

ESTABLISHMENT SURVEYS IN BRITAIN: A BOON TO LABOUR ECONOMISTS

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For clarity, as well as other good reasons, a discussion of establishment surveys in Britain needs some definitions. Both the terms 'establishment' and 'survey' have a range of uses. In the specialised usage of statistical and survey research methodology, the general notion of an 'establishment' is that of a place of employment or economic activity. More precisely, the term is used in this paper to mean *a single site or address containing some or all of the employment-related activities of a single employer*. This is in contra-distinction to organisation or enterprise, which indicates a set of activities under common ownership or control. Common examples of establishments within the various sectors of economic activity are farms, plants, factories, mines, depots, offices, shops, schools, hospitals and so on. Such examples, however, do not necessarily fit the above definition without qualification. A hospital or depot, for example, may contain the activities of more than one employer. Alternatively, a hospital might be spread over a number of sites. Numerous rules and examples are needed to operationalize the concept of establishment for survey research. Indeed, in the surveys that are the principal focus of this paper a considerable amount of training, backed up by some six pages of written instruction, was given to interviewers to help achieve a rigorous and consistent definition of 'establishment'. Many statistical surveys and censuses do not go to such lengths to operationalize a conceptual definition; many resort to a cursory phrase and accept information from multi-site organisations at what ever level of disaggregation is convenient to the provider.

In statistical and social science usage the term 'survey' is generally used to mean a sample survey, that is an activity involving the gathering of information from a statistical (or probability) sample of social or economic units with the purpose of making general descriptive or analytical statements about the population from which the units were selected. The most familiar examples are, of course, surveys of individual persons, but social units such as

households are not uncommon. Surveys of establishments are even less common.

Establishment populations may be defined in numerous ways, with restrictions as to the type of economic unit, the geographical or administrative area covered, and so on. Whilst such restricted populations may undoubtedly be important and interesting for survey researchers and their clients, the problems encountered and the solutions adopted may well not be transferable to other restricted populations. It is the comprehensive, national interview survey that provides the most challenging and potentially rewarding case. It is with these that this paper is concerned.

One further limitation has been made in the subject of this paper - the public availability of the survey results. Without this feature, surveys have very limited potential for contributing to democratic discussion, scholarly analysis and debate or the advancement of social science methodology. Before the advent of modern electronic data-processing and storage, few surveys met this condition of public availability. The published reports of results were usually all that emerged. No-one beyond the individual report-writer or research team could confirm or challenge the published findings or re-analyze the survey data in alternative ways. In recent years, electronic data storage has made public access to survey datasets a real possibility, facilitated in many countries by the setting up of national data archives. The subject of this paper, then, is establishment surveys in Britain, conducted on national probability samples, and for which the micro-datasets are publicly available.

The development of establishment surveys in Britain

The first establishment survey in Britain that broadly fits this specification was carried out by W W Daniel in 1975 as part of a programme of research on the causes and consequences of inflation, funded by the Leverhulme Trust. It was based upon a national probability sample of manufacturing establishments with 200 or more employees, drawn from a

commercial listing of employing units derived from local government taxation registers. The focus on manufacturing arose from the wish to study the largest sector of economic activity (at the time) and the one with the most complex systems of pay determination, the subject of the inquiry. The survey involved face-to-face interviews with managers and, where appropriate and possible, trade union representatives who were involved in pay negotiations. Daniel's report (1976) and research design had an immediate and enduring impact. Other surveys followed, but the unavailability of the results to other interested parties, the restriction to manufacturing, and the exclusion of respondents representing employees, all reinforced a growing view within government and the research community in the late 1970s that a new series of establishment surveys on management and labour relations was required.

The Workplace Industrial Relations Survey series

The Workplace Industrial Relations Survey (WIRS) series was thus developed to remedy a widely acknowledged lack of systematic and comprehensive information about the structures and practices of labour relations in Britain. The series is the result of continuing collaboration between the *Department of Employment*, the *Economic and Social Research Council*, which is the main provider of state funds for scholarly social research, the *Policy Studies Institute*, an independent research institute, and the *Advisory Conciliation and Arbitration Service*, the state-sponsored bi-partite body responsible for improving industrial relations. The reports from the 1980 and 1984 surveys (Daniel and Millward 1983; Millward and Stevens 1986; Daniel 1987) have been widely used in policy discussions and academic debate, as well as becoming standard references for teaching purposes. The report on the 1990 survey (Millward et al. 1992) was published last September and has achieved a similar status. Indeed, the June 1993 issue of the *British Journal of Industrial Relations* devoted six articles and some 90 or so pages to assessing changes in British industrial relations over the past 25 years by reviewing the evidence from the WIRS series. The survey micro-datasets have each been made publicly available not long after completion of the survey. In short, the WIRS series is the major series of establishment surveys in Britain, conducted on national probability samples, and for which the micro-datasets are publicly available.

Design

A number of fundamental design issues had to be addressed before the first survey was carried out, many of them of a novel nature or complexity. These included the choice of the most appropriate sampling frame, the practical problems of using the particular register that was selected, the operationalisation of the concept of 'establishment' across an enormous variety of cases and the optimal methods of approach to achieve co-operation (the survey being voluntary). These issues were discussed in detail in an earlier paper (Millward, 1991).

In the WIRS series, the establishment (or workplace) is the unit of observation and analysis because the substantive focus is on the actual practices of management-employee relations. Most of the survey questioning is about matters that occur at the workplace and so respondents are, where possible, people who are employed there. The design specifies three primary respondents: the senior manager at the establishment who deals with industrial or employee relations; and, where present, the senior representative (or shop steward) of the largest manual and of the largest non-manual negotiating group or individual trade union. Secondary respondents were (in 1984) production or 'works' managers in larger manufacturing plants and (in 1990) financial managers in industry and commerce where the primary management respondent was a personnel specialist. Primary and secondary respondents are role-holders, selected on the basis of being the best-informed employees at the establishment about the substantive concerns of the survey.

The sample coverage for the series was intended to be as comprehensive as possible, including all sectors of industry, commerce and the public services. In practice only agriculture, forestry, fishing, coal-mining and the armed forces have been excluded. The other exclusion was very small workplaces, because they were likely to lack the formal institutions and practices that are the concern of the surveys. A minimum establishment size of 25 employees has been maintained throughout the series. This excludes about 90 per cent of workplaces and 30 per cent of employees from the scope of the surveys.

On each occasion the sampling frame has been the most recent Census of Employment. The samples have not been clustered geographically, although the

outlying islands of Scotland were excluded. They have been stratified by size (number of employees), industry, region and type of employee. To facilitate comparisons between large and small establishments, and to increase the accuracy of estimates of employees covered by particular practices or arrangements, large establishments were over-sampled. The datasets contain appropriate weights to make the samples representative of the populations from which they were drawn. In the 1990 survey the sampling fractions varied from one in 90 for the smallest establishments (25 to 49 employees) to one in 1.8 for the largest (1000 or more employees). Overall, the 1990 sample selected 3009 census units from the population of 142,283 units with 25 or more employees, an average sampling fraction of one in 47.

In each survey the achieved sample has been just over 2000 establishments, involving around 4500 face-to-face interviews. Those with the main management respondents took about 90 minutes on average, using a complex schedule of questions ranging from 66 to 82 pages. Those with employee representatives lasted about 50 minutes, using much shorter schedules. Fieldwork and data processing for all the surveys have been carried out by Social and Community Planning Research, an independent, non-profit-making research organisation. Interviewers have received substantial training for the surveys and this, together with the use of same research organisation throughout the series, has resulted in datasets of high consistency and quality.

