organisation, STATEC, in carrying out the fieldwork for the census of population and as agents of the tax department for the annual tax census; they also maintain the local population registers. The basic information about a person's residence is therefore available to the commune from three separate sources - though with different timings. The communes do in fact use one source to supplement or support another, though the degree of support varies from one commune to another and according to circumstances. For example, in the 1981 census of population the initial substantial under-coverage in the City of Luxembourg was rectified following checks made against the records of the tax census and the local population registers. In some places data from the census of

population and from the tax census may be used to update the local population registers. This mutual support between the three sources of personal data, though variable in its effectiveness, is an unusual feature of the Luxembourgish situation; it is capable of further development.

4. For the future the technical possibility exists of making linkages for statistical purposes between the central population register and other administrative registers and also links with a conventional census enumeration. Such linkages would require statutory authorisation and backing from the consultative commission set up under the 1979 law on data protection (referred to in this Annex as the Commission sur la Vie Privée). However for 1991 another conventional census of population seems likely, with the option of linking the census returns to the central register of population as a means of improving the accuracy of both.

Organisation

5. The census of population in Luxembourg is organised by the Service Central de la Statistique et des Etudes Economiques, STATEC, which, as a part of the Ministère de l'Economie, is responsible to the Minister of the Economy. STATEC receives advice from the Conseil Supérieur de la Statistique; the Council includes representatives of government departments, employers and trade unions as well as academics and other independent experts.

The objectives of the census: its frequency

6. A general objective of the census of population is to collect statistics that are needed for planning: on the size of the population and its characteristics and on housing. Specific objectives are to provide figures of the resident population used for a number of political and administrative purposes including: determination of the representation

in the Chamber of Deputies and in the Councils of the communes; the distribution of government funds between the communes; and application of laws regulating, for example, the number of cabarets (taverns).

7. The census of population is normally taken at decennial intervals; the most recent was on 31 March 1981. A mid-decade census with restricted question content was taken in 1966 to monitor changes in the structure of the population. The next census is foreseen in 1991.

The tax census

8. Before discussing other features of the census of population, it is appropriate to mention the Recensement fiscal or tax census which is taken by the tax department annually in October as a basis for establishing revised tax deductions from salaries etc. The tax census has many features which resemble the census of population: each household must complete a form to show all the members of the household, their basic demographic characteristics, details of their employment and the rental paid. And, as in the case of the census of population, the collection of the returns for the tax census is in the hands of the officials of the communes; indeed, the communes maintain the relevant records. As a result of the similarities of title and form, the public often confuse the tax census with the less-frequent census of population. However the two censuses have different purposes - the census of population serves mainly statistical purposes and the tax census almost wholly administrative purposes; and there are some differences in coverage and definitions. The possibility of combining the two censuses has therefore been rejected.

9. Nonetheless the experience in the City of Luxembourg at the time of the 1981 census of population (see paragraph 16) was evidence that the coverage of the tax census was better than that of the census of population. This is due, at least in part, to the

fact that, if a worker is missed from the tax census, he and the members of his household are added in to the records at a later stage when he applies at the communal administration for a tax card. Because the census of population had been postponed from 31 December 1980 to 31 March 1981 to meet the EEC directive on synchronisation, the tax census of 15 October 1979 took the place of the census of population for the purpose of determining the number of councillors in each commune for the October 1981 communal elections. Future tax censuses may again be used for statistical purposes if resources for their exploitation are available.

The census fieldwork: the rôle of the communes

10. Officials of the communes manage the fieldwork of the census of population under the overall direction of STATEC. They recruit the enumerators, each of whom is assigned to a quartier de recensement (enumeration area) containing on average 50 households. Enumerators are trained by STATEC. Enumerators make a house-to-house delivery of the census forms and later collect the completed forms, which are checked by the communes before transmission to STATEC for processing.

11. As already noted, the communes also manage the fieldwork of the annual tax census and maintain the associated records. Further they maintain the local registers of population and the electoral registers. These various activities of recording and record-keeping do in fact support one another; but there are no standardised procedures and so the extent of the mutual support varies from one commune to another and from time to time. Data collected in the census of population and in the tax census may be used to correct the registers of population; and the lists of names and addresses from the tax census and the population registers may be consulted to ensure a full coverage in the census of population.

12. The Luxembourgish census of population has not used sampling either at the

collection or processing stages. Nor has the mail been used, though mail-back of the completed census return may be an option available to the citizen in future to give additional privacy.

The census questionnaire: the population base

13. The principal census forms in 1981 were, first, a form for the building (bordereau de maison), which asked seven questions; and, second, a form for the household and housing unit (feuille de ménage et de logement). (The household was defined as one or more persons living together and sharing une vie commune, and the housing unit was defined as the accommodation occupied by just one household.) The household form asked seven questions on the accommodation occupied, one question on the availability of a car and 19 questions about each person who was usually resident in the household or was present in the household at census day; this form was marked as "serving statistical purposes only".

14. A question on each person's place of usual residence enabled visitors to be distinguished from usual residents. But the question whether a person was present or absent at census day, asked in the preceding census of 1970, was omitted in 1981; and so in 1981 counts for each area could be made only in terms of the persons usually resident in the area and not additionally, as in 1970, in terms of the persons present in the area on census day. (In 1981 a visitor was to be returned on the feuille de ménage so that his details could be passed back to the commune of usual residence in case he had not already been enumerated there.) The instructions on the questionnaire laid down that the term 'usual residence' normally referred to the address at which a person was recorded in the communal population registers; but the term gave rise to difficulties of interpretation in some cases and to the duplication of some individuals in the population counts - for example, people in long-term stay in hospital. One way of eliminating this duplication would have been for STATEC to introduce into the census

records the personal reference numbers referred to in paragraph 23 below (using date of birth and name as shown on the census return) - in effect linking the census returns to the central population register: but this possibility was not pursued.

15. The remaining questions asked in respect of each person covered basic demographic topics and nationality, place of residence at the time of the previous census in 1970 (migration), economic activity and daily journey to work or to study. There was also a question on each person's main source of income or support. A simple question on the number of children born to a married woman took the place of detailed questions on marriage and childbearing that had been asked in the 1970 census; this simplification followed pretests on these topics and advice from the Commission sur la Vie Privée. (In fact some protests were made during the 1981 census that the question on the number of children born to a woman had not been addressed to single women and married women equally.) Questions on education and training were again omitted from the census (- they had also been omitted from the 1970 census), following pretests in which the questions were poorly answered and on the advice of the Commission. Questions on ethnicity, language and the level of income have not been asked in the Luxembourgish census. And the question on religion asked in the 1970 census was omitted in 1981 on privacy grounds, as required by the general legislation on data protection of 1979.

The coverage of the census: the processing timetable

16. The main problem in achieving a high level of coverage in the 1981 census centred on the City of Luxembourg with its large numbers of foreign nationals - in the Grand Duchy as a whole more than a quarter of the population are of foreign nationality. The numbers enumerated in the City were initially 5,000 (6 per cent) lower than expected. Foreign workers are however picked up in employers' returns to the tax authorities and, in turn, by the population registers. Thus it proved possible to make

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good the 5,000 deficiency following a detailed check of the census returns against the returns made in the tax censuses of October 1980 and October 1981 and against the population registers. This check delayed the publication of the official counts of the population beyond the date (one year after census day) laid down by statute.

17. Although most of the results were available much earlier, the final set of results from the 1981 census were not published until March 1985 - four years after census day as against the aim of publishing them by the end of 1983. Even so the timetable achieved was better than for the 1970 census whose final results were published six years after the census. A factor that contributed to the improved performance in 1981 was that close collaboration between statisticians and computer personnel was established from the earliest planning stages of the census.

18. Anonymous individual data (microdata) are released to specified government departments.

The cost of the census

19. The total cost of the 1981 census was about Lux Fr 50 million, that is Lux Fr 140 per person. (1 Lux Fr = 1 Belgian franc.)

The public's response to the census

20. The public's response to the 1981 census was favourable. The Commission sur la Vie Privée had previously given its approval to the plans for the census.

Registers of the resident population: the system of personal reference numbers

21. Registers of the resident population have been maintained by the communes since the early years of this century, but there is no standard régime that is to be

applied in each commune. The registers are manually held in most cases. Registers are updated from civil registrars' records of births, marriages and deaths, and from information on changes of residence supplied by the persons concerned. A person moving into a commune cannot be registered there unless his registration in his former commune is deleted at the same time. But the failure to delete from the registers the names of some people - in particular emigrants - leads to inflation; because of the financial implications there is little incentive for the communes to remove names. Moreover the checks on the contents of the registers by reference to the returns from the tax censuses and from the census of population are limited in their extent and effectiveness. Identity cards are issued either by the municipal police or by the population registries of the communes; but in most cases there is no direct link between the records of identity cards issued and the population registers.

22. A computerised central population register (Répertoire Général des Personnes Physiques), constituted initially from social security records, became fully operational in November 1984 and contains the following data in respect of each person:

- name
- sex
- date of birth and place of birth
- parents' identities
- personal reference number (see next paragraph)
- nationality
- marital status
- spouse's name
- usual residence
- date of death

The register is maintained by the Centre Informatique de l'Etat and is updated from information supplied by civil registrars on births and deaths and by the communes on changes of residence and changes of marital status.

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23. The central population register has been created in connection with the introduction of a system of personal reference numbers which are held in the register. The numbers are made up of the explicit date of birth, a two-digit serial number (which also indicates the sex) and a check digit. The numbers are issued at birth or, in the case of immigrants, when a request is made to issue an identity card. The law specifies the public bodies which can make use of the personal reference numbers or which can have access to the central population register; these bodies include the tax, social security and education departments. The personal reference numbers are not inscribed on identity cards nor in the communal population registers. In principle the personal reference numbers could be used in future to link files for statistical purposes subject to statutory authorisation and approval by the Commission sur la Vie Privée.

24. The main inaccuracy in the coverage of the population registers arises from the failure to delete the names of persons who have left the Grand Duchy: some 6,000 foreigners take up residence in Luxembourg each year and a similar number depart. The numbers in the central population register at mid-1985 exceeded the estimate of the population based on the 1981 census by about 10,000 (3 per cent). When the central population register was being constructed from social security records, a proposal was made to identify persons no longer resident in Luxembourg by matching the social security records against the returns from the forthcoming 1981 census of population; but STATEC rejected the proposal on the grounds of cost and the possible adverse effects on the public's response to the census.

Intercensal population estimates

25. Annual population estimates at communal level are needed inter alia for the distribution of grants from the State to the communes. Because of the inflation in the central population register, which tends to increase in the period between one census and the next, the population estimates are not taken directly from this source. Instead

STATEC carries the population estimates forward from year to year, starting from the count at the previous census, on the basis of information from civil registrars on births and deaths and from communes on migratory movements; adjustments have been made to allow for unrecorded migration.

The future of the census of population and of the register systems

26. A substantial infrastructure of information on population exists in Luxembourg, much of it only recently created but only partially integrated and linked. First, mirroring the local population registers is the central population register with its accompanying system of personal reference numbers. Second, tax censuses are taken annually and have wide coverage; but, though the fieldwork is in the hands of the communes, there has been little cross-checking of coverage between the tax census and the population registers. Third, there is the decennial census of population. In this case too the fieldwork is in the hands of the communes and there is some local checking of coverage against both the tax census and the local population registers. But there has been no linking of the census files - the census of population and the tax census - with the central population register; such linkage would be technically feasible (by reference to date of birth and name) and could be a means of eliminating emigrants from the central population register and of eliminating duplication from the census of population. Fourth, a number of administrative files carry the personal reference numbers - for example, the files on social security.

27. One option for the future would be to develop the linkage of files through use of the personal reference numbers, including linkage with the returns from the census of population. Luxembourg enacted general legislation on data protection in 1979 and set up the statutory Commission sur la Vie Privée with a consultative role. Further development of personal data systems and linkage, even for statistical purposes, would require statutory authorisation and the backing of the Commission. Moreover, though

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the creation of the central population register and the system of personal reference numbers has proceeded so far without any adverse public reaction, a reaction against new developments is possible in future, particularly given Luxembourg's proximity to events in the Federal Republic of Germany. STATEC is therefore taking a cautious approach to the linkage option.

28. A conventional census of population in 1991 seems likely with a topic content that reflects anticipated tight budgetary constraints - though the reinstatement of questions on education and training that were dropped from the 1970 and 1981 censuses is a possibility. Linkage of the 1991 census files to the central register of population - as a means of improving the accuracy of both - is one option.

