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The Analysis of Micro data from an international perspective

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**STATISTICS DIRECTORATE
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THE ANALYSIS OF MICRODATA FROM AN INTERNATIONAL PERSPECTIVE

**to be held on 7-8 June 2004 at 10h00
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THE ANALYSIS OF MICRODATA FROM AN INTERNATIONAL PERSPECTIVE

Introduction

1. International comparability of statistics has been on the list of priorities of international organisations for many years. The System of National Accounts (SNA) continues to be refined under auspices of the United Nations and serves as a basis for production of economic statistics in national statistics offices (NSOs). The theoretical harmonisation of national accounts statistics through the SNA is brought into practice by NSOs, for example in the EU countries with the ESA95. Nonetheless, data from NSOs often require further attention to be comparable internationally. Collections of national data are ‘republished’ by international organisations on a comparable basis by standardising dimensions of the data such as unit of measurement, periodicity, and classifications. For example, national statistics on monetary aggregates are republished by the IMF and data relating to employment or wages are collected by the ILO from statistics offices world-wide. A rather broad collection of economic and social data from member countries is put together in a comparable fashion and made available by the OECD.

2. Comparability of statistics, however, is not a goal in its own right, but a means to provide high-quality information for further analytical work. Statistical material underlying international comparisons are desired by policy makers as well as academics. Comparable economic statistics at increasing levels of detail are now vital to the needs of economic policy makers, who have shifted from demand management policy to structural policy. Comparable measures of macro-economic outcomes do not suffice to evaluate structural policy; instead details of changes in behaviour of economic agents such as households or firms are needed. For academic researchers, detailed datasets with comparable information across individual units and over time are required to estimate parameters of structural economic models.

3. In order to meet these demands, NSOs of many OECD countries have facilities to conduct research with the micro datasets that were originally collected as raw material for aggregate economic statistics. In some countries, statistics offices already have considerable experience in making longitudinal micro data available to outside academic and policy researchers. By contrast, in other countries, employees of the statistical agency may just be starting to experiment themselves with the micro data. Recently, networks of researchers in different countries have collaborated to undertake studies simultaneously with data available at the various the statistical agencies. The OECD has co-ordinated an ad-hoc network to collect the data for the firm-level growth project (OECD 2002, Bartelsman and Barnes, 2001). An institution that can facilitate cross-country studies with micro data does not exist at present, even though the academic and policy community greatly appreciate the results of this type of work.

4. The purpose of this document is to outline an institutional set-up that would allow, in the OECD context, international collaborations of research with micro data that reside at the OECD or at the various national statistical offices. Such a “centre for distributed micro-data studies”, henceforth to be called Centre, will provide an international platform to conduct analytical work with confidential micro data residing in the participating countries. Further, the Centre will serve as a platform to enhance comparability of statistics that may be created with the data sources available at the individual national statistical offices. Many logistical, legal, and practical hurdles need to be overcome before such a Centre can become operational. In this note the hurdles are outlined and material is provided for discussion of the issues that need to be resolved in an international context.

5. The outline of this note is as follows: First, attention will be given to the importance of longitudinal micro data for policy research and academic research. Next, a brief overview will be given of what NSOs have done in their own countries to allow micro data to be used for analysis, and how they have coped with the various hurdles. Following this, suggestions are made on how the Centre can address the hurdles and deal with other issues that pertain specifically to the use of micro data from multiple countries.

Applied research with micro data

6. Applied research using micro-level data has entered the mainstream in the economic literature. In particular, longitudinal micro datasets with information on individual business firms that together account for most of the output or employment in an industry, are being used to explore hypotheses in many fields of study.¹ For example in industrial organisation, the availability of micro datasets has helped the development of theoretical models of firm entry and survival. Also, such datasets have furthered the understanding of pricing and mark-up behaviour of firms. Labour economists are making great strides in understanding worker flows and matching between worker skills and firms' needs through linked employer-employee data. In the area of innovation, much work has been done to trace how R&D spending and other innovative activities affect output and productivity. Finally, in the field of international economics, micro-level datasets have been used to explore the linkage between trade and growth or to validate models explaining firms' choices between export and FDI. While this list of research topics is not exhaustive, the message is that by using micro-level data, researchers are better able to disentangle the behavioural mechanisms at play for individual agents from interactions between agents and market outcomes.