Having multiple respondents per survey unit makes it harder to achieve a complete set of data, but in terms of the main respondent the WIRS series has achieved high response rates. Moreover, while response rates have generally been on the decline in household and individual surveys in recent years, the WIRS series has shown an improvement over its ten-year history. After a response rate of 75 per cent in 1980 and 77 per cent in 1984, the 1990 survey achieved 83 per cent. Part of the increase may have come from improvements in approach and procedure which have been developed from the experience of earlier surveys, particularly with respect to organisations requiring a head-office approach for access. Other factors may have been the broad dissemination of the findings of previous surveys, the detailed undertakings on confidentiality and the promise (always honoured) of providing all respondents with a summary of the results.

A new feature of the project in 1990 was the inclusion of a separate and additional 'panel' sample, drawn from those establishments where interviews were successfully carried out in 1984. The panel data have already proved invaluable in illuminating changes between 1984 and 1990 and have considerable potential for causal modelling.

Content of the questionnaires

The questionnaires contain a large number of questions about employee relations at the workplace, mostly of a 'factual' nature (Smart and Stevens 1992). Generally the questions are focused on the whole workforce or on discrete sections of it that have different arrangements on the topic in question; sometimes the questioning is repeated for a number of occupational groups. There are many background and contextual questions about the establishment itself and the organisation to which it belongs. The series contains a core of substantive and background questions which have been asked on each occasion; around two thirds of the questions asked in 1990 were of this type.

The core substantive topics are: the role of managers responsible for employee relations; trade union membership; recognition of unions by management for representation and negotiating purposes; the coverage of collective bargaining; the structures, processes and outcomes of pay determination; union representatives, their local organisation and contacts with national officials; formal procedures for resolving disputes; the extent of disputes and industrial action; recruitment, dismissals and redundancy; the use of peripheral workers; payment systems and job evaluation.

Other questions included a special section on the introduction of new technology in the 1984 survey, the subject of a separate report (Daniel 1987), and a range of questions in the 1990 survey which concern the adoption of some of the newer employee relations practices used by employers.

Primary analysis

The primary analysis for each of the three WIRS surveys has been conducted by a small team of researchers drawn from the Department of Employment, the Policy Studies Institute and, latterly, the Advisory, Conciliation and Arbitration Service.

The 'sourcebooks' (Daniel and Millward 1983; Millward and Stevens 1986; Millward et al. 1992) have been commercially published with the four sponsors as joint copyright holders. The books range in length from 350 to over 400 pages. They contain a descriptive overview of the survey results, based on tabular analysis, as well as detailed descriptions of the design and conduct of the surveys. On substantive matters the later volumes have concentrated on making comparisons between the most recent and earlier surveys, setting the findings in the context of economic, social and legislative developments in the country.

On the second and third surveys in the series the primary 'sourcebook' has been complemented by a companion volume written by one or more of the members of the primary analysis team. On the 1984 survey this analyzed a special module of questions concerning the introduction and implementation of technical and organisational change (Daniel 1987). The results have recently been updated on the basis of a much-reduced set of questions in the 1990 survey (Daniel and Millward, 1993). The latest 'companion volume', further analysing the picture of change derived from all three surveys and focusing on questions about newer practices in industrial relations and human resource management in the third survey, is to be published later this year (Millward 1993c).

Secondary analysis

Within a year of their delivery to the research team responsible for the primary analysis and initial report, the WIRS micro-datasets have each been made available through the UK ESRC Data Archive to other researchers². The 1980 and 1984 datasets have been widely used by labour economists in Britain, as well as in some other countries, notably the United States, Australia, Germany, Italy and New Zealand. Regrettably, they have been used to a much lesser extent by industrial relations specialists, sociologists and industrial geographers (Millward 1992). Secondary analysis of the 1990 survey data began in early 1992 and the first conference discussing early findings was held at the London School of Economics in January 1993. In the following review of the use of WIRS by labour economists, citations are omitted for lack of space. They are contained in the full version of the paper.

Trade unions and wages

The issue that inspired some of the earliest and most extensive secondary analysis of the WIRS datasets was the question of the effect of trade union bargaining upon levels of pay. The pay questions in the 1980 survey were not designed specifically for statistical estimation of the size of union wage differentials, but rather as a general indicator of whether an establishment was a relatively high or low-paying employer. When the potential of the survey for analysing the possible effects of trade unions on wages became apparent, the survey questions in the next survey (in 1984) were made more precise and elaborated with follow-up questions on hours of work.

The question on levels of earnings has given rise to more secondary analysis and more published papers than any other question or topic in the WIRS series. In a recent bibliography of analyses based on only the first two surveys (Millward 1992) there were 11 articles in refereed academic journals on union wage differentials that depended wholly on WIRS. This compared with 31 refereed journal articles on all the rest of the material covered by the surveys, including those by industrial relations and other scholars as well as by labour economists.

In broad terms the studies based on the 1980 and 1984 surveys pointed to an average union wage differential for semi-skilled workers of a little under 10 per cent; for unskilled or skilled manual workers and for clerical and administrative staff the average differentials were smaller and often not statistically significant.

The rich vein of information in the survey datasets on the characteristics of bargaining structures and trade union organisation within and beyond the workplace has enabled labour economists to analyze and decompose the union wage differential in ways that could not be done with individual-level data. The union wage differential was shown to be at its highest in 'pre-entry closed shops', where union membership is a hiring requirement. Such arrangements, and other weaker forms of 'compulsory unionism', have now been made unlawful. In the absence of a closed shop, semi-skilled manual workers only achieved a significant advantage in unionized workplaces if they had very high levels of membership: 95 per cent or more. Where more than one union organized workers

at the same workplace they achieved a larger pay premium if they bargained separately with management than if they bargained jointly. Monopoly or near monopoly product markets increased the unions' ability to achieve higher pay. So did higher than average financial performance by the firm. High local unemployment constrained the unions' ability to raise wages.

Results such as these have contributed much to discussion of the role of trade unions in wage-setting in Britain. Some of them have been quoted by the government in support of successive legal restrictions on trade unions and especially on the closed shop. Unfortunately, none of the published analyses based on the 1984 and 1990 surveys have yet taken advantage of the improved questioning, notably on hours of work; the size of the trade union wage premium in Britain remains in some doubt³.

Finally on the subject of trade unions and wages, the issue of the dispersion of wages has begun to be addressed through the WIRS establishment-level data. Prior to the 1990 WIRS, the issue of whether union reduced the dispersion of wages had only been addressed in the UK at the aggregate level using individual data. The results of two new questions, reported in aggregate in the 1990 survey sourcebook, confirm the expectation based upon the American literature, that wage dispersion is substantially lower in unionized workplaces. Recent econometric analysis has confirmed that this relationship is robust to the inclusion of numerous control variables.

Whilst the surveys have included a variety of information about different types of payment system, the one that has been the focus of attention by economists has been profit-related pay. This, together with employee share ownership, has been intensively analyzed, both in terms of its determinants and its consequences. Responding to the debate engendered by Weitzman's (1984) book and British government proposals for further tax incentives for employee share ownership plans (ESOPs), researchers used the 1980 WIRS data to determine whether the existence of such schemes had beneficial effects on employment and investment. They could find none. Subsequent examination of profit-related cash payments showed no discernible effects on corporate financial performance or a number of other important economic indicators. Other analysts of the 1984 survey identified a role for trade unions in whether the

various types of scheme were present, as well as a number of other determinants.