THE CENSUS OF POPULATION IN THE NETHERLANDS

Summary

1. It was in 1971 that the decennial census of population in the Netherlands first ran into difficulties. Following public debate on computers and privacy, action groups opposed to the census sprang up, and nearly 300,000 people (2.3 per cent of the population) failed to cooperate in the census.
2. The plans for the next census in 1981 were developed against the background of the 1971 experience and with the aim of reducing costs: the enumeration was to be restricted to people whose names appeared in the population register, and at 4 addresses in 5 only a short form was to be completed. But, following a poor response to a voluntary census test in 1979 and in the continuing absence of general legislation on data protection, the 1981 census was cancelled.
3. The statistical gaps created by the cancellation were partially filled by increasing the sample size of the spring 1981 Labour Force Survey, by making a 1 per cent housing survey in autumn 1981 and by drawing on other regular sources of statistics. Whilst up-to-date and reliable demographic statistics for small areas were available from population registers, the loss of small area statistics on the labour force and on housing that resulted from the demise of the census was the subject of widespread complaints.
4. Local population registers have been continuously maintained by the municipalities since 1850. Personal reference numbers have been issued in municipalities with automated registers and now cover 70 per cent of the population; the issue of numbers will be extended to the whole population. Proposals to operate the population

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registers at a higher, regional, level and to interlink them are before Parliament. Proposals for general legislation on data protection are also before Parliament. These developments, if accompanied by the wider use of the personal reference numbers by administrative agencies, would open up the possibility - in technical terms - of developing projects that involve large-scale linkage of records. However the political climate is against such a scheme.

5. Nor are any plans being made to take another conventional census of population and housing. As a substitute, it is proposed in the medium term to obtain statistics from the population registers, a survey of housing needs taken every four years, municipal information on housing and a re-structured Labour Force Survey.

Organisation

6. The Centraal Bureau voor de Statistiek (CBS) has responsibility for government statistics, including statistics of population and housing from censuses, sample surveys and registers. The programme of work of the CBS has to be submitted for approval to the Central Commission on Statistics (CCS), which is made up of some 50 people representing government departments, the municipalities, employers, trade unions, parliamentarians, the scientific world, etc. The Minister of Economic Affairs, subject to Parliament, provides the resources to the CBS. These organisational arrangements, which date from as long ago as 1899, give the CBS a degree of independence of central government which is thought to be helpful in securing public cooperation in providing the information needed for statistical purposes. Generally speaking, all statistical activities at the national level are performed by the CBS. Some statistical work is located in departments, but is subject to consultation with the CBS and CCS.

Censuses in the Netherlands

7. The census of population and housing in the Netherlands was taken decennially

up to and including 1971. It asked for a return in respect of each person resident at an address. The census fieldwork was carried out by the municipalities, which recruited, trained and paid the enumerators. The municipalities made use of the census responses to check the completeness and accuracy of the registers of population; and on the other hand the registers provided a starting point for the fieldwork in the shape of an initial list of persons to be enumerated.

The 1971 census

8. In 1971 a separate questionnaire was provided for each person. The questionnaire applicable to a head of household contained about 60 questions making it comparable in length to the long form used in the United States. There were questions on nationality, religion, disability, marital and childbearing history (for married women) and income, together with a considerable number of questions on economic activity and housing; there were none on ethnicity or language.

9. The questionnaire was in the format of 11 punched cards bound together - taking as example the questionnaire for heads of households. The first of the 11 showed name, address, sex and date of birth and was normally completed by the municipality before delivery on the basis of the information in its population register; after collection this card was detached from the other ten and retained by the municipality for the purpose of checking and, if necessary, correcting its population register. The remaining ten cards, without name and address, were passed to the Central Bureau of Statistics for processing for purely statistical purposes. The cards with names and addresses were, by law, destroyed within three years of census day.

10. In 1970 a new law on the census had been enacted but there was no general legislation on data protection. In the period leading up to census day, 28 February 1971, there was public debate on automation, registers and privacy and "action groups" grew up opposed to the forthcoming census. The opposition's case was helped by the

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fact that the questionnaire took the form of punched cards in which, for technical reasons, serial numbers had been pre-punched. Some parliamentarians proposed that the 1971 census should be postponed to give time to make better data protection arrangements and to inform the public more fully on the purpose of the census. In the event Ministers and Parliament decided that the census should take place on the date originally planned. However about 296,000 people did not cooperate (2.3 per cent of the population); they were concentrated in the big cities (in particular in Amsterdam). There were 23,000 open refusals. No prosecutions were made. It was possible to fill the gaps on, for example, age, sex, marital status, relationship in family, place of birth and nationality from the population registers; the missing data on housing could be derived in part from other municipal administrative sources; for some other topics values could be imputed using hot deck and similar techniques and for some topics the final tables show columns headed "not known".

11. Although the provisional results became available within a year of census date, a further blow to the 1971 census was the lateness in producing many of the final results - some appeared five years after census date. The 1971 forms were designed for the optical reading of pencil marks made by respondents (except for answers to questions needing clerical coding), but a serious printing failure led to the reading of spurious marks. It took more than a year to detect the failure and make arrangements for its correction.

12. The 1971 census saw the introduction of a geographical analysis in terms of grid squares measuring 500 metres by 500 metres.

Proposals for 1981

13. The proposals for the 1981 census were made against the background of the experience of 1971 and with the aim of reducing costs. After discussion in the Central

Commission on Statistics, the following important changes in the design of the census were proposed:

- a) The 1971 census had revealed very few persons not recorded in the population registers (only about 1 in 5,000 though about 1 in 500 had moved from the address recorded in the registers). It was therefore proposed to limit the 1981 enumeration to those people recorded in the registers and not to attempt to enumerate any illegal immigrant; name and address etc on the census form was to be pre-printed from the registers. Thus the 1981 census would no longer be a check on the completeness of the population registers.
- b) Basic demographic data would be taken from the population registers.
- c) A short form would go to each address to identify the number of housing units, number of households and number of residents in each household. (The population registers identify only addresses, families and persons, but not housing units or households.) A long form would go to a sample of 1 in 5 addresses, such a sample size being adequate to meet the main needs of users; its content would be broadly on the scale of the 1971 census form though the trend was towards a shorter form, with the question on disability omitted.
- d) Response to the census would be obligatory but there would be no penalties.

This scheme would cost less than a full census of the 1971 kind and would require fewer enumerators - who were difficult to recruit. Mail-out and mail-back had been tried in a pilot by the Belgians before 1981 but with disappointing results, and so the CBS decided to stick to traditional enumeration methods.

Cancellation of the 1981 census

14. Pilot tests of the census were carried out in 1979. Response, which was voluntary, was disappointing: some 25 per cent did not cooperate, rising to 40 to 50 per cent in the big cities. Another matter for concern was the continuing absence of general legislation on data protection, though a Commission had made proposals in 1977. Accordingly the Central Commission on Statistics recommended that the 1981 census should be cancelled, to which Parliament agreed. The following arrangements were substituted:

- a) The sample size of the Labour Force Survey, usually $2\frac{1}{2}$ to 3 per cent, was increased to 5 per cent in the spring 1981 survey. This provided reliable basic data on individual geographical areas with 30,000 or more inhabitants.
- b) A housing survey was carried out in the autumn of 1981 on the basis of a 1 per cent sample.
- c) The basic demographic data on age, sex, marital status and nationality were, of course, readily available from the population registers for each of the 774 municipalities (the smallest administrative areas) and, in the big cities, for smaller areas such as census tracts.
- d) Regular sources of statistics were drawn on to estimate regional trends in economic and social topics.

15. Strong complaints were made about the loss of small area data on the labour force and on housing.

A review of the need for regional and small area statistics

16. Following the cancellation of the 1981 census, an advisory committee set up by the Central Commission on Statistics has been considering the demand for regional statistics at all geographical levels (provinces, municipalities and small areas) in relation to possible sources of supply. Parallel to the committee's deliberations moves were under way to place a greater responsibility for the collection of data on the provincial and other local levels as a way of supplementing centralised collection. Under this philosophy the provincial and municipal collecting agencies would have the same degree of independence and would offer the same protection to data as the CBS currently does at the national level. The rôle of the CBS would be that of a bureau of standards in relation to such operations.

The rôle of registers

17. Population registers containing name, address and basic demographic data have been maintained by the municipalities since 1850 on the basis of information on births, deaths, marriages, changes of residence, etc. The data in the registers are of a high standard of accuracy, as checks against past censuses of population have demonstrated; this is because the population registers form an integral part of many sides of government administration and so there are many contacts between the registries and the public.

18. About 70 per cent of the population - about 10 million people out of a total population of $14\frac{1}{2}$ million - are recorded in registers that have been automated by the municipalities. Personal reference numbers have already been assigned to these people and numbers will be issued later to the rest of the population. The numbers have a standard format with a check digit. Their use is extending in the administrative files of municipal agencies.

19. At the present time there is no central register of population. So, in order that CBS can compile annual demographic statistics for each municipality, data on individual events (births, deaths, marriages, migration, etc) are at present sent by the municipal population registers to CBS on paper. In 1983 a proposal was made by the government to link the municipal registers to a central population register, which would have provided individual information to CBS and administrative agencies in automated form. But the municipalities did not favour this centralisation and the proposal was abandoned. A new plan now before Parliament provides for a system of automated and interlinked registers at a regional level. By virtue of the interlinking, this will give a similar service to CBS and to administrative agencies as the central population register would have done - subject to the administrative agencies obtaining the appropriate authorisation. Under the plan the records held in the municipal registers will be removed to the regional registers (of which there will be at least ten) and each municipality will have access to its own part of the regional register. A start on the new system is envisaged in 1988 with completion in 1993.

20. The municipalities also maintain registers of dwellings. They provide a source of information on the housing stock and its characteristics. Some municipalities may link the registers of dwellings with the population registers.

21. A geographical base file containing all addresses in the Netherlands has been created by the CBS, in conjunction with the Post Office and the National Institute for Physical Planning. The file shows, in respect of each address, the municipality, the census tract, the grid square and the postcode, but does not show the character of the address (for example, whether residential). This file provides a sampling frame for surveys as well as a tool for the geographical analysis of the data collected.

22. The locational information that is at present contained in the geographical base file refers to the address. But a single address may include more than one housing unit.

The possibility is foreseen of extending the geographical base file to show the individual housing unit in addition to the address on the basis of the information in the municipal registers of dwellings; but implementation would depend on the municipalities making wider use of computers for handling their registers.

23. General legislation on the protection of personal data held on computers was put before Parliament in July 1985.

The rôle of sample surveys

24. In the Netherlands, perhaps to a greater extent than in other countries, sample surveys are taking over some of the tasks that have hitherto fallen on traditional censuses. The EEC Labour Force Survey is playing a key rôle in this respect. The response to sample surveys addressed to persons and households is voluntary. Non-response to the Labour Force Survey is some 18 per cent.

25. The CBS is developing a plan to change the Labour Force Survey into a continuous survey addressed to 10,000 households each month. This would give an annual sample of $2\frac{1}{2}$ per cent, which is big enough to provide annual statistics for 40 regions. Aggregates over, say, three years could provide reliable statistics for somewhat smaller areas. A system of rotation would provide for each household in the sample to be interviewed four times at intervals of three months. Development is proceeding on a computer that could be hand-held by the interviewer at the first interview. The second and subsequent interviews would be by telephone where possible.

The future of the census of population

26. Following the setback in the execution of the 1971 census and the cancellation of the 1981 census, there are no plans to revive a conventional census of population and

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housing. Meanwhile further development of population and housing registers is being made or is foreseen in the future, including - as already noted in paragraphs 18 to 22 - the issue of personal reference numbers, the proposal for interlinking automated population registers held at regional level and the refinement of the information on location to distinguish individual housing units. These improvements, if accompanied by the wider use of personal reference numbers in the files of administrative agencies, would increase the technical possibilities of moving towards an integrated register system that, as in Scandinavia, might supersede the conventional census approach. However, the present political climate is not favourable to the development of projects that involve large-scale linkage of records.

27. Instead the CBS is developing a medium-term plan for providing a range of statistics as a substitute for the conventional census. The main components of the plan are:

- (i) Demographic statistics - population by sex, age, marital status, country of birth, nationality, etc as well as by area - will be obtained from the new system of automated population registers on a regular cycle. From the register data on the persons living at each address statistics of family composition would be prepared every four years; in cases in which the persons at an address did not constitute one family, the composition of the household (or households) at the address would be studied on a sample basis by means of a special survey.
- (ii) Information on housing will be taken from the municipal dwellings registers.
- (iii) The Labour Force Survey would be re-structured on the lines set out in paragraph 25 to provide regular information particularly on economic activity.
- (iv) A sample survey of housing needs would be made every four years, to coincide with the analyses of family and household composition referred to in (i). The

sampling fraction - 1 per cent - would yield separate statistics for some 40 regions (average population 350,000).

28. This "package" represents a development of the measures taken to provide alternative sources of statistics following the cancellation of the 1981 census. The main weakness is, of course, that the sampling fractions in the Labour Force Survey and in the other surveys are not big enough to yield reliable figures for the smaller geographical areas. To fill this gap the CBS and CCS recommend that surveys should be made by local institutions to meet local needs but following standards laid down nationally by the CBS.

THE CENSUS OF POPULATION IN PORTUGAL

Summary

1. The most recent census of population and housing in Portugal was taken on 16 March 1981 and followed censuses at 10-year intervals up to 1970. The census is on conventional lines. Sampling has not been used at the collection stage; and, though sampling had been used at the processing stage in the 1970 census, all processing for the 1981 census was carried out on the complete set of returns in order to give reliable areal detail. Public response to the 1981 census was favourable and was encouraged by the first major publicity campaign to be undertaken at a census of population.