7. Policy researchers also have become aware of the strength of micro-level data for many areas of policy. Competition policy authorities rely on such data to define the scope of markets and to monitor market dynamics. In policy aimed at knowledge diffusion, research with micro-data was used to evaluate the effects of specific policy.² Firm-level data also has been used for policy evaluation, for example to understand the effects of R&D subsidies on employment and wages of R&D personnel. In recent work, studies have been conducted using firm-level data to understand the policy implications of multinational enterprises.

8. Most of the research with micro-data has taken place with data for a single country. Owing to the variation across agents and time in micro data for a single country, many effects may be identified econometrically. However, in the case of general policy changes affecting all agents, the micro data often does not help in identification.³ Here, cross-country comparisons often bring relief. Datasets such as the OECD STAN database, with information that varies by industry and time as well as across countries, have been used frequently by academic and policy researchers. For many purposes analysis with international panel data provides reliable answers. However, because the economic outcomes, such as employment, output or productivity, are for industries and not for agents, behavioural response can not be identified.

9. A dataset consisting of 'stacked' micro-level datasets from multiple countries will contain the necessary information lacking from either single-country micro datasets or multiple-country sectoral datasets. Unfortunately, owing to the confidentiality of micro datasets in most countries, the individual country datasets cannot be stacked for analysis. As a workaround, a dataset consisting of results from single-country studies could provide the input for 'meta-analysis.' For example, a collection of results from single-country studies on the link between ICT and growth at the firm-level, were presented in a recent volume of the OECD (2003b). However, the combination of results of analyses from single-country studies will not provide a solution if the effect of interest is not identifiable within a single country. Creating 'public use' data from the underlying sources is another possible workaround for collecting the necessary information. For example, sub-samples of the population census data from many countries have made available, with some screening, randomisation and top-coding to ensure confidentiality. For ease of cross-country analysis, the IPUMS 1-percent samples of population data for a large selection of countries is made available on-line. For firm-level data, a public-use dataset made through randomisation or micro-aggregation often is not feasible without the loss necessary information.

10. Recently, some studies have been done with micro-level data from multiple countries. The studies did not use 'stacked' data. Instead, identical analyses were conducted separately using datasets residing in participating countries. The country-level work was designed to produce output that provided the information necessary for cross-country analysis. For example, the OECD firm-level growth project followed this strategy. This project required tighter co-ordination and less flexibility in research design in each country than for 'meta-analysis,' where the methodology and

¹ In 2000, an overview by Bartelsman and Doms described results from more than a decade of work in this area. Detailed work in subfields described below includes Bartelsman, Scarpetta and Schivardi (2003); Roberts and Supina (1996); Roberts and Supina (1996); Abowd et al. (2002); Kremp and Mairesse (2004);

² Jarmin (1999).

³ In the unlikely even that an intervening variable can be found that varies cross-sectionally and also determines the magnitude of the policy effect on the individual agent, the effect of the general policy can be identified.

output may vary across samples. Further, the project was fairly costly in terms of the coordination effort involved in keeping the analyses in the separate countries on track. The method of distributing work to participating countries and analysing the comparable output centrally does provide better results than meta-analysis of single country micro-level studies or multi-country studies with aggregated data.

11. The method of distributed micro-data analysis maintains the advantages of multi-country studies with aggregated data, because the output provided by each country consists of indicators aggregated to a pre-specified level of detail that passes disclosure in all countries. The method also maintains information on behaviour of agents residing in micro data because the computed indicators on the (joint) distribution of variable(s) are designed to capture hypothesised behaviour. While not allowing the full flexibility of research design available with multi-country stacked micro data, distributed micro-data analysis provides a skilled researcher the ability to use cross-country variation to identify behavioural relationships.

Micro data access at NSOs

12. Great strides have been made in the previous decade at NSOs to better utilise the wealth of information originally collected as building blocks for published statistics. The changing use of micro-data at NSOs has been the result of two separate movements. From one side, researchers within and outside the statistical agencies have been clamouring for improved access to the individual records, in order to conduct basic and applied research. From the other side, statistical agencies have realised that their traditional production process, where individual records are collected and aggregated into published statistics for one survey at a time, is too wasteful of resources. Instead, through the process of merging various registers and surveys, more flexibility can be gained in the production process, and better quality statistics may be produced at lower cost, especially if burden to respondents is taken into account.