Unions and employment

The existence and size of a trade-off between pay and jobs has been a matter of contention within economics for a long time. Unions have been seen by many as being at the heart of this trade-off. It is therefore surprising that some time elapsed before the WIRS surveys were used to examine the association between union presence and employment growth or decline. A simple but striking tabulation of union density and employment change in the sourcebook on the second survey suggested that unions were strongly associated with declining employment in the private sector of the economy. Subsequent econometric analysis has shown that the effect is robust to a large number of controls and that the *ceteris paribus* employment growth differential arising from union recognition is of the order of minus 3 percentage points per annum. This is similar in magnitude to that subsequently found in the first US and Canadian micro-economic studies of this issue.

Economic performance

Nationally representative micro-data on the performance of economic units, where available, are most common at the level of the enterprise or company. At this aggregated level it is difficult to investigate the impact of management and labour relations because, *inter alia*, these features may vary widely within multi-site enterprises. No single level of data collection and analysis is appropriate for addressing the issues of corporate performance. The theoretical entity of much micro-economic theory, the firm, has no clear real-life referent; it certainly does not coincide with any economy-wide standard statistical data units. But in so far as individual workplaces do coincide with economic decision-making units, there seemed good reason to collect in WIRS some rudimentary information on their performance so that evaluation of labour relations practices could include some reference to their economic impact.

In the first survey in the WIRS series a single question of this type was addressed to the management respondent who, it should be remembered, was the most senior manager dealing

with personnel or labour relations matters, although in most cases had broader management responsibilities. It was confined to those working at establishments in industry and commerce. Some results indicating that financial performance was lower in unionized workplaces were reported in the initial sourcebook. The question was modified in the 1984 survey to improve its precision and subsequent analysis of non-response revealed that it was inappropriate to certain types of establishment. As a consequence the clearest cases where the question was inappropriate (head offices and other administrative units) were filtered out of the question in the third survey.

Economists became interested in the data from this question when the results of the second survey were released. The focus was the association with trade union activity. Scepticism about the crude measurement of the variable was moderated as a result of the analysis and the work provided reassurance that questions about economic outcomes and conditions were a valuable part of the WIRS design. It also led to suggestions for collecting more information of this type in the 1990 survey, much of it obtained from a second managerial respondent, the most senior manager responsible for financial matters.

Brief examination of some of the new questions asked of financial managers has led to a number of useful findings. The first concerns the type of economic unit which occurred in the sample of cases where financial managers were interviewed. The results confirmed the expected variety of financial unit and showed how inappropriate it would be in a survey of establishments to rely on financial performance measures that assumed a single type of unit (Millward, 1993a or b). In particular it showed that reliance on a profits-based measure of performance would be inappropriate for about one third of this particular sample because they were cost centres and simply were not accounting units where profits were measured. Indeed, it would only be reasonable to assume that 57 per cent of the sample of respondents could attempt to answer a question on the rate of profit of their establishment because only in these cases did the establishment coincide with a profit centre or company for accounting purposes.

In fact the next item in the financial manager interview put just such a question to this subset of respondents. The question was, "In the last financial year what was the approximate gross rate of return on

capital here?" Non-response to this question amounted to 20 per cent of cases. Thus valid data were obtained in only 80 per cent of the 57 per cent of financial manager interviews where a question about the recent profitability of the establishment was an appropriate question: 46 per cent of all cases where a financial manager was interviewed. This reinforces the argument in favour of the subjective financial performance measure, where 85 per cent of respondents were able to give an answer.

To summarize, the subjective measure of financial performance is applicable to a much wider range of economic units than a profit-based measure, has less of a non-response problem and contains a comparative element with reference to the product market as defined by those involved in management decisions. It also by-passes the many accounting issues that arise in the measurement of profitability. Further discussion of the pros and cons of this question and alternatives to it can be found in Millward (1993a or b).

What substantive conclusions have been drawn from this question so far? In summarizing the three econometric studies published by 1992, Metcalf (1993) notes the lack of a link between the presence of performance-related pay systems and financial outcome and focuses on the link between labour relations institutions and performance. Union recognition and the closed shop are linked with below-average performance; multiple unionism with separate bargaining units is especially disadvantageous for financial performance. Metcalf asks whether it matters, if it is only a case of shifting the distribution from capital to labour - from profits to pay? He cites 'tentative evidence' that this is indeed largely the case; again the WIRS series is the source of much of the evidence. The debate is likely to continue, with the 1990 survey data playing an important role.

The WIRS question on relative financial performance was not the only economic outcome question that was asked in the 1990 survey. Other important economic variables that were incorporated into similarly-phrased questions included:

- a) the level of costs compared with other similar workplaces;
- b) labour productivity compared with similar workplaces;
- c) labour productivity compared with 3 years ago at the same workplace.

These, and many of the other questions in the financial manager questionnaire, have yet to be evaluated and exploited.

Other economic variables included in the first two surveys and which have been the focus of detailed analyses are corporate takeovers, investment, technical innovation and organizational change.

Strikes

The 1980 WIRS was designed at a time of widespread strike activity and intense political concern about it. The questionnaires used for interviews with both managers and worker representatives asked about the frequency and characteristics of both strikes and non-strike industrial action; broadly similar questions have been repeated since. On this topic the benefits of having responses from worker representatives as well as managers have been especially apparent. The results have illuminated the causes and consequences as well as the nature and conduct of industrial disputes in ways not possible with other existing datasets. Secondary analysis of these data has focused mainly on the strike propensity of workplaces. Findings have related this to a wide range of factors including types of trade union organisation, bargaining structure, payment systems, dispute-resolution procedures and economic conditions.

Union membership and recognition

The central concerns of the survey series, labour relations structures and practices, have also increasingly become the subject of secondary analysis. A growing literature on the determinants of trade union membership has broadened the range of explanatory factors greatly beyond those that have historically been used in studies based on aggregate time series or, more recently, on surveys of individuals. A similar development has occurred on the determinants of union negotiating rights.

Public policy uses

It should be evident from the above discussion of primary and secondary analysis of the WIRS datasets that a great deal of use has been made of the surveys to inform public discussion about labour relations practices both directly and through the educational system. In an area as politicised as labour relations

is in Britain it would be far harder to substantiate a claim that findings from the surveys have directly affected government policy. But the surveys have unquestionably provided information about a wide range of employee relations practices on which there was little other systematic information available. On many of these there have been important changes in public policy, including primary legislation. Examples include numerous features of the conduct of industrial disputes, union membership (closed shop) agreements, the payment of union dues, and the determination of pay through multi-employer agreements. In other areas of policy, such as the structures for communication between management and employees, the survey evidence has been used to argue against legislative intervention. Recently the 1990 survey finding that fewer than half of all employees were covered by collective bargaining (compared with a substantial majority in former times) has been used to justify further withdrawal of state support for trade unions. Broadly speaking the descriptive accuracy of the survey results has not been doubted, even though arguments using them as evidence may have been highly contentious.

Similar surveys in other countries

Britain has not been alone in seeing a need for systematic evidence about the structures and practices of management-employee relations, collected through comprehensive, establishment surveys. A very similar survey to WIRS was carried out in Australia in 1990 (Callus et al. 1991; Whitfield, Marginson and Brown 1992) and secondary analysis on the publicly available micro-data has generated a growing literature. Fieldwork for a similar survey in France began in April this year. There are also plans for a survey of comparable design in the Republic of Ireland. However, compared with surveys of individuals, international comparative research using establishment surveys of this type is in its infancy.