2. There are two systems of population registration: centrally in connection with the issue of identity cards and locally for electors. Identity cards that carry a unique personal reference number are issued to everyone at age 10, and are updated to show the person's current address. The Ministry of Justice maintains a central register of data from the identity cards and most of these data are in computer form. The registers of electors cover Portuguese citizens aged 18 and over who have applied for voting rights in their place of residence; the registers are maintained at parish level and are at present in manual form. To prevent a person from being registered as an elector in two parishes, details of each electoral registration are sent back to the parish in which the person was born and copied into his birth record. An analogous procedure ensures that a person's name is removed from the electoral register when he dies.

3. Shortcomings of the systems of registration - at least from a statistical point of view - are that they do not cover the youngest age-groups and that events, in particular changes of address, tend to be reported only when the person concerned perceives the need to do so rather than when the event occurs. Some events, such as emigration, may go unreported and this can lead to inflation in the registers: the numbers in the electoral registers in 1981 were 3 per cent greater than the census counts of the relevant age-groups.

4. The two systems of population registration operate independently, though an up-to-date identity card is needed to support a person's application to be entered on the electoral register. Moreover the census of population is carried out independently of both registration systems even though the local administrations are responsible both for the census fieldwork and for the maintenance of the electoral registers.

5. The personal reference numbers that appear on identity cards are carried into other administrative systems including the electoral registers, and in principle they offer a mechanism for the linkage of files for statistical purposes. In the longer term therefore there is the possibility of moving in the direction of a register-based census through the development of the systems of population registration including extension to all age-groups. A step in that direction would be to associate a conventional census questionnaire, perhaps addressed only to a sample of households, with a population register. But projects of this kind would require a great deal of technical development, major administrative changes and greater incentives for the public to report events promptly. No study of these possibilities has been made.

6. The 1970 census encountered difficulties, both of a technical kind and in public relations. By contrast the 1981 census was seen as a success, and for 1991 a further conventional census is planned building on that success.

Organisation

7. The organisation of the decennial census of population and housing is in the hands of the Instituto Nacional de Estatística (INE) which is the department of central government responsible for most governmental statistical activities. Above INE there is a National Statistical Council which brings together the government departments with major statistical interests; it has a consultative rôle and reports to the Minister responsible for INE. Nowadays the National Statistical Council considers mainly technical issues; for the 1981 census the Council set up four working parties to consider

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the overall census programme, mapping, data processing and publicity. Wider policy issues are considered by a National Council for Planning on which other interests, such as employers' organisations and trade unions, are represented.

The census fieldwork: the rôle of the municipalities

8. The census fieldwork is organised on conventional lines: each enumerator is responsible for surveying the enumeration area assigned to him and listing the buildings and housing units (only buildings containing at least one housing unit are covered); for delivering the questionnaires; and, later, for collecting them. In the remoter rural areas, information is collected by interview because of illiteracy.

9. Mainland Portugal is divided into 18 distrito (regions), 273 concelho (municipalities), some 4,000 freguesia (parishes, the population of which ranges from 50 to 70,000, average 2,500) and 17,000 seccao de recenseamento (enumeration areas). There is a corresponding hierarchy of personnel responsible for carrying out the census fieldwork. Each municipality appoints a delegate to take charge of fieldwork in the municipal area. The delegates are trained by INE and their work is supervised in its technical aspects by 90 INE staff who operate at the higher (regional) level. The municipalities appoint coordinators to act at parish level and they, in turn, recruit and oversee the work of the enumerators, of whom there were 17,000 in 1981. Each enumerator in the more densely populated areas was responsible for an area containing some 250 to 300 housing units.

10. One of the aims of making the municipalities responsible for the data collection is to ensure an accurate enumeration: the municipalities have a direct interest in the outcome since the allocation of funds from central government depends inter alia on the census figures of population. However, the municipalities are not entitled to retain the individual data collected in the census; they do of course receive the statistical results from INE.

11. In preparation for the 1981 census a major task was to update the maps used for planning the enumeration areas. For this purpose an aerial survey of the whole country was made by the Portuguese Air Force.

12. The Portuguese census has not employed sampling at the collection stage (the long form/short form approach) and has not used the mail for delivery or collection. Nor is the adoption of such methods foreseen in the near future.

The census questionnaire: the population base

13. In the 1981 census four kinds of unit were identified and separate forms were completed in respect of each of them: the building, the housing unit, the família (household) and the individual person. The household is defined for census purposes as one or more members of a family related to each other living together and occupying the whole or part of a housing unit.

14. The persons to be returned in the census are those resident in the household, whether present or absent on census night, together with visitors (that is, those resident elsewhere but present in the household on census night). Hence the population count for an area can be compiled on the basis of the persons resident in the area or on the basis of the persons present in the area on census night. But the census asks only very limited information about visitors, so that all the main census analyses are expressed in terms of the resident population. In some cases the concept of residence gives difficulties: thus, workers who emigrate, whether for just part of the year or for longer, may be returned by their families at home as 'resident but absent'.

15. In the 1981 census the questionnaire for the building was filled in by the enumerator and contained questions on the number of housing units in the building, the non-residential use of the building (if any) and details of its construction. The

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questionnaire for the housing unit, in addition to questions answered by the enumerator, asked the occupant 13 questions on the characteristics of the accommodation and on the cost of mortgage or rent. The household questionnaire was completed by the enumerator; it listed the persons in the household and showed the relationships to the head of the household and also parental and marital relationships between members of the household.

16. The questionnaire for the individual member of the household asked 27 questions. These covered basic demographic topics and nationality, place of residence at 31 December 1973 and at 31 December 1979 (migration), education including ability to read and write, economic activity, travel to place of work or of study and, for women, marriage and childbearing. There was also a question on religion, which was optional and was answered by 80 per cent of the population, and questions on the individual's main source of income or support.

17. In all, therefore, there were 40 questions addressed to the occupants of the housing unit or the individual person - a relatively large number by European standards. This was about the same question content as in 1970, and no major change in content is envisaged for 1991. But the 1981 census forms were a complete redesign following unfortunate experience in 1970 when some members of the public had been confused by the layout of the census questionnaire which had attempted to identify the various units (housing unit, household and person) and family relationships; this confusion led, in turn, to delays in processing the 1970 results.

Census processing and dissemination

18. In the 1981 census sampling was not employed at the processing stage: INE took the view that sample analyses would not give sufficiently reliable information for small areas. This was a change from 1970 when only 20 per cent of the questionnaires

were processed in the first stage to give population characteristics and housing characteristics at higher geographical levels; but in a second stage all questionnaires were processed to give tabulations at local level. An auto-edit of the 'hot deck' kind was used for the first time in 1981 to correct inconsistencies in the responses, as well as omissions, in respect of most of the census variables.

Sample checks on census coverage and quality

19. About six months after the 1981 census, a sample survey was carried out by the field staff of INE to measure the coverage of the census and the quality of the information collected in it. A sample of 1 in 40 enumeration areas (that is, some 400 enumeration areas) were re-surveyed and, within the selected areas, interviews were conducted in a sub-sample of 1 in 10 housing units. Unfortunately, due to losses of data processing staff, the results of the survey are still not available. However INE believes that the coverage of the census was better than 99 per cent, though there was some under-coverage of isolated houses in the remoter rural areas.

The cost of the census

20. The 1981 census of population and housing cost 620 million escudos, including 80 million for mapping. The cost per person - 63 escudos - appears to be relatively low by comparison with other countries in the EEC.

The public's response to the census

21. The public response to the 1981 census was good, particularly when compared with the rather unhappy experiences of the previous census. In 1970 the level of emigration had been a political issue, and during the census enumeration the President had made a remark questioning the accuracy of the figures that the census would yield. Communications between INE and the media were not sufficiently developed to dispel

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the doubts that had been generated by the Presidential remark. It was as a result of the 1970 experience that INE decided to mount a major publicity campaign in 1981; this included, in addition to posters and advertising in the press and television, such items as a special issue of postage stamps and a lottery. The campaign is regarded as having made a major contribution to the success of the 1981 enumeration.

Registers of the population

22. There are two systems of population registration in Portugal - using this term in a wide sense. The first system is associated with the issue of identity cards; it is central and partially computerised. The second system registers electors and is linked to the birth registers; it is local and in manual form. Neither system covers the whole population: in particular the youngest age-groups are excluded from both the central population register and the local registers of electors. The two systems are maintained independently of one another. Moreover the census of population is independent of both systems: that is, on the one hand material from the registers is not used in carrying out the census and, on the other hand, the census data are not passed to the registers.

The central population register

23. The Centro de Identificação Civil e Criminal, which is a part of the Ministry of Justice, maintains a central population register in conjunction with the issue of identity cards. Identity cards must be obtained by everyone who has reached the fifth year of compulsory schooling, that is those age 10 or more, though there is an option to obtain a card at an earlier age. Hence the register has only partial coverage of those aged under 10. Each person is given a unique person reference number when he first receives an identity card; the number is entered on the card. The main items recorded in the central register are:

(a) items held in computer-readable form

- name
- personal reference number
- date of birth and place of birth (parish)
- names of parents
- marital status
- nationality
- height
- place of residence (parish)

(b) items held in manual form (to be converted to computer-readable form)

- name of spouse or former spouse
- occupation
- full postal address

Photographs, signatures and fingerprints are also held.

24. The records are updated from information on marriages and deaths supplied by local registrars; and from information given by individuals when they request amendments to cards (for example on change of address) or renew their cards. There is a tendency - perhaps less marked now than in the past - for a person to have his identity card updated only when a specific need to do so arises; for example he would need an up-to-date address on his card if he wished to get married, to register as an elector or to obtain a driving licence or passport. But in addition identity cards have to be renewed every five years and at renewal the person has to complete a form giving details of his current situation. (The interval between renewals is ten years for persons aged 40 and over, and a card issued to a person aged 50 and over remains permanently valid.)

25. The personal reference numbers used on identity cards are carried into other administrative systems, for example into the electoral registers and tax files, though

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these other systems often have their own personal numbering schemes in addition. In principle, therefore, linkages could be made between files using the personal reference numbers.

The registers of electors linked to the registers of births

26. In each freguesia (parish) two registers are maintained clerically: the first records all persons born in the parish; the second is an electoral register that lists Portuguese citizens of 18 years and over resident in the parish. Registration of electors is compulsory in law; in practice the right to vote provides a strong incentive to register and the exercise of other local rights may depend on registration. Each May those reaching the age of 18 and those who have moved from another parish must register by giving name, address, names of parents, date of birth, parish of birth and the personal reference number that is entered on the identity card. The electoral registrar sends particulars of each person who has newly registered to the person's parish of birth; there the details of the electoral registration are appended to the person's name in the birth register. Thus, the birth register of a parish carries in respect of each person born there a longitudinal record of electoral registration (or, as seen by the statistician, a longitudinal record of migration). This procedure ensures that a person cannot appear on the electoral register in two parishes. When a person dies, the civil registrar notifies the person's parish of birth, so that the fact of death can be recorded in the birth register; and in turn, the notification of death is passed on to the parish in which the person is registered as an elector.

27. The joint use of the two local registers - of births and of electors - eliminates most kinds of 'dead wood' from the electoral register (namely, the names of persons who have moved to another parish or who are deceased). However, because names are not deleted from the electoral register without a positive reason to do so, some dead wood remains: for example, emigrants who have chosen not to register as overseas

voters. Moreover there is often a timelag between a person moving from one parish to another and the transfer of his registration. There is also likely to be some under-coverage at least among the age-groups at and near 18. In fact the numbers in the electoral register in 1981 exceeded the census count of the relevant age-groups by about 3 per cent. There is no central register of electors. The local electoral registers are maintained independently of the central register held by the Ministry of Justice, though a person seeking to register as an elector must support his application by showing an up-to-date identity card.

28. Following the transfer to computer of the centrally-held records of electors born abroad (expected to be completed in 1987), a start will be made on computerising the parish records of electors and of persons born in the parish. Priority will be given to parishes with the greatest numbers of records.

Intercensal population estimates

29. The intercensal population estimates for municipalities are made by updating the most recent census count by reference to figures of births, deaths and migration in the period since the census. The figures for migration are projections of the migration statistics taken from the census. The population registers are not at present used as a source of migration statistics.

Sample surveys

30. A regular Labour Force Survey was first taken in Portugal in 1972, but the methodology was revised in 1983 under a contract with Eurostat. Interviews are addressed to the households in 18,000 housing units each quarter. Response to the survey is obligatory, and a response rate of 97 per cent is achieved. The design involves a system of 'rotation', under which a household selected in the sample is interviewed four times at six-monthly intervals.

The future of the census of population

31. The conventional census of population in Portugal has not so far encountered any major problems. But in the longer term an alternative approach to the census may be based on population registers. Though the two register systems - the (mainly-computerised) central register of the Ministry of Justice and the local registers of electors - operate independently, the possibility exists of interrelating them in the future through the personal reference numbers. However, the quality of the information in the registers is deficient because, as happens in other Latin countries, the public do not always report events such as changes of address as promptly as the rules require. If the quality could be improved through tighter administration, through publicity and through incentives to report events promptly, then the registers might be used for statistical purposes to support the census of population. One possibility would be to associate a conventional census questionnaire - perhaps addressed only to a sample of households - with the population register. At a later stage the central register of population might be linked to other administrative files as a substitute, in part or in whole, for a conventional census.