13. Starting from small scale experimentation with micro data, and aided by the continued improvements in computing power and data storage, many countries now have full-blown facilities for real-time access to all the statistical source material. NSOs needed to tackle many issues in order to provide these facilities. First and foremost, NSOs are committed to the maintenance of confidentiality of their data. Next, NSOs have a stake in safeguarding the consistency and reliability of their output. Driven by these two basic issues, NSOs have made guidelines and rules for micro-data research that determine who has access, how access is granted, how results must be reviewed and screened before publication, and who has ultimate responsibility and authority for outcomes.

14. In most countries, both information on individuals and on firms are collected under the legal requirements that collected data only are to be used for statistical purposes and will not be disclosed to third parties. Further, survey records are often augmented with register-based data, such as tax data, with more stringent legal safeguards. Individual records in these databases are therefore often only accessible to employees of statistical agencies on a need-to-know basis. Nonetheless, in many countries the databases may be used by outsiders that have been granted access under specific rules. The publication of research results based on these confidential data must be screened to prevent disclosure of individual information. Further, the publication over time of different slices of the data, or combinations of the published data with information from other sources, may not lead to revelation of individual information, sometimes called 'secondary disclosure'.

15. Economic and social indicators provide information for many private transactions as well as for government actions. Undisputed, impartial and reliable indicators greatly reduce the costs of such transactions, e.g. indexation of contracts using the CPI, and improve the quality and timeliness of government decision processes. Many economic indicators, such as items from National Accounts, are produced uniquely by NSOs and are therefore undisputed by design. Impartiality and reliability of the indicators is dependant on perceptions or the credibility that an NSO has built up over time. Care must be taken that any information that is made publicly available does not harm the reputation of the NSO, whether or not the NSO is the formal publisher of the information. Conflicting indicators that are based on the same underlying data may undermine credibility, but may increase it as well, depending on the transparency of the methods used and the level of sophistication of the users.

16. While policy of NSOs in regard to the above issues for their own employees and their own statistical processes is interesting, it will not be discussed further here.⁴ However, the rules designed by NSOs for access of outsiders to

⁴ An interesting hybrid form where statistical agencies make custom tabulations or conduct special studies for external clients is blurring the distinction between external research and internal processes.

micro data in response to these issues will be addressed. First, the NSO must make access rules. Who may have access to what data, through what channel, for what purpose? In some countries, access is limited to researchers with academic affiliation, while in others, also researchers from think-tanks or even for-profit firms are allowed. Access rules for researchers from other government agencies or central banks also vary across NSOs.

17. Next, NSOs often limit use of the data for academic or statistical purposes. Sometimes use of the data for enforcement of laws and regulations is strictly prohibited. For screening proposals, a peer-review board may be set up or officers of the NSO may do the screening. Further, the ex-ante screening process may place limitations on the scope of the data to which access is allowed: often access is granted to the minimal set needed to answer the scientific question at hand.

18. The access channel also varies across countries. In some countries the datasets are allowed on the computer of the researcher with the stipulation that datasets are confidential and need to be destroyed at completion of the project. In other countries, remote access is allowed, or regional access centres are available. In the strictest cases, access is limited to physically secure locations on computer systems that are not connected with the outside world or with networks at the NSO itself. In the proposal for an international micro data centre, all three channels will be explored, although most attention will be paid to the latter two channels that pose the most problems for cross-country research.

19. After a research project with micro-data has been conducted, the outcomes need to be screened for disclosure of confidential information. A considerable literature exists on disclosure analysis, with rules and practices varying across countries. With an expanding number of researchers having access to an expanding number of datasets, secondary disclosure may be a more important issue than in the past. Also in this area, research by the statistical community is moving ahead. With the wealth of online information, piecing together data from disparate sources on individual respondents is becoming more feasible. On the other hand, availability of online sources makes the benefit of breaching confidentiality of the NSO data smaller, at the margin.

20. The issue of consistency of research results and previously published official statistics often is covered by requiring research output to carry a disclaimer that the underlying data are from the NSO, but that the outcomes are the responsibility of the author. Further, sometimes the publication by external researchers of tables that match the detail of official publications is explicitly prohibited. In general, the more transparent the methods of the NSO, and the better their track record in producing undisputed indicators, the less they need to worry about external researchers publishing conflicting indicators. Further, having a policy that allows access to reputable external researchers may in and of itself enhance the credibility of the NSO.