Conclusions

Experience with the British Workplace Industrial Relations Survey series has demonstrated the usefulness of nationally representative, establishment-based interview surveys for a number of different purposes. Few would argue that the WIRS surveys have not proved their worth in the field of labour relations, on which they have largely been focused. But they have also been used to address important

economic issues that were not the *raison d'être* of their design. These include the union wage premium, numerous other 'effects' of trade union representation, and a range of sources of influence upon economic performance at the micro-level. Their utility for addressing issues in both labour economics and in main-stream economics is well testified by the rising number of research papers that use them. Moreover, the status of the academic and policy analyses based upon them is greatly enhanced by the fact that the WIRS series is founded on proper, nationally representative, probability samples. The public availability of the micro-data is crucial to the credibility of the findings.

Clearly the range of information obtainable through establishment-level surveys is limited. And using face-to-face interviews, especially with multiple respondents, is expensive. But, in the author's view at least, workplace-based surveys of the type discussed here have a key role in understanding the labour market and the real economy, a role that is now becoming more widely recognized in Britain and other countries⁴.

Establishment surveys are a distinctive type of social survey with many conceptual and practical problems that are different in nature from those encountered in surveys of individuals or households. They have an important place in the armoury of research methods used to describe and analyze the functioning of economic systems. They deserve to be more widely used and available.

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NOTES

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2. Technical reports and copies of the three sets of questionnaires, as well as the complete micro-data from the three surveys, are available at cost from the ESRC Data Archive at the University of Essex, Wivenhoe Park, Colchester, Essex C04 3SQ, UK.

3. The point has been given more elaborate treatment in Millward (1993 a and b). Work on the lines suggested there is in progress.

4. A forceful plea for more data on the employers' (demand) side of the US labour market has recently been reiterated by Hamermesh (1993).

THE IMPORTANCE OF ESTABLISHMENT DATA IN ECONOMIC RESEARCH*

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Introduction

As part of their basic function, statistical agencies collect information from establishments and then aggregate it for publication into sectors such as industry, region, or economy. Researchers and policy analysts regularly employ these establishment aggregates to estimate economic models and conduct policy analysis. Most economists and statisticians are very familiar with such aggregate measures -- among them, industry shipments, GNP, retail sales, and inventory changes -- and their uses. The many uses for traditional establishment-based aggregate cross-section measures, such as those used in national income and product accounts, are well known. What is less well known is that this aggregate cross-section focus for data products is far too narrow and ignores important economic and policy needs for establishment data.

In this paper I direct attention to the importance of establishment microdata and its access by qualified researchers. The relatively heavy use of aggregates by researchers and policy analysts is more a reflection of supply than demand. Given a choice, most users prefer microdata. Where this is impossible, statistical agencies must broaden the scope of their product offerings and provide more information regarding the statistical properties of the aggregates they release.

Aggregation effectively changes the unit of analysis from the establishment -- an economic agent -- to the sector, industry, region, or economy. This change, from the establishment (or firm) to an industry or other sectorial aggregation, is not innocuous. The conditions under which an individual economic agent's behavior can be adequately represented by the "average" agent's behavior are quite restrictive. If they are not met, then serious measurement error is introduced into estimates of many economic models.

Economists value establishment data not merely for the evaluation and correction of measurement errors in economic models estimated with aggregate data. A broad range of issues simply cannot be addressed without microdata on establishments and the firms that own them. For example, many policy questions revolve around the issue of who bears the costs of particular policy actions -- who wins and who loses.

Such questions cannot be answered satisfactorily without individual microdata.

The Establishment as the Unit of Analysis

Economic analysis is generally based on a model of individual behavior that specifies the objectives and constraints facing the economic agent. Agents are assumed to maximize an objective function subject to those constraints. The maximization problem can be specified either as a static or dynamic optimization. Solutions to such problems provide relationships for the endogenous variables, the variables the agent has choice over, as functions of the exogenous variables of the model. Using estimates of the parameters of these models, analysts examine the effect of some change in the agent's environment on her behavior.

For many problems, the establishment is a sensible unit of analysis. For example, from the standpoint of the production decision, the choice of labor, energy, materials, and capital for use in output creation is often made at the plant level. While the firm is the ultimate decision-maker, and thus the preferred unit of analysis for most problems, establishments have very different behavioral patterns, even when owned by the same firm. Thus, establishment data are also necessary in order to understand the behavior of the firm. (The behavior of one establishment is not completely differentiated from another simply by the identity of its owner.) Establishment data are also necessary in order to estimate the marginal impact of some event -- for example, a purchase or divestiture of assets -- on the firm.

Focusing on the production relationship, one can see that the establishments are the primary purchasers of the factors of production: labor, materials and capital products produced by other establishments, services, and energy. Even though the primary resource allocation decisions are likely to be at the firm level, establishment data are also useful in analysis of technical change, both product and process, since technical progress is characterized by changes in the

production relationship. Similarly, the establishment must be the unit of analysis for many environmental issues. Environmental problems involve the production of two outputs, products (good output) and emissions (bad output), at the same establishment. Understanding the relationships between the "good" and the "bad" outputs is essential in developing environmental policies.

Aggregation and Establishment Microdata

Earlier I noted that most published data reported by the U.S. statistical system are aggregations. These aggregations reduce the myriad of individual detail to manageable proportions and provide confidentiality protection. Unfortunately, information is lost or distorted in this aggregation process. For some problems, this loss of detail may not matter: The phenomena under study may be sufficiently understood without reference to the underlying microdata. Without analysis of the microdata, however, it is virtually impossible to evaluate the extent of any aggregation error. Moreover, perfectly acceptable aggregate measures at one point in time may be misleading at another point in time because the economy is constantly changing. Aggregation must therefore be approached with substantial caution and must be continually re-evaluated using microdata. This is an important use of establishment data and, in the absence of universal access to the microdata, it cannot be accomplished without an internal program of analytic subject matter research by the statistical agency. Even then, it is difficult to provide a general demonstration of the importance of aggregation errors in economic research, because the extent to which aggregation bias is present is model-specific. That is, the importance of the error **depends on the application or use of the data.** Thus, the analytical research program needs to be broadly based.

While it is clear that establishment microdata are preferred for many applications, the extent of the problems that arise when aggregates are substituted for microdata on establishments is less well recognized. In earlier work, McGuckin (1990), I argued that the homogeneity of establishment behavior that is assumed in empirical studies based on aggregate data is not evident in the detailed data. A legitimate response to the lack of homogeneity among establishments is that this fact is not sufficient to invalidate the use of aggregate data. Even if the behavior of the individual units to be aggregated is idiosyncratic, the use of

aggregate variables introduces negligible bias in the estimated relationship under certain conditions. Unfortunately, as a long line of economic research has demonstrated, these conditions are quite restrictive. (See Solow, 1960 and Fisher, 1993). Thus, even if one is interested only in aggregate responses to alternative policies (such as the effect of changes in pollution regulation, defense reductions on employment in a sector, or tariff increases), aggregate industry responses will not be captured by a simple linear function of an average or representative firm if the responses of individual firms to changes are very different. In such cases, industry responses will be a weighted average of individual responses, and the weights can change over time.

Recent empirical work at the U.S. Bureau of the Census' Center for Economic Studies (CES), by Baily, Hulten, and Campbell (1992), Davis and Haltiwanger (1990 and 1992), Doms (1993), Doms and Dunne (1992), Dunne (1991), Dunne and Roberts (1990 and 1992), Dunne, Roberts, and Samuelson (1989), Jarmin (1993), McGuckin, Nguyen, and Andrews (1991), Olley and Pakes (1992), Streitwieser (1991), and Troske (1992) extends the evidence on heterogeneous plant and firm level responses I cited at that time. This body of work -- and there is much more from CES, as well as from other sources (e.g., Bresnahan and Raff, 1991, and Bertin, Bresnahan, and Raff, 1992) -- shows a striking degree of heterogeneity in the levels and movements of variables such as productivity, employment, growth, output, product structure, investment, and ownership change among establishments located in similar markets, industries, and cohorts.