32. The statisticians in INE recognise these possibilities. They also recognise the great effort - both technical and administrative, involving many interests - that would be needed to change the system and the degree of public cooperation that would be a prerequisite. They also have to weigh the risk that the public would react against a more sophisticated system of registers and linkage. No study of a register-based system has yet been made.

33. For 1991 at least another census on conventional lines is being planned. Success in 1991, is seen to depend on early planning and on attention to the following needs:

- (a) To prepare accurate maps of the enumeration areas and to establish enumera-

tors' workloads in good time. (This work will also serve as a basis for area sampling for social surveys.)

- (b) To improve cooperation with the municipalities on the fieldwork.
- (c) To improve the timetable for processing and dissemination of the results, which will, of course, depend on the availability of adequate data processing resources.
- (d) To improve quality control procedures.

34. Public cooperation on the census seems reasonably assured, though the atmosphere could be unsettled by unforeseen events, such as discussion on the draft bill on data protection now before Parliament.

THE CENSUS OF POPULATION IN SPAIN

Report prepared in August 1985

Summary

1. A census of population and housing is taken in Spain every ten years. In most respects the census is on conventional lines. Whilst there has been no sampling at the collection stage, sampling is introduced at the analysis stage to save time and costs. Only the counts of population, by sex, are made in full; all other processing is done on a sample of households.
2. The distinctive feature of the census enumeration is that it shares the same field operation as the canvass for the local population registers, for which the head of the household has to complete a separate form. The canvass for the population registers occurs every five years and provides, in effect, a census of population asking only basic demographic questions in the middle of the 10-year period between the main censuses.
3. Up to the present there has been inflation of numbers, both in the census and in the population registers, due inter alia to the duplication of persons with second residences and the inclusion of people who have emigrated. The inflation in the registers increases as the period since the last canvass lengthens - due mainly to the failure to delete the names of people who have left the municipality - and is reduced again at the next canvass: following the 1981 canvass the numbers registered dropped by about 3 per cent. The errors reflect both the design of the system and the attitudes of the public and of the municipalities that maintain the registers: without adequate incentives the public may register events late or perhaps not at all.
4. The effectiveness of the system is being improved through the widespread computerisation of the local population registers and the creation of central registers.

Since 1981 a computerised central register has been maintained by the central statistical office in respect of those persons recorded in the local population registers who are aged 16 or more and who have (or will have) the right to vote. Some 250,000 duplicate registrations have already been identified in the central register of electors and action has been taken to eliminate them. A second computerised central register is to be created by the Ministry of the Interior to record details of identity cards: cards are issued to everyone at age 16 and bear personal reference numbers that are also used in other administrative records. It is planned to introduce the reference numbers into the central register of electors, thus establishing a link between the two computerised central registers of the adult population.

5. Efforts are being made to secure greater cooperation from both the public and the municipalities in keeping records accurate and up-to-date. However the quinquennial canvass is seen as a necessary check on the contents of the population registers, at least in the medium term.

6. Because the census enumeration and the canvass for the population registers are a combined field operation, the improvements in the quality of the population registers, including the elimination of duplicate entries, will lead directly to improvements in the quality of the census. For the next census in 1991 the possibility will be examined of basing the census counts on the canvass for the population registers and of distributing a census form asking for the more detailed information on population characteristics and housing to only a sample of households. In the longer term there is the possibility of extending the central registration to all ages and of using the personal reference numbers as a mechanism for linking records for statistical purposes. The way in which the public has, up to the present, accepted the census and population registration gives ground for optimism.

Organisation

7. Responsibility for the census of population in Spain rests with the Instituto Nacional de Estadística (INE), the department within which the main statistical functions of the central government are centralised. INE receives advice from outside interests through the Consejo Superior de Estadística on which are represented government departments, the Comunidades autonomas (regional governments), employers' organisations, the main trade unions, research interests and universities. The Council will give advice on the plans for the next census of population in 1991.

The integration of the census with population registration

8. A census of population has been taken decennially in the last hundred years, most recently on the night of 28 February/1 March 1981. The census is now integrally linked with the maintenance by the municipalities of registers of the resident population. Thus, at the time of the census each householder receives two forms to complete: the first is the census form which in due course goes to INE for statistical processing; the second and shorter form, which is headed "Municipal register of residents", asks for the basic information needed for compiling the register and this form is retained by the municipality. The questions on the population register form are similar to, but not in every case identical with, selected questions on the census form; the population register form is extended in some regions to ask additional questions, for example on languages.

9. A population register form was also completed by householders in 1975 - that is, in between the decennial censuses of 1970 and 1981 - and householders will receive a similar form in 1986. Some of the data from these mid-decade population register forms have been transcribed to sheets for statistical processing by INE (- the sheets will be optically read in 1986). In effect, therefore, there is a quinquennial census with the mid-decade censuses having a restricted question content.

The census fieldwork

10. In 1960 and 1970 the census of population was combined with censuses of buildings and housing; the building census is needed for planning and it covers both residential and non-residential buildings. In 1981, in order to simplify the census operation, the census of buildings was separated off from the census of population and housing: the building census was carried out in October 1980 simultaneously with a census of places of work and commerce. The list of housing units that was generated by this building census became the starting point for the March 1981 enumeration of the census of population and housing.

11. In the March 1981 enumeration each agente censal (enumerator) surveyed the sección (enumeration area) assigned to him and updated the list of housing units to take account of changes that had occurred in the six-months period since the census of buildings. He delivered the census forms accompanied by the population register forms, and collected them when they had been completed. In all there were some 33,000 secciones each with a population in the range 500 to 2,500.

12. Sampling at the collection stage (as in the long form/short form method) has never been used. Nor has the mail been used for delivery or collection; tests of mailing carried out before 1981 showed an unsatisfactory level of response.

The rôle of the municipalities in census-taking

13. Each municipality - of which there are more than 8,000 in all - appoints one of its officials to be responsible for the census fieldwork and the related work on the population register forms. He appoints and trains the enumerators, whose work is full-time over a period of about two months. The municipal official's work is overseen by inspectors of the INE.

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The census questionnaire: the population base

14. For the purposes of the census and population registration, the familia (household) is defined as one or more persons sharing common housekeeping and occupying the whole or part of a housing unit. The persons to be returned on the forms are residents, whether present (P) or absent (A) on census night, plus transients (T) (that is, visitors present on census night but not resident); a filter question distinguishes between these three categories. Thus population figures for an area can be given on the basis of residents (P + A) or on the basis of persons present on census night (P + T). Most analyses are on the resident basis.

15. The household form for the 1981 census contained 18 questions in respect of each person in the household, covering basic demographic topics, nationality, place of residence at the end of 1970 (migration), education (including ability to read and write), economic activity, journey to work or to study and, for married women, marital and childbearing history. The form also contained six groups of questions on the building and the accommodation occupied. The policy is to restrain growth in the question content in order to lessen the burden on the public. No questions on income have been asked in Spain.

Census processing and dissemination

16. The first stage of processing is a manual count of the population in each area on the two definitions (i) resident and (ii) present on census night, with an analysis only by sex. This is completed within six months of the census date. To save time and cost, all later stages of processing are restricted to a sample of households - a systematic sample within each sección. For the 1981 census a 2 per cent sample of households provided early results on all characteristics, and later the percentage was increased to a figure of 20, 25 or 30 per cent depending on the population of the

municipality. The sample figures are grossed up to the manually-derived population counts of men and women in each municipality.

Sample check on census coverage and quality

17. Following the 1981 census a sample of 500 secciones were re-surveyed to establish the under- or over-count of housing units; and interviews were conducted in a sub-sample of 10 housing units in each of the selected secciones to establish the under- or over-count of persons and the quality of the other information collected in the census. This work was undertaken by field staff that were more highly trained than the original enumerators. The results show a net overcount of housing units of 0.5 per cent and, though the full analysis is not yet available, a net overcount of persons of something under 2 per cent (compared with a figure of 2.3 per cent from a similar survey in 1970). Some of the reasons for this net overcount are given below (paragraph 22).

The cost of the census

18. Field costs in 1981 were about 1,500 million pesetas, that is about 40 pesetas per person - a relatively low figure by international standards.

The public's response to the census

19. There has been no adverse public reaction to the census though difficulties of other kinds have been experienced, for example complaints from enumerators about pay. Publicity plays an important part in securing a good response to the census.

Municipal registers of the resident population

20. Registers of the resident population have been maintained by all municipalities under a law of 1952. The principal elements in the register are name, address,

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relationship to the head of the household, sex, date of birth and municipality of birth, nationality, marital status, level of education and occupation or other activity. A main source of information for updating the registers is the quinquennial canvasses; in the case of the data on level of education and occupation the canvasses are the only source for updating. Between these canvasses the registers are updated from information on births, marriages, deaths and migration. Thus in the case of births, marriages and deaths, information should reach the register both directly from the family and indirectly from the local registrar on a form that goes first to INE and is copied by INE to the municipal population register. In the case of a person changing his residence, he should obtain a form from the municipality of origin to hand to the municipality of destination in order to ensure that changes are made to both registers. But mechanisms like these work only imperfectly due to failures on the part of both the public and the municipalities. In the absence of adequate incentives, events may be registered late or, indeed, not at all.

21. A person has a strong incentive to register when he moves to a new municipality because his eligibility to vote there in local and national elections depends on it. Other incentives exist but may be variable in their impact - for example the granting of local parking rights in some places. The municipality too has an incentive to maintain an accurate and up-to-date register because it needs reliable information for planning. Moreover the funds that the municipality receives from the central government depend on the figure for its total population, but this funding formula could encourage a municipality to condone inflation in the register.

22. There are several sources of inflation in the registers. One is the failure to delete the name of a person who has removed to another municipality. Another is the widespread existence of second residences, and in this case the duplication may persist when the municipalities conduct a new canvass for the population register/census. A third source is emigrants who may fail to notify their departure from Spain; and in the

canvasses for the population register/census some of these emigrants may be reported by their families at home in the category 'resident but absent'. One partial measure of the inflation is the drop in the numbers registered following the updating from the quinquennial canvass: the drop was about 3 per cent in 1981.

23. Increasingly the larger municipalities maintain their population registers by computer: 66 per cent of the population are now included in computerised registers. In 1986 the information collected in the canvass for the population register may be passed by some municipalities to INE on magnetic tape.

The central register of electors

24. Since 1981 INE has maintained a computerised central register of persons eligible to vote (aged 18 and over) and those 16- and 17-year olds who will shortly become eligible to vote. The register records name, address, sex, date of birth and municipality of birth and the level of education. It is updated from information on deaths supplied by local registrars and from information supplied annually from the municipal population registers. Duplicate registrations can be identified by computer program - an action that is facilitated by the fact that Spanish personal names rarely change (for example, women's names do not change on marriage). So far some 250,000 duplicate entries have been picked out (about 1 per cent of all records) and action is being taken to eliminate them; thus, people who are registered in two municipalities are being contacted to establish which municipality they should be registered in.

Identity cards: personal reference numbers

25. At age 16 each person must obtain an identity card from the Ministry of the Interior, though there is an option to obtain a card at the earlier age of 14. The identity card records name, address, sex, date of birth and municipality of birth, names of parents, marital status and occupation. A personal reference number is also entered

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on the card, but unfortunately some reference numbers have been issued to more than one person. The cards have a five-year validity and must then be renewed. In between the five-yearly renewals a person may notify the Ministry of the Interior of changes so that his card can be updated - for example a change of address; but there is no obligation on him to do so and any action he may take is separate from the action he must take to notify the municipality for purposes of population registration.

26. The personal reference number that appears on the identity card is entered on some other personal documents such as driving licences, passports and bank accounts. It is also entered in the population registers of some of the larger municipalities. But other numbering systems are in use - for example in social security records. Some prospective developments in registers and personal reference numbers are mentioned below (paragraph 30).

Intercensal population estimates

27. Because of the inflation in the local population registers and of the way that the inflation varies through time in a quinquennial 'sawtooth' fashion, intercensal population estimates are not based on data from the registers. Instead, the intercensal estimates, made only for the 50 provinces and at higher levels, are projections from the most recent quinquennial count on the basis of hypotheses concerning births, deaths and migration.

Sample surveys

28. A continuous labour force survey, the Survey of the Active Population (EPA), is addressed to some 60,000 housing units each quarter. Response is compulsory under the same law as the census of population and a response rate of about 98½ per cent is achieved. In the first stage of the two-stage sample design a stratified sample of about 3,000 census seccions (out of 33,000) are chosen. The interviewers update the list of

housing units in the selected secciones and draw a second-stage sample of housing units for interview. A system of rotation provides that a sample household is interviewed six times at quarterly intervals, so that a sixth of each quarter's sample of households are being interviewed for the first time.

29. Anonymised individual data (microdata) are made available from sample surveys, but not from the census of population except to the comunidades autonomas.

The future of registers and the census

30. A number of steps are being taken to improve the effectiveness of the systems of population registration and personal numbering. First, duplicate registrations, as identified in the central register of electors, will continue to be eliminated from the population registers. Second, the Ministry of the Interior intends to set up a computerised central register of the data in the identity card system, starting later this year. At the same time a check digit will be added to the personal reference numbers that appear on identity cards, and duplicated numbers will be eliminated over a five-year period. Thus, a second computerised central register of the adult population will be created alongside the existing system of population registration that comprises the municipal population registers and the central register of electors. Furthermore, the personal reference numbers will be introduced into the central register of electors, so establishing a link between the two central registers of the adult population.