Cross-country micro data research: A first proposal

21. The basic problem with cross-country research using confidential micro-data is that the data often may not be combined in one location. The solution lies in designing a research protocol for distributed micro data analysis, i.e. conducting identical analysis in participating countries and analysing the combined output. Besides the issues of confidentiality and consistency as discussed above, some additional issues need to be resolved to allow for distributed cross-country research. These include the locus of responsibility for approval of applications for research projects and for distribution of research results, the increased danger of secondary disclosure, methods for sharing costs of resources employed, and intellectual property rights. Besides these issues, practical matters include methods to improve efficiency of the process, and budgetary tradeoffs between the fixed costs of developing a Centre and the marginal costs of future distributed micro data research projects. Finally, the balance must be made who benefits in what way from the Center.

22. The suggestions below are intended to elicit discussion on how to create an international institution that resolves the issues and the practical matters. Further the list of issues may not be exhaustive and any discussion concerning omissions is welcome. Figure 1 presents a schematic overview of the proposed Centre. In going through the list and the suggestions, it should be kept in mind that co-operation of the NSO always remains on a volunteer basis.

23. The first issue is to decide who the 'customers' of the Centre are, or who may have access to the distributed micro data research facilities. The customer of the Centre, or researcher, may or may not have access to micro data in any country, but makes a proposal for a research design to be distributed to members of a network with access to micro data. The researchers could include international organisations, agencies and departments of OECD member

country governments, including NSOs, and academics at research universities. Further, any participant of the network with access to micro data would have the right to be a customer of the Centre.

24. The next issue is who decides which research questions are valid for being granted access to the distributed micro data network via the Centre. In order to facilitate the application process, it is suggested that the Centre have a panel of academics and representatives of NSOs that may judge whether the project fits the purpose of the Centre. Next, the Centre, which maintains a database of access rules for each of the NSOs, draws up a list of countries whose rules in principle would allow the proposed project. The proposal would then be sent to these countries, along with the recommendation of the Centre. Over time, as the Centre gains a reputation for good judgement, NSOs may decide to speed the review of these projects, or always grant access to projects accepted by the Centre.

25. The next step is in deciding how access to the distributed micro data network is granted. The access could take place via three routes. First, a researcher in a central location could have remote access via secure networks. Next, the researcher could distribute work to a researcher with access to the data in the host country. Finally, staff members of the NSO could do the work on behalf of the research. For the first route, the Centre could provide the technical facilities for such secure access. Unfortunately, this route is at present feasible only to a subset of countries. The conditions under which the OECD could become a secure repository for more countries could be discussed in this forum, as well as the changes in NSO rules and procedures that would need to be changed in order for an even larger group to grant access through this route in the future.

26. The second route should not be a problem for NSOs that already have access rules. The Centre could facilitate this route by maintaining a network of researchers at universities and research institutes with access in their respective countries and with experience working with micro data. The NSO has final say on allowing the suggested network member access for the proposed project. The Centre also could serve as the main contractor to the researcher and subcontract out to members of the distributed network.

27. The last route, access through NSO staff, seems most direct but actually may be difficult administratively. The OECD is not authorised to pay for work by member governments. Instead, the researcher would need to contract directly with each NSO participant. Alternatively, some means would have to be found for NSOs to budget resources for this task and make sure that the work is done on a reciprocal basis between countries.

28. The next issue is disclosure of confidential information. The responsibility lies with each NSO to enforce its own laws of confidentiality. The practical rules used to determine what is allowed outside the NSO, however, are not always transparent, and in some countries are actually confidential. The issue of secondary disclosure makes NSOs wary about letting large, custom-made, tabulations become public. However, it is precisely this type of information that is often needed by the researcher doing cross-country work. One possibility is to have a two-tiered disclosure system. One level determines the type of data that may be made public by the researcher. Each NSO has veto rights over this. The second level allows larger tables, that by themselves pass disclosure but are suspect owing to secondary disclosure, to leave the NSO, but restricts their use to researchers at the Centre. Such tables, or datasets, would be documented at the Centre and the list of all such tables would continuously be available to NSOs to aid in their disclosure analysis. A side benefit of this system is that duplication of effort by researchers over time would be minimised, as earlier tables could be re-used for other studies. Alternatively, an NSO could choose to have their contribution to the cross-country table destroyed at conclusion of the research project.