Moreover, the heterogeneity is not simply a matter of differences in firms and plants continuously operating in an industry. Entry and exit decisions also generate aggregate industry responses that are not simple linear functions of the representative firm. Thus, any analysis of the aggregate effects of a policy or environmental change in a market in which there is entry and exit must incorporate not only the distribution of the response of the market incumbents, but also an analysis of both the entry and exit that the policy or environmental change induces. For example, recent work at CES by Olley and Pakes (1992) demonstrates significant errors in aggregate estimates of productivity relationships in telecommunications, an industry with substantial entry and exit.

This last example illustrates more than the need to evaluate aggregation bias in traditional cross-section

models. It also illustrates that longitudinal microdata are necessary to sort out the fundamental role of entry, exit, and changes (growth and decline) in continuing establishments. They are also necessary for many other economic issues, as is made clear in the next section.

Many Problems Require Microdata

The problem with exclusive use of aggregate statistics is not simply one of inferior estimates of economic relationships such as the earnings equation, elasticities of production functions, or inventory adjustment coefficients. With aggregate data alone, it is impossible to examine the differential effects of policies on the entities classified within the aggregate. Examining individual changes is necessary if particular components of an aggregate movement are significant.

As an example, consider the problem of evaluating product choice and energy usage decisions in reaction to a change in energy prices. This kind of problem arises in assessments of economic or environmental policies such as imposition of an energy tax. Energy taxes raise the cost of energy, and, in theory, lead establishments to economize on energy use. In the short run, the possibilities for substitution are likely to be restricted so that prices rise for products requiring relatively high energy inputs for production. This causes consumers to reduce their purchases of these products. Consumers will also shift away from products that require substantial energy for their operation (e.g., away from low gas mileage cars).

Ascertaining the precise effects of such policies must include estimates of various elasticities of substitution in both the short and long run. These estimates require information on the mix of products and inputs used by establishments, as well as information on how these factors change over time. Since long-run adjustments in products and processes that substitute for those using high amounts of energy also involve the allocation of research and development resources, decisions on these resources (probably made at the firm level) must also be explicitly treated in the modelling process.

To study this energy tax problem, research associates at CES are extending a dynamic model of firm behavior developed in recent work (Pakes, Berry, and Levinsohn, 1993) to evaluate how structural changes, such as price shocks or government gasoline mileage requirements, affect the automobile market. The model incorporates both the demand and supply side of the market. It includes estimates of the demand

for particular car models in terms of their characteristics. It also includes the supply side of the market through plant production relationships and firm specific technology differences as well as through allowances for entry and exit. The use of longitudinal establishment microdata, along with detailed data on product characteristics from public records to describe the demand side of the market, allows for estimation of the relationships between automobile production costs and automobile product characteristics -- the "cost characteristics surface." In the absence of establishment microdata, a model completely describing the effects of the policy change is not possible. For example, in this application, the responses of small high mileage car makers and low mileage car producers differ. Also, poor people who cannot afford to shift to new high mileage cars will bear a significant burden of the tax. They will continue to use their high mileage cars longer than high income drivers (income effect). Aside from equity issues, this will affect dynamic adjustments and delay increases in the miles per gallon of the average car on the road.

The importance of explicitly dealing with establishments as economic agents is also illustrated in the literature on labor markets. Until very recently, most labor market analyses were carried out using demographic data on individuals -- the supply side of the labor market. One type of analysis consists of trying to explain earnings differentials among individuals by various characteristics such as education, sex, race, age, family status, and occupation. These studies offer many insights into the factors that explain differences in earnings and have been important in formulating social policies (e.g., support for education, a factor that is positively related to earnings). Despite a large literature on this subject, including analyses of available public use microdata sets on individuals, and despite enormous interest by economists, social planners, sociologists, and policymakers, among others, the earnings models explain less than 50 percent of the variance in earnings in most studies. One explanation for this is that it has been difficult to include the demand side of the market in earnings equations. For example, education stock and skill levels are not completely captured by variables such as years of formal education derived from the supply side data. On-the-job training, learning by doing, and general experience all contribute to earnings and are, at least partially, reflected in the characteristics of the plant in which the worker works. Several studies at CES have documented important differences in worker wages

associated with individual establishment characteristics that are not captured well in models estimated with "representative" firm industry data. See Dunne and Roberts (1993) and Dunne and Schmitz (1991).

Research with longitudinal microdata has been at the center of an important recent development in macroeconomics: The idea that understanding aggregate fluctuations requires analysis of time-series fluctuations in the cross-sectional distribution of activity across establishments. This idea contrasts with the standard empirical approach (based on representative agent models) in macroeconomics, which uses aggregate data at the economy-wide or industry level of disaggregation. While pursuit of this new idea is in its infancy, it has already yielded many new insights. For example, the conventional view of recessions -- that jobs disappear temporarily while the creation of new jobs declines, and that most workers are recalled when aggregate demand recovers -- appears incorrect. In fact, job creation continues almost unabated during recessions, while job destructions increase. Furthermore, most jobs created are created permanently, and most jobs lost are lost permanently, at least for the manufacturing sector. See Davis and Haltiwanger (1990 and 1992).

This research also shows that variations in new job creations and destructions, which can be calculated only from longitudinal microdata on establishment employment, are primarily associated with movements among plants within the same industry. That is, both lost jobs and new jobs are observed simultaneously in the same industry as transfers from one plant to another. This means that, for example, the effects of regulatory changes that may force firms to substitute away from labor and towards capital in production will depend on the detailed characteristics of the distribution of plants within an industry and cannot be captured by a representative or average industry response.

Aside from its policy relevance, this new line of macroeconomic research has fundamental implications for statistical data programs. For example, the research suggests that, at a minimum, construction of new measures of the distribution of economic activity within sectors -- such as (1) higher level moments (e.g., variance, skewness, and kurtosis) and (2) longitudinally based measures such as job creation and destruction statistics -- will be required for policy analysis. See Caballero (1992), and Haltiwanger (1993).

Another area of study in which establishment microdata are essential is in the evaluation of the effects of ownership change (mergers, divestitures, leveraged buyouts, etc.). Firms, particularly large ones, have multi-establishment structures, and many firms are diversified across a wide spectrum of industries and products. In order to assess the effects of mergers, the analyst must be able to separate out the components of the firm both at a point in time and across time. This allows for evaluation of the performance of the firm and its components pre- and post-merger. See Lichtenberg (1992), McGuckin, Nguyen, and Andrews (1991), and Long and Ravenscraft (1992a and 1992b).

The use of establishment data in understanding the nature of the firm is not restricted to analysis of the role of ownership change in performance. (One reason for emphasizing ownership change studies here is that they are essential in understanding the evolution of the sampling frame for most economic statistics. They are also extremely important for many policy issues.) Since the establishment is often the site for particular sets of products and processes, it provides the natural unit for understanding the nature and interrelationships of the activities of the firm. As a geographically fixed production unit, the establishment makes it possible to identify the role of "the firm" -- as distinct from such factors as geographical and product markets -- in the establishment's operating characteristics and behavior. In turn, this provides insight into the functions and boundaries of the firm.