31. These specific improvements will be accompanied by campaigns to secure more help from the public in updating the registers and greater efficiency on the part of the municipalities in maintaining the registers. However improvements will take time to be realised and INE believes that a regular quinquennial canvass to update the population register will continue to be needed at least in the medium term. For the 1986 canvass the possibility is being considered of asking the public to examine, and as necessary

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correct, individual forms on which the personal information from the municipal population register has been preprinted.

32. Because of the way that the enumeration for the census of population is integrated with the canvass for the population registers, all the measures to improve the quality of population registration, including action to eliminate duplication, will directly improve the quality of the census. For the next census in 1991 the possibility is foreseen of combining the canvass for the population register with the distribution of a census form that is addressed to only a sample of households. In principle this would be a long form/short form census.

33. Other issues concerning the future of the census are the need to establish better cooperation with the municipalities and good working relationships with the newly-created comunidades autonomas, the regional governments such as that in Cataluna. The latter administrations will want to play an increasing rôle in some aspects of the census such as question content; some of them have already set up their own statistical organisations.

34. The developments in registers and personal numbering that have already been put in hand open up longer-term possibilities for statistics, particularly if central registration were extended to the under-16 age-group. Some statistics at present collected from the public through the decennial census might instead be derived by linking administrative files with the population register, using the personal reference numbers as the linkage mechanism. Appropriate safeguards would be needed: whilst the 1945 law on statistics protects the confidentiality of the information collected in the census, there is as yet no general legislation on data protection in Spain.

THE CENSUS OF POPULATION IN SWEDEN

Summary

1. The household questionnaire for the 1970 census of population and housing was the longest ever used in Sweden. But the 1975 and 1980 censuses adopted successively shorter personal forms, which were mailed out to individuals and to married couples on the basis of information in the population registers and were then mailed back. The shortening of the forms was achieved by dropping some topics from the census and by extracting an increasing range of data from registers; the register data were linked to the census responses using the personal reference numbers as the linking mechanism.

2. Following the 1980 census, proposals were made for dispensing with a census questionnaire of the conventional kind and instead relying entirely on data from registers. It was proposed to create registers of households and of buildings that contain housing units to supplement the long-established register of population. The results of an interview survey had suggested that the register approach to censuses would be endorsed by public opinion. On the other hand a debate on the proposals in the media had showed widespread concern on privacy issues.

3. Mainly because of doubts about the quality of the data that could be obtained from registers on some topics, it was decided that the 1985 census should retain a conventional questionnaire addressed to individuals and to married couples. This asked questions only on occupation, household composition and housing: it therefore covered even fewer topics concerning the individual than the 1980 census had done, but it reintroduced questions on housing that, in the 1980 census, had been taken from administrative returns. Data on other topics needed in the 1985 census were to be extracted from registers: demographic topics, employment (apart from occupation) and income. A Parliamentary Commission is reviewing the 1985 census operation on issues concerning privacy and confidentiality.

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4. Sweden has therefore made substantial progress towards a register-based census, but the proposals to take the final step in this direction in the 1985 census were shelved. Further progress in the 1990 census or later depends on a solution to the unresolved problems of quality and timeliness of the register data, as well as on public acceptability of the principle of a full register-based census.

Organisation

5. Most governmental statistics are centralised in Statistics Sweden, but some statistics are produced outside, for example statistics used by public authorities in their daily administrative work. Statistical policy, the program of work of Statistics Sweden and its requests for funding are formulated by a Governing Council chaired by the Director General of Statistics Sweden; the Council includes representatives of government departments, political parties, employers' organisations, trade unions, local authorities and research interests. Final decisions on all these matters are taken by Ministers and, ultimately, Parliament. Statistics Sweden consults widely with users of statistics through committees and expert groups on which are represented relevant sections of Swedish society.

Objectives of the census: frequency

6. The census of population and housing serves two main objectives: to produce statistics for national and municipal planning, research and general information; and to provide a check on the data in the population registers. From 1960 censuses of population and housing have been taken every fifth year.

The census fieldwork: the rôle of the municipalities

7. The 284 municipalities play an important rôle in the census operations. They assist in the distribution of the questionnaires and in the collection of the completed

questionnaires. They are responsible for scrutinising the returns and they use them to check, and if necessary correct, the population registers.

The population base

8. The persons to be returned in the census at a given address are the persons permanently resident there, following the same rules of residence as the registers of population. There is no formal definition of the household: the household consists of the persons who return themselves on the census form as members of one household, that is, it depends on the perception of the respondents. Thus there is no necessary congruence between the accommodation occupied by one household and the housing unit. (The latter is defined as a dwelling with its own kitchen or kitchenette or any other dwelling with its own entrance from an entrance hall, staircase or similar.)

9. Because of the close relationship between the census and population registration, the next paragraph describes briefly the Swedish system of population registration, or civic registration. There follows an account of the development of the census from 1970 onwards together with parallel developments in registers and in legislation on data protection.

The Swedish register of population

10. Registration of the population in the parishes started in the 17th century and the function of local registrar is still carried out by clergymen of the established church. A unique personal reference number was introduced in 1947, that is, long before the introduction of computers. The main items in the register for each person are name, personal reference number (part of which is the explicit date of birth), place of birth, citizenship, marital status and address. A person who changes his address must register the change. Automated registers are maintained by the county administrations and a

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central register based on the county registers is maintained by Statistics Sweden for statistical purposes. The population register and the personal reference numbers used for linking are the foundations on which Statistics Sweden has been able to take the steps towards a register-based census described in the following paragraphs.

The 1970 census

11. In 1970 there were two main questionnaires. The first, completed by owners of real estate, asked for details of buildings and of housing units within the buildings. The second form (the household form), completed by the occupier of each housing unit, contained 14 questions on the housing accommodation and a set of questions on rental payments; and, in respect of each occupant of the housing unit, questions were asked on the following topics:

demographic details including personal reference number	(4 columns of the form)
ownership of a car	(1 column of the form)
economic (or other) activity and commuting	(11 columns of the form)
educational achievements	(23 columns of the form)

The 1970 household form was the longest in the history of the Swedish census, principally as a result of the inclusion of the detailed questions on education.

12. But, in addition, other information was extracted from registers and linked to the census records using the personal reference number, namely:

data from the population register, for example on country of birth and citizenship

data on income from the registers of the tax authorities.

13. Up to the end of the 1960s there had been little public discussion on the issues of privacy and confidentiality - for example in connection with the introduction and subsequent use of personal reference numbers. However the 1970 census was taken at a moment when these issues became a subject of intense public debate. Among the complaints made by the public at the time of the census were: worries that the person who completed the household form would know the details of other members of the household; and the reluctance of some of those with low educational qualifications to admit that fact on the census form. Despite some public disquiet the census operation was successfully completed.

The Data Act 1973

14. The public debate at the time of the 1970 census was one reason why a government committee was set up to study the problems of data protection, and the committee's report led to the enactment of the Data Act 1973. The Act's purpose is to protect the individual from any "undue infringement of personal integrity" which may result from the use of computers to handle personal data. A government agency, the National Data Inspection Board, was set up in 1974 to oversee the implementation of the Act. A recent evaluation of the Act's working has suggested that it has had the desired effect of preventing encroachment on personal integrity and that those affected by the workings of the Act accept the additional burden that it places on them.

The 1975 census

15. Some radical changes were introduced into the 1975 census. Mail-out and mail-back were used for the first time. And, instead of a single form (the household form) for all the residents in the housing unit as in 1970, personal forms were mailed to each individual aged 16 or over (strictly, those born in 1959 or earlier) or to each married couple, using the population register as the mailing list. Names and personal reference

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numbers - including the names and reference numbers of any children - were preprinted on the forms. The personal form asked for a list of "everybody permanently living in your home", so that the responsibility of defining the household was placed on respondents. The personal form also contained questions on housing similar to the questions asked in 1970 (but omitting the questions on rent); the housing particulars were to be returned on only one form per home.

16. By dropping the extensive set of questions on educational achievements that had been asked in 1970, the information asked in 1975 in respect of each individual was much reduced. Moreover, the information extracted from the population register was extended in 1975 to include data on marital status; and data on the ownership of cars were extracted from the register of car ownership. Questions on these two topics could therefore be dropped from the personal form used in 1975. Data on income were again taken from income registers.

17. Innovations were also made on the processing side of the census. Optical character recognition (OCR) was used to read some parts of the census form containing printed characters and the crosses that respondents had marked within preprinted boxes (- manuscript responses were not read by OCR equipment). For the coding and editing of the responses on employment, including details of industry and occupation, some 150 terminals were used: each comprised a visual display unit (VDU) and a keyboard, and was linked to a computer holding registers of, for example, enterprises and occupations. The operator at the terminal keyed in the responses on the census form, and coding and editing took place on-line in a conversational mode. This system is similar in principle to the COLIBRI system introduced into the French census of 1975 (see Annex 4 on the French census).

The 1980 census

18. In the late 1970s ideas were developed for a 1980 census that would be based

entirely on information extracted from registers, but these ideas were taken up only in part. In 1980, as in 1975, a personal form was mailed to each individual aged 16 or over or to each married couple; names and personal reference numbers were again preprinted. The form asked only for a list of adults permanently living in the home and for details of the economic (or other) activity of the individual or married couple to whom the form referred. The personal form was therefore much shorter in 1980 than in 1975. Indeed, there was public surprise at the brevity of the form, and the census operation was carried out smoothly and with little adverse public reaction. In both the 1975 and 1980 censuses some 97 per cent of the personal forms were mailed in without the need to send reminders. Statistics Sweden attributes this success to careful planning and to the publicity campaigns.

19. In the 1980 census, data from the population register were again linked to the data returned by the public on the personal forms. But data on income and car ownership were omitted from the census, though the potentiality of extracting them from registers existed.

20. The important data on housing that in 1975 had been returned by the public on the personal forms were collected in 1980 by extending the details asked for in the returns made by the owners of real estate in connection with the general assessment of tax that took place in the same year. From these returns the National Tax Board compiled a computerised register of buildings, each of which was given a reference number. This reference number - together with the reference number and the census characteristics of the housing unit if the building contained more than one housing unit - was transferred clerically to the personal forms returned in the census. The linkage between the real estate (housing) data and the personal data was complicated by two factors. First, the addresses extracted from the population register and preprinted on the personal forms generally referred to the unit of real estate rather than to the

building or to the housing unit. Second, the definitions of the housing unit appropriate to a census do not always correspond to the definitions applied in the context of assessment to tax. The difficulty of effecting the linkage was, in fact, a main cause in slowing up the processing of the 1980 census.

21. The data returned in the 1980 census were protected by the revised Secrecy Act, 1980, as well as by the Data Act of 1973. Under the Secrecy Act the data are classified as secret for 70 years from the date of the census. The Act placed very strict limits on the release of data for individual persons. But anonymised individual data may be released for particular research purposes if tabulations would not meet the needs and if, after examination of the risks, Statistics Sweden is satisfied "that the information can be disclosed without the person whom the information concerns or any person closely related to him suffering loss or being otherwise harmed" (to quote the words of the Secrecy Act).

22. The cost of the 1980 census, to the government and municipalities together, is put at 140 million kronor or 17 kronor per person.

The 1983 study of future censuses

23. The 1980 census had been finally agreed by Parliament on the understanding that it would be the last census in which the public would have to complete the conventional census questionnaire, and that a new study would be made of how this aim could be achieved. The objectives of the study were therefore to devise a census methodology which would: maximise the use of information already held by the government, minimise the burden on the public, cut the cost of the census, reduce the time taken to process the census data and have due regard to privacy. The conclusions of the study were published in 1983 and it is referred to below as the 1983 study.

24. The first stage of the study was to identify users' needs for information from the census. Consultation with users confirmed the needs that were identified when planning the 1975 and 1980 censuses. The value of income as a census variable was re-established (following its omission from the list of variables included in the 1980 census).

25. The study looked again at the possibilities of replacing 100 per cent counts by samples but found no new evidence to contradict the conclusion reached in previous studies: that it is not feasible to use sample figures for small areas or small domains. However Statistics Sweden is interested in the possible use of techniques by which available counts in respect of a small area can be combined with sample data referring to a much wider area in order to make estimates in respect of the small area that are more up-to-date or in more detail than the available counts. Statistics Sweden is making experiments along lines that have been suggested by N J Purcell and others.

The data available from registers

26. The study of a future register-based census identified the existing registers that could form the base for a new system and also a number of topics for which new registers or new mechanisms would be required.

Register data on employment

27. The 1983 study established the need for annual statistics of employment in small areas. The source for this could be the annual returns made by employers to the tax authorities and to the employees that record the wages and salaries paid to each employee. The existing returns gave each employee's personal reference number but would need to be supplemented by details of place of work (in the case of employers with more than one workplace) and hours of work - an addition that would be regarded as burdensome by both the employers and the tax authorities. A register extended in

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this way would yield data on the industry at the employee's place of work (by linkage with the place of work in the central register of enterprises) and on the employee's journey to work. The information from this source about employment in year N should be available by the middle of year N + 1.