29. Besides the inadvertent release of confidential information, NSOs need to guard their reputation as providers of undisputed data. Researchers making use of the services of the Centre, however, will be responsible for the outcomes of their work. In a disclaimer attached to any publication, researchers will make known the underlying source data of their work, the rules regarding disclosure and their own responsibility for the results. Because disclaimers of a particular format may be required by different countries, this may be cumbersome to researchers and to readers of the publications. Possibly, a generic disclaimer of the Centre could be established that refers to the detailed national disclaimers available in a publication of the Centre. NSO rules likely would have to change to allow this delegated procedure.

30. Nonetheless, disclaimers on research of academics or policy analysts that makes use of data from various NSOs, may not be enough to prevent 'public relations' problems, especially if the research shows results that deviate substantially from official national publications. The Centre can provide institutional support, with clear explanations of the nature of the exercises conducted by the researchers and with broad-based dissemination of research results. Further, the work methods that make possible the distributed research also provide excellent documentation of the

methodology and ensure replicability of results. Additionally, to enhance transparency, the Centre should have guidelines that require the researcher to make the distributed computer programs publicly available at conclusion of the project.

31. Besides consistency of published indicators, some concern may arise owing to political implications of research results, especially for research initiated by a government agency. Careful ex-ante screening of proposal by the panel of the Centre should minimise blatant statistical abuse. Further, public availability and replicability of the research methodology could make abuse or shoddy statistics backfire and result in public humiliation of the researcher. The suggestion is to make the researchers responsible for the content of their publications. Alternatively, the Centre could institute an ex-post screening that will allow the researcher to place a methodological ‘stamp of approval’ on their publication.

32. The last issues pertain to technical and operational matters for the Centre. The Centre will be a repository for the Metadata that allow a researcher to write the programs that will interface with micro data at NSOs. The NSOs will agree to supply the Centre with up-to-date Metadata over the available datasets, the units of observations and the variables in each dataset, as well as Metadata on national classification systems. The Centre also will be a repository for the computer programs written by researchers and run by members of the distributed network. Finally, the Centre will maintain a (secure) archive of cross-country datasets that have been created as output of the distributed micro data work. These may be used by other accepted research projects, unless use of a country-subset is prohibited by an NSO.

33. Finally, some suggestions are made over the incentives, financial and otherwise, that will make sure that distributed micro data research can take place. At present, many NSOs find it in their interest to provide access, at a charge, to users. Besides getting reimbursed for costs, NSOs provide a service that fits within their organisational goals and they receive the benefit of knowledge spillovers from external researchers. Further, the reputation of the NSO may be enhanced by their association with high quality researchers and the publication of path breaking research that uses their data. These benefits will be enhanced through the enlargement of their user-base and the increased pool of researchers providing spillovers that occur when requests for access arrive through the Centre.

34. While the knowledge spillovers and international interactions will be beneficial to the quality of work at NSOs, the system must make sense financially. The initial investment in the infrastructure of the Centre would consist of collecting the Metadata, gathering information on NSO access rules, forming a network of researchers, and putting in place guidelines for operation and a panel to review proposals. These actions could be funded by an initial contribution from potential researchers or customers, or through an initial investment by NSOs that can be recouped through future work. The NSOs would need to spend time in organising their micro-data and the Metadata, if they have not yet done so. The Centre could provide technical guidance and facilitate the sharing of international best practice.

35. Projects that make use of the distributed micro data access through the Centre or other facilities of the Centre will be funded by the researcher. The project applications need to be screened by a panel at the Centre, which may entail an application fee. Next, the program code for an accepted project is distributed to network members for the relevant countries. Depending on the type access available for each country, the researcher contracts with NSOs, with members of the network, or directly with the Centre who subcontracts to network members. Projects also may contract with the Centre for use of archival cross-country tables. Division of possible rents from such projects between NSOs, the Centre and the researcher that first created the tables will need to be settled.