For example, Streitwieser (1991) shows that the pattern of secondary products produced by establishments owned by the same firm is much more closely related than those produced by other establishments with the same primary products. As another example, Gollop and Monahan (1991) show that while the structure of production has become more specialized over time, the structure of the activities of the firm became more diversified. While the focus of these inquiries is the nature of the firm, the data required are from the establishment.

Finally, I note that with the exception of the job creation and destruction example, each of these examples involved linking of data from more than one source. In fact, a substantial number of economic problems require that data from a variety of sources be linked. For example, not all plants classified in particular SIC industries are unionized. Therefore, to assess the performance of union and non-union

establishments the individual establishment data are required. Linkages between data sets require work with the micro establishment data.

Concluding Comments

Given the extensive use of cross-section aggregates in economic and policy analysis, it is no wonder that the 1993 International Conference on Establishment Surveys (Buffalo, New York, June 1993) would focus its efforts on improving estimates of these establishment-based aggregates. While the quality of these aggregate estimates is of considerable importance, recent work at CES using establishment microdata shows that establishment behavior is often idiosyncratic with respect to aggregation categories (e.g., industry). These findings are reinforced by new work with data from many other countries -- (e.g., Canada (Baldwin and Gorecki, 1989, just one of many examples); England (Millward, 1993); Germany (Wagner, 1992, Gerlach and Wagner, 1993, and Boeri and Cramer, 1991); France (Abowd, Kramarz, and Margolis, 1993); Ireland (Keating and Keane, 1989); and Israel (Griliches and Regev, 1992).

This means that statistical agencies must begin to seriously rethink the way they view establishment data products. Two possibilities exist for increased microdata access. First, statistical agencies can expand opportunities for access to their establishment microdata. For a description of one such approach, a plan for regional research data centers, see McGuckin (1992). A second and complementary approach is to start to develop new data products that allow researchers to better describe the evolution of the distribution of establishments. This approach is suggested by Caballero (1992), and Haltiwanger (1993) and is now beginning to be explored seriously as part of the CES research program. For example, the possibilities of capturing the economic behavior of individual establishments using models of aggregated behavior, supplemented with higher-order moments of the distribution of certain variables, is a primary objective of several new CES projects. While this work is in its infancy, it has the potential to redefine the way statistical products are produced and substantially increase the usefulness of establishment-based aggregations.

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THE PRODUCTION OF INDUSTRIAL STATISTICS: BRAZILIAN RECENT EXPERIENCE

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The aim of this paper is to discuss the production of industrial statistics in Brazil carried on by the Brazilian Statistical Office - IBGE. The main focus of this discussion will be the definition of the unit of investigation (standard unit) adopted in the industrial surveys along the time.

It is an assumption of this paper that economic analysis and statistical production are complementary activities (cf. Triplett, 1990) and so, an important challenge to a statistical institution is to keep its capacity of explaining economic activity as something that evolves through time. In this sense we develop this paper, first making an attempt to identify different theoretical approaches which support definitions of unit of investigation usually employed in industrial surveys. In the second part we discuss the definitions employed by IBGE and their evolution through time, and in the third part we make a summary of our comments.

I. STANDARD UNIT: THE THEORY BEHIND

The relevance of a piece of information depends on the appropriateness and precision, in conceptual terms, of the definitions of the process that is under study. A piece of information is an abstraction, built as an attempt to select from a concrete object significant aspects to reveal its nature. In our case we are interested in discussing the relation between the theoretical firm and the definitions adopted by IBGE to approach the firm in the real world. We identify two different theoretical definitions that denote different emphases. In one case the firm is seen as a production function, in the other, the firm is seen as a policy maker.

a. the technical approach

We identify as the technical approach the emphasis on the definition of the firm as a productive establishment, where it is manufactured only one product or similar products, employing the same raw materials or the same industrial processes. This approach allows to isolate the technical problems involved in the production process, and it stresses the point that the object of study is the mechanism of

transformation of Nature into useful goods. It is assumed, under this view, that the firm knows which is the most efficient technique available, and does not face any difficulty in allocating resources to obtain the maximum output at the lower cost.

The source of uncertainties faced by the firm is limited to the choice of the technical combination of the production factors, given their prices. Traditionally the technical approach assumes competitive markets, where efficiency can be reached without any restriction, although this approach is not incompatible with other forms of market organization. Assuming perfect competitive markets, the theory of the firm is developed in an environment of perfect information, and decisions made by the firm concern mostly with the allocation of productive resources - labour and capital - that will enable the firm to maximize its profits. Up to the mid seventies IBGE has followed this formulation as the only description of the industrial firm.

This approach of the firm evolved, after mid seventies, from the single plant firm to the multi-plant firm allowing for the studies of industrial organization. We distinguish this sort of emphasis from the strategic definition of the firm, that we shall see below, in the sense that much consideration is given to the knowledge of the minimum size of the plant as a potential barrier to the entry of new firms in the market. Although many empirical studies carried on in the United States in the fifties, sixties and seventies showed that the importance of the technical barriers could not be overestimated (see Feijó, 1980, chapter 2), they were the starting point of the analysis about the degree of competition of the markets. Investigations about the laws of returns, the shape of the scale curve and the indivisibility of the factors of production were the focus of those studies.

The choices faced by the firm in the context of industrial organization studies are how to protect their markets in order to increase their profit share. This means that the main concern of the firms is about their pricing policy which can aim either to avoid new entrants in their market, or to increase their share in their market or even exclude competitors.

Ansoff (1969) summarizes his criticism to this view as two-fold: on one hand it failed to explain

the behaviour of real firms and, on the other, it is not useful to managers in their decision-making activities. The economic literature in the seventies and eighties devoted most attention to discuss the theory of the firm emphasizing not only its technical aspect but also its management aspect. Following this debate, the industrial surveys carried on by IBGE in the mid eighties introduced a new unit of investigation, in an attempt to cope with a broader definition of the firm.

b. the strategic approach

We can oppose the technical definition to a definition that sees the firm as a centre of policy-making. Its main objective is to produce in order to increase its money profits, and so its potential growth rate. It is assumed, in this conception, that the strategic problem faced by the firm is not knowing its demand function; technical characteristics of production do not severely interfere alone in its strategic decisions.

In this case, the firm is approached as an institution that controls productive assets and which, in order to bring them into operation or to expand its productive capacity, can issue claims to absorb resources from the community. This institution thus has a double feature - it not only transforms real resources, but also deals with financial resources. This dual characteristic is of great importance in the study of its behaviour because it is the efficient administration of both aspects that assures its long run survival. The aim of this institution is to survive which, in a competitive world, with imperfect information, means to grow and to expand (Feijo, 1993).

Defining the firm in this way implies that its interaction with the external environment in its many aspects should be an important focus of attention if statistical surveys are to describe its actual, ex-post path of growth. In the publication of the 1985 Census of Enterprises this point is stressed : "The enterprise as an investigation unit permits a better understanding of its strategy through the analysis of economic and financial indicators like : the level of profits, the mark-up, the capacity of payment" (IBGE, 1990, p. xii).

The motivation of the firm is to increase its long term profit and its financial and investment decisions will be taken to achieve this aim. In this kind of assumption the firm is assumed to be operating in several markets, and also that it can allocate its funds between productive assets and

financial assets, besides absorbing funds from other agents.