28. Statistics of occupation at five-year intervals were seen as adequate. It was proposed to take information on occupation from the forms on which employed persons report changes in their incomes to the national insurance offices, but it was recognised that this source would be less reliable than the information obtained from census questionnaires.

Register data on household composition and housing

29. The 1983 study proposed that two registers should be created and maintained for statistical purposes: a register of household composition, as defined by respondents, with a reference number for each household and a register of buildings that contain housing units. Both registers would start from a survey in 1985 - in effect a 1985 census of households and housing. The entry in the population register for each person would be extended to record the reference number of the household unit and the size of the housing unit (number of rooms).

30. It was proposed to update the register of households by extending the information that a person moving house provides: he would give information on the person(s) with whom he is going to live and on the size of the new housing unit. The register of buildings would be updated by the municipalities mainly from information on new housing developments. Regular monitoring of the quality of the data in these two new registers would be needed.

31. It was proposed to establish a committee to study further two possibilities for improving the quality of population registration: first, the use of the housing unit, rather than just the property, as a part of the address in the civic registration records, and, second, the construction of a register of buildings/housing units.

Register data on educational achievements

32. The 1983 study proposed that a register of educational achievements be created from the 1970 census returns and be updated from data on subsequent graduations at the secondary and tertiary levels.

33. The study recognised that some variables could not be included in a register-based census. Examples are method of travel to work, included in the 1970 and 1975 censuses but dropped from the 1980 census, and cohabitation as defined by the persons involved (- though statistics of households would give a fairly good estimate of the numbers cohabiting).

34. It was proposed that the register material would be analysed annually within particular fields (apart from occupation) and would be assembled together for the purposes of a census every five years. In Statistics Sweden's view, the success of a register-based census would depend on the ability to ensure that the data were timely and of high quality.

A survey of public attitudes

35. A field-test of register methods in 1981-82 was accompanied by a survey of public attitudes towards a register-based census. The first step in the field-test was to assemble together the data available from registers in respect of about 60,000 employed persons living in three municipalities; the data included, for example, details of employment extracted from employers' returns to tax authorities supplemented by

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details of place of work and hours of work, and details of occupation extracted from the employed persons' returns to national insurance offices. Each person in a sample of 1,000 was presented with the data that referred to him (or her). He was then invited to check their accuracy and was asked a series of questions about his attitudes towards a register-based census. About 50 per cent of respondents said that they preferred the register approach, against 25 per cent who preferred the conventional census questionnaire. The remaining respondents stated arguments for both methods or had no preference. When asked which approach was preferred in relation to a particular topic (such as employment), as many as 80 per cent favoured the register approach. The response rate to the interview survey was about 75 per cent. Statistics Sweden interprets the survey's findings as an endorsement by the public of the register approach to censuses.

36. About 1,000 employers participated in the field-test. In a separate survey addressed to a sample of about 100 of these employers, over 90 per cent considered that it was very easy or easy to report details of place of work and of hours worked; in general it was easier to report place of work than hours worked.

The debate on the conclusions of the 1983 study: the decision on the 1985 census

37. A consultation document setting out proposals for a register-based census was circulated in 1983. The proposals were generally supported by users of the statistics who welcomed the prospect of improved annual information. But they were opposed by employers who would have to provide additional information about their employees and by the tax authorities who would have to record this information in their registers. The proposals were vigorously debated in the media, particularly so far as they raised issues of privacy and confidentiality; the wider use of registers was generally considered as an activity "going over the heads of the citizens" and as a symbol of a move towards a fully registered society (Orwell's "1984").

38. The government finally decided, and obtained Parliamentary approval, to retain a conventional questionnaire in the November 1985 census and, as in the censuses of 1970, 1975 and 1980, to link certain data from registers using the personal reference number as a linking mechanism. The decision not to rely wholly on register data stemmed mainly from concern about the likely quality of register information on occupation, household composition and housing. Thus the use in 1980 of housing data extracted from returns made by property owners for tax purposes had caused problems (see paragraph 20) and there was no new general assessment of real estate in 1985.

The 1985 census

39. The 1985 census questionnaire, distributed to individuals born in 1969 and earlier and to married couples, asked for information only on:

- (1) Whether economically active in a specified week and, if so, the occupation.
- (2) Household composition - a list of adults (born in 1969 and earlier) living permanently in the dwelling.
- (3) Details of the housing unit - tenure, number of rooms and facilities.
- (4) Housing - additional questions on the type of house, period of construction, heating etc (to be returned only if the respondent was the owner).

The questions at (2) and (3) were to be answered on only one questionnaire in each household.

40. The questions on housing represented an addition to the census form in 1985 as compared with 1980. But, in terms of questions about the individual person, the 1985 form was even shorter than that of 1980. A range of questions on a person's economic activity that had been asked in 1980 was dropped in 1985: namely, on the kind of

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activity (paid work, self-employed, pensioner, housewife, student, etc), hours of work, name of the enterprise at which employed, the industry of the enterprise and the address of the usual place of work. The omission of the questions on the enterprise and the place of work was possible because of the creation in 1985 of a register of employment on the lines that had been proposed in the 1983 study (see paragraph 27) and the use of these register data in the census. But the proposal that the register of employment should include a record of hours of work was not implemented on the grounds that it would impose an unnecessary burden on employers, and so this item of information was lost from the 1985 census.

41. The topics on which data for the 1985 census are being taken from registers are: demographic information from the population register (nationality, country of birth and date of last immigration, marital status and data on children born in 1970 and later); employment information from the employment register; and income from tax records.

42. Because of the concern expressed in the public debate that led up to the decision on the 1985 census, a Parliamentary commission has been set up to review the 1985 census operation with particular reference to privacy and confidentiality.

43. In the 1985 census 95 per cent of the personal forms were mailed in without the need to send reminders. After reminders 99 per cent were mailed in.

Future census developments

44. Action is being taken on other proposals made in the 1983 study. First, a committee is examining the possibility of refining the civic registration system by recording the housing unit as part of the address rather than just the property. Second, a register of educational achievements is being set up (see paragraph 32) but completion is not expected until 1987.

45. Statistics Sweden and the Parliamentary commission are now reviewing their experiences of the 1985 census as a preliminary to considering proposals for the 1990 census. The possibility of taking a further step towards a register-based census depends on two main factors: first, whether solutions can be found to the technical problems of quality and timeliness of register data, particularly for the topics retained in the 1985 census questionnaire; and second, an assessment of the acceptability to the public of the principle of a register-based census.

The rôle of surveys

46. As already noted (paragraph 25), sample surveys are not seen as a substitute for censuses; they complement censuses. Thus sample surveys can contribute directly to a register-based system by providing a means for testing the quality of the data in registers, and for making estimates that are in more detail than the data in the registers, particularly concerning the interrelationships between households and housing.

47. Key monthly statistics on the Swedish labour force, including the statistics on unemployment, are taken from the Labour Force Survey. Some 16,000 persons a month take part in a 15-minute telephone interview, the response rate being 90-92 per cent. A person recruited to the sample is interviewed eight times at intervals of three months (that is, over a two-year period), so that there are three independent "rotating" samples to which 1 in 8 of the sample members is newly recruited at each "sweep".

THE CENSUS OF POPULATION IN THE UNITED KINGDOM

Summary

1. The census in the United Kingdom, taken decennially, involves the door-to-door delivery of questionnaires, and their later collection, by enumerators directly employed by the census departments. Sampling in recent censuses has taken place only at the processing stage. Noteworthy features of the 1981 census were a much-shortened questionnaire and the rapid publication of the results. The Government had intended to include a question on ethnic origin but, following hostility from ethnic minorities during a census test in 1979, the question was dropped. There was less public disquiet in 1981 than in 1971.

2. The systems of registers that at present exist in the UK do not offer an alternative approach to conventional censuses of population. But the development of the Longitudinal Study has provided a mechanism by which data from registers - specifically registers held by the departments that manage the census - can be linked on a 1 per cent sample basis with data from the conventional census, and by which data from successive censuses can be linked together so as to introduce a time dimension into censuses that are essentially cross-sectional.

3. The next census in 1991 is likely to follow the lines of the 1981 census but with modifications if tests show that these will lower costs, increase public acceptability or improve the timeliness, coverage and quality of the results.

Organisation

4. Most of the statistical work of central government is decentralised in the statistical divisions of the main administrative departments. A coordinating rôle is exercised by the Central Statistical Office. In England and Wales vital registration,

the census of population, household surveys and related statistical matters are administered by the Office of Population Censuses and Surveys (OPCS); ministerial responsibility rests with the Secretary of State for Social Services. In Scotland and Northern Ireland these functions are administered by separate General Register Offices. The practices followed in the three parts of the UK differ to a limited extent; in such cases it is generally the OPCS practice that is described below.

The fieldwork for the census of population

5. The local administrations in the UK play no part in the management of the census fieldwork or in the scrutiny of the returns. Instead, the enumerators are recruited, trained and employed by the central government departments that are responsible for the census. The non-involvement of the local administrations is presented to the public as an extra safeguard of confidentiality.

6. Door-to-door delivery of forms follows an exhaustive reconnaissance of the enumerator's territory (the enumeration district or ED). The mail has not been used for the despatch of the census forms nor, save in exceptional circumstances, for their return. Although there was sampling in the field in the 1961 census, and the 1966 census was a 10 per cent 'sample census' (- this was the only mid-decade census ever taken in the UK), sampling in subsequent censuses has taken place only at the processing stage.

The population base

7. Censuses in the UK have traditionally asked for a return of all persons present at the address on census night, irrespective of such persons' usual address. Recent censuses have however also asked householders for a return of all persons usually resident at the address. The persons present on census night and the persons usually

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resident are distinguished by the answers to two filter questions that ask about the person's whereabouts on census night and about his usual address. In the case of an address at which no one was present on census night 1981, no information was collected about those usually resident at the address; this led to an undercount in most tables of the population resident in an area. The household is defined as persons living at the same address with common housekeeping, so that more than one household may occupy one housing unit.

The 1971 census

8. The household questionnaire used in 1971 was the longest ever with 25 questions in respect of each person. There were questions on a person's usual addresses one year ago and five years ago (to measure migration) and, for married women under 60, on marital and childbearing history. There was no direct question on ethnicity; but, as the presence of most coloured people in Britain was due to immigration in the 1950s and later, a question on parents' countries of birth in addition to the usual question on own country of birth gave an indirect guide to ethnicity. There were no questions on nationality, on languages (apart from a question about use of the Welsh language asked only in Wales and a question about use of the Gaelic language asked only in Scotland) or on income. (There was however a voluntary survey on income, carried out by mail as a follow-up to the census and addressed to a 1 per cent sample of persons aged 15 and over; but the response rate was under 50 per cent.) Though there was no sampling at the collection stage of the census, the coding and analysis of the responses to 'hard-to-code' questions on topics such as industry, occupation and educational attainments were restricted to a 10 per cent sample.

9. Particular attention was given to measures to safeguard confidentiality, for example by appointing enumerators to work in areas where they were unlikely to be known. A publicity campaign was mounted to explain the purposes of the census and

the safeguards on confidentiality. The enumeration was in general successfully completed despite some public disquiet about confidentiality and opposition from a few Members of Parliament.

10. Delays in the processing of the results led to strong criticism. The delays were attributed to inadequate advance preparation, to late changes to the questionnaire and to the confusion caused by the unexpected arrival at census headquarters of a large number of completed census returns that had been mailed there direct by people who were worried about confidentiality.

11. There was a growing demand for statistics for the smallest geographical areas - often used as "building bricks" for compiling statistics for ad hoc areas. Standard sets of statistics were prepared for EDs and for 1 kilometre squares of the national grid (though national coverage of grid square statistics was not repeated in 1981 as an economy). But there was no release of anonymised data relating to individual persons and households ("microdata"), a policy that is still maintained.

The 1981 census

12. The trend to ask more and more questions in the census was sharply reversed in 1981: there were 16 questions in respect of each person and five questions on housing and cars, compared with 25 and 5 respectively in 1971. There were fewer questions on economic activity, educational attainments and migration, and the questions to women on marital and childbearing history were dropped. The Government had intended that a direct question on ethnic origin should be asked; but the inclusion of such a question in a voluntary census test in Haringey (North-east London) in 1979 led to much controversy and hostility. To avoid the risk that the public reception of the 1981 census as a whole might be jeopardised, it was decided to omit an ethnic question; the question on parents' countries of birth that had been asked in 1971 was also omitted.

Sample surveys, and in particular the Labour Force Survey, have therefore been the main source of recent information on ethnic origin.

13. The 1981 enumeration was successfully completed. There was significantly less public disquiet and opposition than in 1971.

14. Processing plans were laid well in advance and the results of the 1981 census were published much earlier than those of previous censuses. Input of the data was by processor controlled keying (PCK) equipment. A "hot deck" auto-edit was used for the first time to edit data that were processed in full but not the data that were processed on a 10 per cent sample basis.

15. The data from the 1981 census have been analysed and presented in new ways with the aim of reaching a wider audience: for example, summary reports, pamphlets ("Monitors") on particular topics, maps and wallcharts. The distribution of census results through commercial agencies has been encouraged, particularly in the case of the statistics for small areas.