36. A final issue is who will host such a Centre and where the Centre will be located. The discussion is currently taking place under auspices of the OECD and the OECD has gained experience in co-ordinating distributed micro data research. In addition:

- the OECD Council and Ministers issued recommendations concerning Guidelines governing transborder flows of personal data (1980), security of information systems and networks (2002) and use of statistical data for research purposes (2004);
- the OECD has established a “Quality frameworks and guidelines for OECD statistics”, which includes principles and rules for managing confidential data. Such guidelines are currently under revision to make them more precise and mandatory for all Directorates;

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- the OECD already has a secure IT network (OLISnet), where data could be exchanged with Member countries in a safe way.

Moving forward, it would be an advantage to the user community if the Centre had secure locations (accesses) at offices of international organisations, central banks and NSOs around the globe. The restriction, of course, remains the trust that NSOs have in the secure facilities to prevent secondary disclosure through their control of access to the cross-country tables.

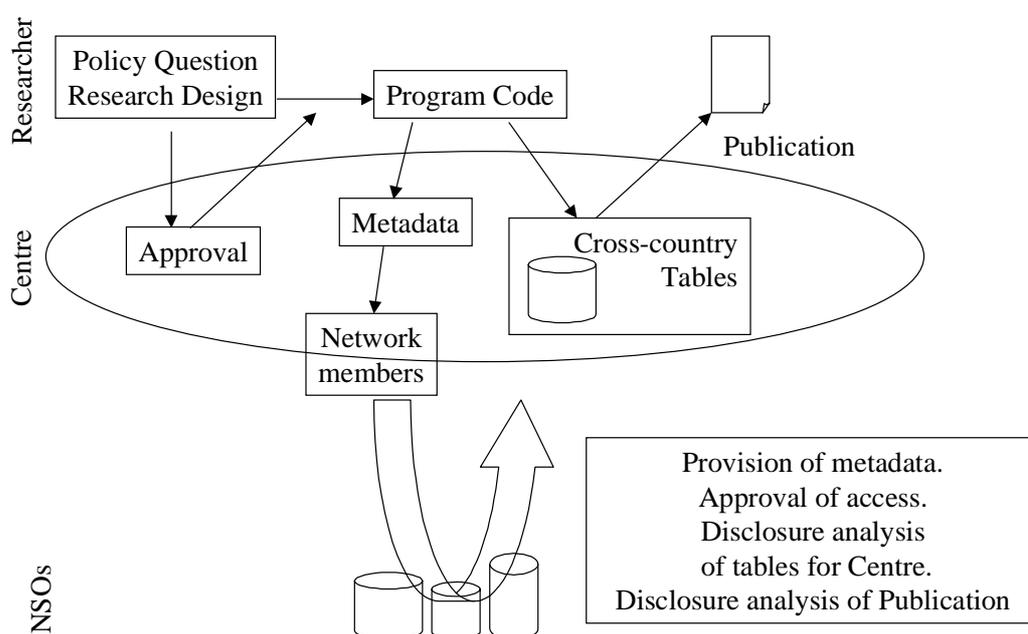
37. An overview of the positioning of the Centre is given in Figure 1. The Centre screens proposals from researchers. The Centre is a repository for Metadata that allow a research to write the programs that will interface with micro data at NSOs. The Centre also maintains contacts with the distributed network that executes the programs at the NSOs, and serves as the repository for the detailed output tables that are released by the NSOs. Finally the Centre gathers authority from NSOs to allow publication of research results.

38. The network members have access to micro data at NSO, execute the programs supplied by the researcher and distributed via the Centre, and supply output from the program to the Centre. They are paid for their work either directly by the researcher or through a sub-contract with the Centre. Alternatively, they could work on the basis of reciprocity.

39. The NSOs may be network members themselves, or have guidelines that grant certain network members access to the data. They have guidelines concerning the types of projects that are allowed to use their data. The NSOs maintain the Metadata stored at the Centre, and keep their databases organised in the manner described in the Metadata. The NSOs screen the output of tables before they are shipped to the Centre and screen output of the researcher before it leaves the Centre. They NSOs determine the fees for access to their data.

40. The Committee is asked to express its view on this initial proposal. If the Committee finds it interesting, a “reflection group” to analyse further legal, technical and organisational issues could be established. The work of this group should be closely co-ordinated with the activities currently undertaken by the project on statistical confidentiality at national level launched under the auspices of the Conference of European Statisticians.

Figure 1. Overview of distributed micro data research



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