Where and how to invest are crucial decisions (in the sense that they do not allow for repetition) for the future of the firm, and as the future involves a great deal of uncertainty, the outcome of an investment decision cannot be predicted with precision. Also, it should be remarked that the task of the "managerial team" when implementing investment plans involves the promotion of changes in the administrative structure of the firm that are required to carry out these plans. The dimension of the challenge posed by investment decisions therefore involves not only dealing with uncertainties of the future, but also with the ability to organize the firm efficiently (Chandler, 1962).

Investment decisions, when they are made, are followed by the way new plans will be financed. The firm can have all the resources it will need to implement the investment project or it can resort to external sources for these resources. It is in this context that we can say that the administrative and financial structures of the firm are the result of its strategy of growth. The execution of investment plans not only involves dealing with considerable resources, but also poses new administrative problems that require innovative solutions. On the other hand, the ability of the firm to fulfill the financial requirements in the markets where it operates and where it intends to operate will also determine its rhythm of expansion.

The firm described above must be treated as a "living institution" with a unique growth path which is translated into its administrative and financial structures. The limits to its growth, as stated by Penrose (1980), are given by its capacity to take advantage of opportunities offered by the external environment.

c. structural difficulties involved in each approach

The emphasis on the technical concept to define an industry implies the desegregation of the local unit into several different establishments. This desegregation should follow some procedures which in empirical terms are dependent on a previous description of the productive process. Moreover, this description may not be adequate to fit all productive processes, and its identification may imply some subjective judgment, as we shall see on the next section. In this sense, to reach at a production function through empirical surveys is a hard task.

Another empirical difficulty in the technical approach is related to the measurement of the size of the establishments, that is to say, the scale of production (the average cost of production, given technology and relative prices at a point in time, cf. Pratten, 1972). According to the economic literature, it is important to the study of barriers to entry the concept of the minimum optimal size of plants, which allows for the exploitation of economies of scale. In practical terms, the measurement of the scale of production depends on several hypothesis, such as the product mix, the numbers of shifts and hours of operation, the downtime for maintenance, and so on. To this list it should also be added that not only technical factors influence the size of the firm; economic advantages, such as facility in obtaining credit, have an important role as well.

Besides empirical problems we can also mention theoretical problems that make it difficult to define a production function in empirical terms. The theoretical definition of a production function (where "relative prices of the factors of production are exhibited as a function of the ratio in which they are employed in a given state of technical knowledge", Robinson, 1964, p. 114) draws the boundaries of the best technical combination of the production factors, given their prices. But, it should be considered, in the real world, establishments may operate a technical combination that is located below the curve of the best production function (which allows for the maximum output at the lower production cost). Market imperfections on the supply and demand side, lack or incomplete information and practical difficulties in implementing new techniques of production are some of the problems that prevent the firm from reaching its frontier of production.

It should be added, as another theoretical difficulty, the classical debate in economic literature, about how to evaluate the production factors, more specifically capital, in the production function. As stated by Robinson (1964, p. 115) "Should capital be valued according to its future earning power or its past costs?" To this question we can add another obstacle that is price instability. In an environment of chronic inflation, such as Latin American economies in recent years, the valuation of long lasting assets does not have a unique solution.

The strategic approach, on the other hand, allows for an easy identification of the firm, normally defined as a legal institution. The empirical difficulty lies on the evaluation of variables such as expectation, uncertainty and strategies.

Theories of the firm that focus on its speculative nature, where plans are elaborated based on future expectations about the behaviour of the market, assume the formation of expectations as an important link between the microeconomic dynamics and the macroeconomics results. The firm assumed as a policy-maker makes decisions about production and employment, which in the aggregate, describe the growth path of the economy. In this context, the growth of a market economy is based and dependent on the performance of the firm.

Decision is a relevant element because the environment does not supply firms with complete information which would allow them to identify the best choices. Expectations that guide decisions emerge in the process of the decision making to fill the time lag between the decision and the realization of plans.

In sum, the point to be highlighted is that it is through the perception of the environment that the firm forms its expectations, but the environment itself changes as plans are implemented. According to Shackle (1970), the difficulty about the study of the decision making in economics is that knowledge is about the past, but decision is about the future.

"If the act of decision or choice contributes in any true sense to the making of history, ...then there can be no knowing for certain what will be the consequences of any course of action which he may now begin. For those consequences will be partly shaped by decisions taken in time to come, decisions which, we are supposing, introduce into the stream of history something that was not previously implicit in it." (p.21)

II. THE IBGE EXPERIENCE

There is a great distance between theoretical propositions and empirical definitions, although the latter should have a reference in economic theory. IBGE, as the official statistics producer in Brazil, has always directed its surveys to flexible conceptions in order to accommodate a great variety of theoretical propositions.

Two moments in the production of economic statistics can be identified in IBGE in the later years. The first, during the seventies, was marked by the beginning of the production of the input-output tables. Given the demands for the building of the matrix of economic relations this experience led to diversification and integration of the statistics produced by the Institution. As an example of diversification it should be mentioned

that monthly surveys of industrial production were carried on systematically, a system of price index started to be constructed, an annual survey at household level was implemented as well as a monthly survey about the level of employment.

Besides this diversification in the statistical production, the elaboration of the input-output tables brought into discussion the accuracy of the definition of the unit of investigation. It was understood at that time that the unit of investigation should be the most homogeneous in terms of the productive process. The emphasis on the establishment, in opposition to the concept of the strategic firm, aimed to stress sector analysis, such as the composition of production and employment, geographical distribution of production, technical coefficients and productivity. The emphasis on the technical aspect of production would satisfy the requirements to produce the input-output tables as well as it would allow for studies in industrial organization. In the mid seventies, statistics were produced linking establishments belonging to the same firm (considering the business firm as constituted by one or several productive establishments), allowing for studies about diversification and industrial concentration.

Another special moment on the statistical production started with the 1985 Economic Censuses, when the firm was introduced as a unit of investigation. That was the first attempt to employ in the industrial surveys the definition of a firm as distinct from the establishment. In the eighties IBGE became responsible for the elaboration of the National Accounts and so the investigation at the firm level was an important step to improve data about income generation and distribution. Pieces of information about total direct and indirect costs, total receipts and expenditure, and so about income and profits, are only available at the firm level. As we saw before, the firm is also the place where economic decisions are made, according to the evaluation of individual agents about the environment, defining the future of the business.

For the 1985 Economic Censuses IBGE collected data on firms registered in the Income Tax Register comprehending mineral, manufacturing and construction industries, retail and wholesale trade, service industries and transportation. The processing of the information integrated data for firm and establishments. The results were presented for 78 kinds of economic activities defined in the 1985 Economic Census Classification, where each enterprise was classified according to the activity responsible for its main receipt. The firm defined in such a way may comprehend more than one market

or industry. In this sense, the firm can be analyzed in several ways as it is possible to identify different segments directly linked to its several activities. The productive establishment defines the link between the firm and an activity.

The planning of the 1985 Economic Censuses deepened in IBGE the discussion about the definition of industrial establishment. Only in industrial surveys individual plants are divided into several establishments according to the number of activities identified in a local unit. In this sense, the definition of establishment depends on a previous concept of industry, that means to say, in a precise distinction among the activities described in the Classification System. As we saw before, the aim on the segmentation of the productive sector was to produce information at the level of specific and homogeneous industrial activities. To adequate the definition of the establishment to the needs of the analysis, the Classification of Activities has been continuously reviewed along the time. So at this point it is important to exam IBGE's Classification System.

a. IBGE Classification System

A Classification System allows for the segmentation of the productive sector according to the nature of the goods and services produced. According to the economic theory, this segmentation is based on the linking of products to industries or specific markets what is translated, into practical terms, in the classification of the productive system into Products and Activities. The link between these two classifications is made through the association of a set of one or more products to each activity.