Sample surveys on census coverage and quality

16. To assess the extent of under-coverage in the census and the quality of the information returned by the public, every census since 1961 has been followed by a voluntary post-enumeration survey or surveys carried out in a sample of EDs within a few months of the census. The results from the 1981 survey suggested that under-enumeration overall was 0.4 per cent net; for Inner London the figure was 2.5 per cent. Although the 1981 survey is considered to be of markedly higher quality than earlier post-enumeration surveys, it is recognised that the extent of under-coverage may be understated because the re-enumeration, even when carried out by highly trained staff, faces the same difficulties of locating some groups of people as did the main census enumeration.

The cost of the census

17. The cost of the 1981 census is put at about £50 millions for Great Britain or about £1.0 per person.

The rôle of registers

18. In the UK there are no local registers of population containing lists of residents with up-to-date addresses, as there are in, for example, Denmark and the Netherlands. There are however other kinds of registers held locally or at national level, but from the point of view of population statistics each of them has shortcomings. The National Health Service Central Register (NHSCR) and related registers at local level cover virtually everyone; but there is some duplication and a person's change of address becomes known only if and when he registers with a different general medical practitioner, perhaps years after the change. The electoral registers, held locally, have the great merit that they are compiled annually mainly on the basis of a survey carried out by mail or by door-to-door enquiry. Thus, addresses are, in principle, up-to-date on the reference date in October to which the survey relates. But the electoral registers do not cover young people who will not reach the age of 18 during the currency of the register or aliens. Moreover, a survey in 1981 showed that at the October reference date some 6 per cent of those eligible to vote were not on the register at their current address (rising to 24 per cent in the youngest age-group and 14 per cent in Inner London). On the other hand there is some inflation in the registers through a failure to "prune dead wood" carried forward from the previous year's registers.

19. The NHSCR and the electoral registers are already used as a source of statistics on local migration in the years between censuses - for lack of any more reliable source. As a way of obtaining better annual counts of local populations, a study in 1979 looked into a proposal that the annual survey on which the electoral registers are based should

be extended to cover everyone resident (and not just those eligible to vote) and that the survey procedures should be improved so as to secure much higher standards of accuracy. But the Government decided not to implement the proposal because of the cost, the additional burden on the public and the difficulties in controlling the quality of the survey procedures adopted locally by independent electoral registration officers. Nevertheless some local authorities have introduced their own voluntary extensions of the annual survey.

20. Early in 1986 the Government made proposals for the reform of local taxation. At present local taxation takes the form of a tax on the occupation of houses and other property (levied on the occupier); under the proposals a new flat-rate "community charge" would be payable by every adult resident in the local authority area. This would require local authorities to create and maintain registers of adult residents. The Government stated that the registers would not serve wider administrative ends. But the registers would, no doubt, provide a much improved source of local population statistics in the years between censuses.

21. Legislation to set up a general scheme for the protection of computer-held records of persons was enacted in the Data Protection Act, 1984.

The 1 per cent Longitudinal Study

22. In the UK registers have not so far been seen as an alternative to conventional censuses. But a significant step forward was taken in 1973 when it was decided to set up a Longitudinal Study (LS), in which data from registers would be linked with conventional census data and data from one census would be linked with data from subsequent censuses. Not only was a time dimension introduced but, in addition, census data about the individual were to be complemented by data from other sources. In fact the LS is set up on a limited scale: for a 1 per cent sample of the population, namely,

those born on four days of the year. Moreover, the register data used in the LS are restricted to data held in the departments that administer the census of population and refer mainly to: the deaths of LS sample members and of their spouses; births to mothers who are LS sample members and subsequent infant mortality; and cancer registrations amongst LS sample members. Thus the subjects so far studied in the LS have concerned mortality, family-building and cancer. The census-to-census link, 1971-81, can measure transitions in relation to all census topics, for example, household composition, place of residence (migration), economic activity and social class.

23. Linkage in the LS is made by reference to a person's date of birth and name, and not by use of any personal number. The NHSCR is used as a reference point to facilitate the linkage. The success rate of linkage (linkages actually achieved as a percentage of potential linkages) varies according to the sources of data. The success rate for the census-to-census link is 91 per cent overall, but falls below 70 per cent for some groups amongst the overseas-born.

The intercensal population estimates

24. Annual estimates are made of the population resident in each local authority district, by sex and age. They are important both for planning and for the distribution between authorities of large sums of public money. The estimates are carried forward from year to year starting from the most recent census, by adding births and net (inward) migration and deducting deaths. The weakest elements in the calculation are the estimates for internal migration, which are based on data held in registers - mainly the electoral register, the National Health Service Central Register and school enrolments. The error in the estimate of the total population of a local authority district, accumulated over the ten years from the 1971 census up to 1981, exceeded 5 per cent in some 20 of the 403 districts in England and Wales but was less than 2½ per cent in some 290 districts.

The rôle of sample surveys

25. OPCS carries out a wide range of voluntary sample surveys of persons and households that, at national and regional levels, complement the basic information from the decennial census. Among the continuous surveys may be mentioned the General Household Survey and the Labour Force Survey. The General Household Survey initiated in 1970 is a general purpose survey that examines a number of subjects in some depth, particularly population, housing, employment, education and health. The interview is addressed to the adult members of some 12,500 households in Great Britain each year, and a response rate above 80 per cent is achieved.

26. The Labour Force Survey has been conducted biennially since 1973. From autumn 1983 it was transformed into a continuous survey which obtains interviews from about 5,000 households in Great Britain each month throughout the year. This number is supplemented by an additional 45,000 households in the second quarter of the year (to make a total of 60,000 interviews in that quarter). A system of "rotation" has been introduced into the sampling scheme for the regular 5,000 households a month: each household is interviewed five times at three-months intervals, so that the final interview takes place 12 months after the first interview. And whilst the first interview with one (or more) member(s) of the household is face-to-face, the second and subsequent interviews are by 'phone wherever this is practicable.

The future of the census

27. The 1981 census was the most successful of the post-war censuses in Britain: complaints from the public were not widespread and the results were published more quickly and in more detail than ever before. The next census in 1991 is seen, therefore, as a repeat of the proven methods employed in 1981, but with modifications that might improve the timeliness, coverage and quality of the results, reduce costs or the burden on the public and perhaps permit the inclusion of questions on ethnic origin and language.

28. Among possible changes in census methodology now being studied, three may be mentioned. The first is the wider use of post-codes. Post-codes as one element of an address are in increasingly general use in the postal service and for other purposes; each post-code covers on average some ten addresses. Applied to the census, post-codes might be used both in organising the collection process and in analysing the results: on the collection side each enumeration district might be defined as an aggregate of post-code areas; and on the output side the post-code area would be the smallest geographical building brick. This approach was adopted in Scotland in 1981 and may be extended to the whole of the country in 1991. Second, attention is being given to ways of collecting information about households usually resident at addresses at which no one is present on census night - a lacuna in 1981 in the statistics of persons resident in an area (paragraph 7). Third, a study is being made of an alternative processing strategy employing a disc-held data base with 'transposed files' - that is, each file would contain the responses of the whole population in respect of a single variable (for example marital status or occupation).

29. Further development is foreseen of the marketing and 'packaging' of results, as described in paragraph 15 above.

30. Following the decision to omit an ethnic question from the 1981 census, a Parliamentary Committee has examined the need for this question and has recommended its inclusion in future censuses. The Committee has also proposed that the census should ask questions of a general character on languages spoken, and has urged continuing liaison with the ethnic communities in the intercensal period. These particular questions apart, the aim for 1991 will be to keep the census form short since this greatly contributed to the public's favourable reception of the 1981 census. A field test is planned for April 1987 and a dress rehearsal in 1988.

THE CENSUS OF POPULATION IN THE UNITED STATES

Summary

1. The public response to the 1980 census in the United States was good. The questionnaire had been mailed out and mailed back in most areas: a long form for a sample of households and a short form for the remainder. The success was attributed in no small measure to an unprecedented publicity campaign that was directed in particular to minority communities that had been undercounted in the past. There were also new field programs to extend census coverage. Preliminary estimates of coverage in the 1980 census indicate that there was some improvement in coverage as compared with the 1970 census, especially for the black population.

2. The Bureau of the Census has in hand a program of research and field tests to prepare for the Bicentennial Census in 1990. The Bureau is giving sustained thought to three fundamental and related questions: first, how can census coverage especially of minority communities be still further increased? Second, should the census be only a count or should counting be supplemented by more sophisticated techniques such as sampling and imputation? And, third, should the census figures be adjusted to take account of the undercount, as litigants in court cases have argued?

3. The Bureau sees sampling and the use of administrative records as ways of supporting a conventional census rather than as alternatives to a conventional census. Even in this rôle, however, administrative records have many limitations and moreover there could be risks to the public's perception of census confidentiality if administrative records were to be used too widely in support of a conventional census.

Organisation

4. The decennial census in the United States falls within the responsibility of the

Bureau of the Census. The Bureau is answerable to the Secretary of Commerce and it forms a separate office within the United States Department of Commerce. Besides the decennial census of population, the Bureau carries out a wide range of censuses and surveys in such areas as housing, construction, agriculture, manufactures and trade, in collaboration with, or under contract to, other federal agencies, the States and local government agencies. The Bureau also makes use of administrative records held by other federal agencies for the purpose of compiling statistics. The Bureau has developed an extensive program for consulting with users of its statistics through advisory committees, conferences and workshops. Coordination of the statistical activities of all federal agencies, including the Bureau of the Census, is effected by the Office of Management and Budget which is a part of the President's office.

Objectives of the census: frequency

5. Beginning in 1790, the census has been taken every ten years to fulfil a Constitutional requirement that seats in the House of Representatives be apportioned between the States on the basis of population. Other important uses of the census results are for redefining the boundaries of electoral districts and for allocating very large sums of public funds between different areas and different groups. Though legislation to introduce a mid-decade census was signed into law in 1976, no provision was made for a 1985 census.

The census fieldwork

6. To take the census, the staff at the headquarters of the Bureau of the Census and at its regional offices and processing centers is augmented by a large force of field workers hired on a temporary basis: at the peak of the 1980 census there were about 270,000 working, mainly full-time, from about 400 temporary district offices.

7. The use of the mail and sampling by means of long and short forms have become

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established features of censuses of population in the United States. Mail-back was first used in the census of 1960 and mail-out in the census of 1970. The use of sampling to obtain responses to some questions from only a sample of households had begun earlier, in the census of 1940.

8. In 1980 mail-out of the census questionnaires and mail-back was extended to areas covering about 95 per cent of the population. Mail-out requires the preparation in advance of mailing lists; many of these are based on commercial lists that have been checked by the Post Office and checked again by the census enumerators in a street canvass. The mailing list provides the sampling frame for the distribution of long and short forms. A long form was mailed in 1980 to a sample of one in six households and a short form to the remaining five in six. (In places with 2,500 or fewer people, a long form was mailed to half the households and a short form to the other half.) The conventional use of enumerators going from door to door was confined to about 5 per cent of the population living mainly in very rural areas. In such areas the Postal Service delivered unaddressed short forms to all households. Later enumerators called to collect the completed forms; at the same time they compiled a list of addresses and, at a sample of households, helped residents to complete the long form.

9. A notable feature of recent censuses has been the continuing efforts to achieve higher levels of coverage, particularly among the poorer members of the community and ethnic minorities who have been undercounted. In 1980 some \$300 million was spent on coverage improvement programs. In every case in which a housing unit had been classified as vacant on the basis of the enumerator's visit (including enquiries he had made of neighbours), a different enumerator paid a further visit to determine whether the unit was vacant or occupied. Where doubt about the occupancy of a housing unit remained, the status of occupied or vacant was assigned by imputation, and, where the status occupied was assigned, the number of people living there was also imputed. These imputation procedures alone resulted in an addition to the census count of some

$\frac{3}{4}$ million persons (0.3 per cent). In some areas with significant minority populations, administrative records concerned with immigration and naturalisation and with drivers' licences were used as a check on coverage: if a person on these records was not found on the census list, an enumerator called at the address shown in the record and, if the person was found to be living at the address, he or she was added to the census list. This check added nearly 100,000 persons to the census, mainly blacks and Hispanics.

10. In 1980, as a way of ironing out difficulties and eliminating errors, the Bureau invited comments on the preliminary census counts from local government officials before the local census field force was disbanded.

The questionnaire: the population base

11. The census form asks for a return of persons "living here", that is, those usually resident in the household. The household consists of the persons occupying a housing unit, which is defined as a group of rooms or a single room occupied or intended for occupancy as separate living quarters.

12. The short form used in 1980 asked only seven questions about each person living in the household; of these, five were demographic (sex, age, marital status, etc) and the remaining two were concerned with race (white, black, etc) and whether of Spanish/Hispanic origin. The short form also asked 12 questions about the household, mainly about the accommodation occupied. In the long form there were no less than 33 questions about each person living in the household and 32 questions about the housing unit. The questions about each person - additional to those on the short form - asked about place of birth, citizenship, ancestry, language, address five years previously, marital history, fertility (for women), disability and income, as well as series of questions on education and on economic activity.

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Processing and dissemination

13. Features of processing in which the United States was an early pioneer include the use of optical sensing equipment and the system of hot deck auto-edit for handling incomplete and inconsistent responses. Strictly speaking, the machines developed by the Bureau of the Census for the input to computer of data from the questionnaires - called FOSDIC (Film Optical Sensing Device for Input to Computer) - are not optical mark reading (OMR) equipment, because the questionnaires have first to be microfilmed and it is the microfilms that are read by FOSDIC. For the input of write-in responses, the Bureau has so far relied on manual coding as a stage prior to the microfilming of the questionnaires.

14. Another pioneering development in the United States has been the dissemination of the results from demographic censuses and surveys by means of files of anonymised individual data relating to a sample of persons and/or households. These are often referred to as microdata or public use tapes. The confidentiality of the data is assured by the removal of direct identifying information, notably name and address, by not identifying geographical areas with a population under 100,000, by collapsing data values into appropriately broad categories (for example 5-year age bands) and by the fact that the release of data is restricted to a sample of the population.

15. Processing of the 1980 census results was delayed by shortages of funds and by inaccuracies in the geographical database, though the Bureau met the statutory requirements to provide population totals for States within nine months of Census Day and for smaller areas within a year of Census Day. There were however an unusually large number of legal challenges to the census results: in fact over 50. These were concerned mainly with the case for adjusting the census figures for undercount and with the legality of imputing persons as part of the population count.

Coverage evaluation

16. The Bureau of the Census has been notably active in efforts to measure the extent of the net undercount as well as to find ways of reducing the undercount. In 1950 net undercount was estimated to be 3.3 per cent, reducing to 2.7 per cent in 1960 and 2.2 per cent in 1970. In the 1970 census, estimates of the net undercount, analysed by sex, age and race, had been made mainly by the method of demographic analysis - that is, a comparison of the census counts with estimates of the total population resident in the United States using sources independent of the census; these sources are annual figures of births, deaths and migration, figures of enrolments in the medical care scheme for those aged 65 and over and figures from previous censuses for some age-groups (the older of the under-65s). The results showed marked differences between groups defined by sex, age and race: thus the undercount for blacks in 1970 was estimated to be 7.6 per cent and for whites 1.5 per cent. But demographic analysis can be applied only at the national level: lack of good information on State-to-State migration prevents its application at State (or lower) levels. Even at the national level the results are subject to considerable uncertainty because of the absence of data on emigrants and illegal immigrants and because of the reliance on figures from previous censuses in the case of some age-groups.

17. For 1980, the Bureau used demographic analysis and a second program for estimating coverage - the Post-Enumeration Program (PEP) - which was a variation on the Post-Enumeration Surveys used in the 1950 and 1960 censuses. The PEP, which cost around \$15 million, was in two parts. In the first part, aimed at measuring the gross undercount, 160,000 households that had been interviewed in the Bureau's monthly Current Population Survey (CPS) were matched with the census returns. The greater part of the matching could be done in the office but for about one in five households a further interview had to be carried out. Inevitably, whether a person recorded in the CPS had been correctly recorded in the census could not be determined in a proportion of cases (about 4 per cent), so introducing uncertainty into the measurement of

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undercount. In the second part of the program, aimed at measuring the gross overcount, a sample of 110,000 households drawn from the census returns were interviewed and were asked about other addresses at which each person could possibly have been counted; this led to office checks to see whether in fact that person had been counted elsewhere a second time. The sizes of the two samples in this program were chosen large enough to give an analysis of undercount/overcount by State, but the Bureau does not regard the results as sufficiently precise for use in adjusting the census counts.

18. The Bureau is cautious in making estimates of coverage because of the limitations of demographic analysis and of the Post-Enumeration Program. For the demographic analysis, in which an estimate of the total population resident in the United States is built up from sources independent of the census, there is no accepted and valid estimate of undocumented aliens which could be included in this total. So, for the purposes of the evaluation, the Bureau has deducted from the census count the 2 million undocumented aliens estimated to have been enumerated in the census, and has compared the resulting census count for legal residents with the independent estimate of legal residents. A preliminary assessment points to a net undercount of about $\frac{1}{2}$ per cent for the legally resident population, made up of a small net overcount for legally resident whites (perhaps 0.2 per cent) and an undercount of about 5 per cent for blacks. These figures are broadly consistent with the results of the coverage checks in the Post-Enumeration Program. Because of unresolved problems of matching, preliminary estimates of coverage from the PEP have been expressed as a range, extending from a net undercount of 2 per cent to a net overcount of 1 per cent.

19. Another method of measuring undercount is to match the names of persons listed in administrative records against the census records. This approach has not been applied nationally but only for particular sub-populations. A pioneering exercise of this kind took place in the context of the lawsuit brought by the City and State of New York following the 1980 census; they had claimed that the census had seriously

understated the population of New York City. In this exercise a sample of names of people living in selected enumeration districts in New York City (the "megalist") was drawn from ten local lists (with procedures to avoid duplication) and was then matched against the census records: the result showed that 76 per cent of the sample of persons had been included in the city's census count and, following field checks with the people concerned, that 7 per cent had been missed from the count, leaving 17 per cent unclassified (including people not living in NYC on census day).

The cost of the census

20. The cost of the 1980 census over 10 years is put at over \$1 billion, or \$4.7 per person.

Public response: publicity

21. The 1980 census is regarded as a good census in terms of the extent of the data collected and of the public's response. Of the forms that were due to be mailed back, some 83 per cent were mailed in before follow-up action. Part of this success was attributed to the thorough publicity campaign - described as "unprecedented" - in which special efforts were made to reach, and to secure the cooperation of, minority communities that had been undercounted in the past, for example the blacks and Hispanics. Publicity included public service announcements provided free by the Advertising Council (reckoned to be worth \$38 million).

1990 and the future

(1) Objectives for 1990

22. For the next census, scheduled for 1 April 1990, the overall objectives of planning are: to keep the size of the questionnaire reasonable by balancing data needs versus the time it takes householders to fill in the questionnaire; to maintain the confidentiality

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of individual census responses; to maintain high levels of coverage and accuracy; to meet the legal mandates for the release by 31 December 1990 of the data needed for apportioning seats in the House of Representatives and the release by 1 April 1991 of the data needed for redistricting; to provide dissemination of the results particularly from the long form more quickly than in 1980; and to hold costs (in real terms) to at most the levels of 1980.

(2) Collection

23. The Bureau is examining a wide range of issues concerned with the collection process and a program of field tests is in hand. The most cost-effective method of compiling the list of housing units is being sought. Consideration is being given to the possibility that, in selected areas and particularly those in rural-route delivery areas, the census questionnaires would be delivered by enumerators instead of by mail: delivery would be combined with the street canvass in which enumerators make the final corrections to the list of housing units; questionnaires would continue to be mailed back. A field test of enumerator delivery is a part of the 1986 census test in Mississippi. An earlier field test in 1985 in Jersey City, New Jersey, examined the feasibility of dividing the collection process into two stages: in the first stage a standard short form was delivered to every household for return by mail, and this was followed two months later by the second stage in which a long form (repeating all the questions that appeared on the short form) was delivered to a sample of households for return by mail. There was a risk that the merit of this procedure - the more rapid collection and processing of the basic information on the short form - might be offset by reduced public cooperation in the return of the second form and this indeed proved to be the case: the two-stage procedure is not being considered further for 1990.

24. Consideration is being given to extending the Local Review Program (see paragraph 10) whereby local officials would have the opportunity to review and challenge

the counts of housing units before census day, as well as (as in 1980) the postcensus counts of housing units and population before the temporary census offices close down.

(3) Automation and other issues

25. The Bureau aims to make the 1990 census less people- and paper-intensive through the wider use of automation. The benefits are seen to be a more accurate and timely census, better control of the census process and greater cost-effectiveness. Consideration is being given to automating tasks such as the updating of address lists, the check-in and editing of questionnaires, coding, and cost and progress reporting. It is planned to construct a new computerised geographical database that would integrate three elements whose lack of consistency in 1980 led to difficulty and delay. The three elements are: first, maps; second, the existing record system (GBF/DIME) that specifies the street network and its relationship to addresses; and, third, the directory of areas used in field operations and analysis, setting out their definitions, relationships and classifications.

26. Other subjects for review for 1990 include: methods of organising the temporary personnel (there were problems in 1980 in hiring and retaining temporary full-time workers, and in 1990 it may be better to increase the proportion of part-timers in the field force); development of the publicity program; and methods of data dissemination.

(4) Coverage and adjustment

27. Some of the Bureau's most intense thinking is being directed to three fundamental and related questions. The first is: how can census coverage be still further increased? In particular, how can deficiencies in the level of response from the minority communities be overcome? The second question is: should the census be only a count or should counting be supplemented (or replaced in part or in whole) by more sophisticated techniques such as sampling and imputation? This question is not just one of accuracy. It must also be considered in a wider context in relation to: the legislation under which

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the census operates; public perception of the credibility, fairness and acceptability of the census results; and the political consequences of introducing new techniques - in electoral terms and in terms of public funding.

28. The third question (which is a particular case of the second question) is: should the census figures be adjusted to take account of the undercount and, if so, how? In 1980 the Bureau decided against adjustment for the technical reasons that there was not a satisfactory method to measure the undercount even at the national level or, even if measured, to distribute it between sub-national areas. But the Bureau has come under considerable pressure through cases brought before the Courts and from advisory groups to adjust for the undercount.

29. Adjustment was one of the issues on which advice was sought from a Panel of experts drawn from the Committee on National Statistics of the National Academy of Sciences. The Panel reported in 1985 in The Bicentennial Census: New Directions for Methodology in 1990. The Panel viewed adjustment as a complement to cost-effective coverage improvement, not a substitute for it, and set out guidelines on methods. The Panel recommended that adjustment should aim at minimising coverage differentials between demographic groups or areas and should be carried down to the microdata level by weighting records or imputing records. The adjustment procedure should be chosen, the Panel argued, on the criterion of its robustness in relation to a reasonable range of loss functions.

30. The Bureau of the Census does not regard adjustment as an alternative to the programs that aim to increase census coverage: these programs will be maintained and developed. The present (mid-1986) position is that the Bureau intends to come to a decision in 1987 on the technical feasibility of adjustment. This decision will take account of (1) progress in establishing methods of measuring coverage, (2) progress in developing methods for carrying down coverage estimates from large geographical

areas and broad demographic groups to the block level using statistical models, and (3) the results of the field tests in 1985 and 1986. If adjustment is found to be feasible, the machinery for making adjustments would be developed and put in position for 1990. When the counts that have to be released by mandatory deadlines became available they would be adjusted; but only then would a decision be made on whether the adjusted figures or the unadjusted figures were the better set to release as the official census results. That decision would be made on the basis of an appraisal of the quality of the census counts themselves and of the quality of the coverage measurements, the appraisal being made by reference to criteria that had been discussed amongst interested parties and published at an earlier date (1987-88). To help in reaching its final decision on whether to adjust, the Bureau of the Census would receive advice from outside experts. The Bureau aims, if possible, to make the choice between adjusted and unadjusted figures before it has to fulfil its legal obligation to release the first census results on 31 December 1990 - in order to avoid the confusion that would arise if unadjusted figures were released at that date and were followed by adjusted figures at a later date.

31. As one approach to a better measure of the undercount in 1990, the Bureau has been conducting an experiment known as the Forward Trace Study. In essence the Bureau's aim was to use administrative records to try to keep track throughout the decade 1980-90 of the place of residence of a sample of individuals recorded in the 1980 census, and then to check how many of this sample were recorded in the 1990 census returns at the addresses shown in the forward trace study. The sample has been divided into two parts. For one part, forward tracing is facilitated by keeping in touch with the individuals by mail, phone or visit - at the risk of affecting their propensity to get recorded in the 1990 census: but there is no contact with the individuals in the other part of the sample. (The Forward Trace Study is a variant of the Reverse Record Check - which is currently employed in the Canadian census and indeed was employed in the United States census of 1960.) Preliminary findings from the Study are that tracing is expensive and that there is a residual group of untraced individuals, particularly

among the demographic subpopulations that tend to be missed in the census. The Bureau concludes that the method will not be useful for coverage evaluation in the 1990 census.

(5) Sampling

32. The Bureau sees sampling and the use of administrative records as ways of supporting a conventional census rather than as alternatives to a conventional census. Sampling is already widely used in the census, notably in the sample questions that appear only on the long form and in some of the methods of measuring undercount (for example the 1980 Post-Enumeration Program). Its use would be widened if a decision were taken to adjust the census counts. The report of the Panel from the Committee on National Statistics recommended that sampling should be considered in the later and more difficult stages of the follow-up of census non-respondents and in the coverage improvement programs that occur after census day.

(6) Use of administrative records

33. Administrative records might in future be used more widely in support of the census for purposes such as the compilation of the list of housing units to be enumerated, measures to extend census coverage (see, for example, paragraph 9) and the preparation of estimates of the undercount/overcount (see paragraph 19). However administrative records are seen to have a number of limitations for use in the census: their coverage and accuracy may be questionable; they contain a limited range of data and may not give a person's precise geographical location; time is needed to assemble the data; there may be legal and bureaucratic obstacles to using them; and matching of records can introduce further difficulties and uncertainties. Concern is also expressed that the extended use of administrative records in the census might be erroneously perceived by the public as a two-way process - with census data being passed to administrative agencies - and hence might jeopardise the public's trust in the confidentiality of the census.

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