The IBGE Classification System to the industrial sector is associated to a classification of products, raw materials and industrial services, built through the information obtained in the industrial surveys. The list of products discriminates around five thousand items describing the standard unit of measurement and the activity to which the product is associated to. The classification of activities discriminates activities aggregated according to the following levels: class, sectors (two digit), aggregate group (three digit), group (four digit) and segregate group (six digit). These different levels are associated to an hierarquized structure of numerical codes (IBGE, 1988). In this sense the classification of activities does not determine a unique division of the productive sector, it is characterized by an hierarquized structure where the

activities are grouped in increasing levels of aggregation.

The classification of activities has been suffering modifications along the time as a result of the transformations observed in the productive system. These modifications can vary from a reclassification of certain products or activities to the regrouping of products and activities and the introduction of new activities, what affects the degree of the fragmentation of the industrial sector. According to the 1985 Census the industrial sector was divided into 22 two digit, 141 three digit, 393 four digit and 690 six digit. Along the time the two digit level of classification has been the same.

Lack of uniformity is one of the empirical problems faced by the classification of activities. Although classifications of activities are based on characteristics of the productive process (the technology employed, the inputs used and the organization of the production), very often it contemplates the use of the goods and services also as a criterion. One question often posed is that which level is the closest to the theoretical concept of an industry and a market. According to Guimaraes (1990), the level of activity classification that comes close to the theoretical concept of industry or market is the group.

The classification system adopted by IBGE differs from the one used by other countries and the one by UN. The project to adopt the UN classification (Rev.3, or a classification close to it) depends on the realization of the next economic censuses, when the introduction of a new classification could be made, taking into account the comparability between the old and the new system.

So, given the link between the classification system and the definition of an establishment, we move on next to discuss the characterization of the establishment and the problems involved in its segmentation.

b. Characterization of the establishment

According to Guimaraes (1990), the empirical definition of the establishment results from the combination of two modes of segmentation of the enterprise: according to the geographical distribution of production and according to its insertion in several industries or economic activities. In practical terms, the characterization of an establishment comprehends a set of criteria and operational proceedings that are relevant to know to the correct interpretation of the relevant statistics related to the productive system.

Let us consider the industrial firm operating in more than one address. Each place is a local unit. When, in this local unit, it is produced only one product, and so there is only one activity (as defined by the six digit classification), it is characterized the existence of only one establishment, that is to say, the local unit coincides with the establishment. This situation does not alter when several products are produced in the same local unit, since those products are associated, according to the classification of activities, to only one six digit.

Let us consider now the case when in a local unit the production of a set of products corresponds to distinct six digits. IBGE identifies as many establishments as the identified number of productive activities developed in the local unit, considering the availability of the information. To avoid excessive fragmentation of the local unit, IBGE defines an additional condition to divide the establishment, that is a minimum number of 10 employees.

When desegregation is not possible, the correspondent products of several six digits can be aggregated in an unique establishment. In this case the establishment should be classified according to the value of production associated to the several products, following the classification system. So the steps to be followed are: to define which is the predominant two-digit, in this two digit the predominant three digit, in this three digit which is the predominant four digit and so on. This procedure leads to a certain overestimation of the results of the predominant groups. On the other hand, the statistics related to the products are not affected, and so the sum of the value of production of the correspondent products of an activity, determined from the product statistics, can differ from the value of production of this activity, obtained through the activity statistics.

The procedure to classify non-productive activities, such as quality control, administrative and auxiliary activities, is to aggregate them to the productive establishment. When these activities attend to more than one productive establishment, in the same or in a different local unit, the procedure is to consider this establishment as a non-productive establishment. The final use given to these information has varied through time.

This brief presentation of the norms and procedures adopted by IBGE when characterizing an establishment does not intend to be complete, as this subject leads to a great number of particular situations. The point here is to highlight the peculiarities of the application of the concept of establishment, in order to evaluate its implications to the statistical results.

The criterion to break a local unit into several establishments aims to obtain productive segments which are technologically more homogeneous, and so producing more accurate technical coefficients. A common point of view nowadays is that an excessive break down reduces the quality of the final result, as several estimates have to be made to accomplish the greater level of desegregation. According to Haguenaue (1986), excessive desegregation also introduces an additional element of instability when comparing information along the time.

The aim to desegregate the establishment is to characterize the intermediate phases of the productive process. When the classification of activities stresses the technology in opposition to the market concept, the several steps of a productive chain are separated, no matter if the destiny of the production of each phase is the market or a subsequent phase of the chain. So the desegregation of the establishment increases the weight of the intermediate phases of the productive chain in opposition to the final phases.

An example taken from Haguenaue (1986), comparing the industrial census of 1970, 1975 and 1980 exemplifies this trend as well as the instability of the results in the long run.

	1970	1975	1980
	number of establishments		
Final industries			
automobile	10	13	22
refrigerators	9	15	11
Intermediate industries			
machine repair	1483	2795	3140
stamping articles	439	880	1164

It should be added, as observed by Haguenaue, that the desegregation procedure actually does not avoid the aggregation of heterogeneous activities. In several cases the description of the activity is so general that encompasses a great variety of technical processes. It should also be mentioned that the valuation of production costs lose quality with excessive desegregation as estimates, not always accurate, have to be made. Results obtained at the industry level are in this way biased as heterogeneous terms are added.

IBGE in recent years has been maturing those ideas and is moving towards a revision of the rules and procedures adopted to characterize an establishment. The new definition should consider not only the identification of technical processes, but should also reflect the industrial organization of the

country. This means to say that the concept of industry should be closer to the market concept.

According to Haguenaue, the industrial organization is not independent of the technical aspects of production, that is to say, plants dedicated to the same activity have similar structures. In this sense, the suggestion is that an establishment should coincide with a local unit. It is the size of the local unit that characterizes bigger or smaller production units, and it is the existence of several local units in a firm that shows the operation of multi-plants. The desegregation of a local unit in more than one establishment should occur only in extraordinary cases, when in the same local unit coincides clearly different productive chains. The choice for the local unit would improve value estimates as the valuation process would take into account market magnitudes. Also income and employment estimates would reflect in a more realistic way the industrial organization of the country.

This revision, on the other hand, should be followed by a revision of the classification of activities. For example, phases of the productive process in a same local unit should be reunited in a six-digit, and, under the same token, activities which are not oriented to the market, but correspond to subsequent phases of the productive process should not be identified in the classification.

III. CONCLUDING REMARKS

Although it is quite obvious that economic statistics, and in particular industrial statistics, represent an unquestionable reference to our knowledge of the economic environment, we often overlook the fact that there is not a unique way of interpreting the meaning of those statistics. We want to suggest that the main challenge to be faced by Statistical Offices is that economic reality is dynamic - it changes through time. Because the present is different from the past and will be different from the future, the idea of time is closely linked to the idea of change. The responsibility of Statistical Offices involved with economic analysis is then to identify real-world processes which are fundamental for the understanding of economic activity, and also allow for the study of new processes in the future, as history shows them to be relevant.

In this sense we discussed in this paper the evolution of the definition of the units of investigation in Brazilian industrial surveys. The economic literature about industrial organization only recently has focus its attention on the firm as a policy maker. Even authors like Bain and Sylos-

Labini, who gave a great contribution to the industrial organization literature, did not see the firm making up strategic decisions. Under imperfect competition the firm choose strategies which are affected by demand and not by technical characteristics. Until 1985 the production of industrial statistics in Brazil identified the establishment as the only unit of investigation. It was in the 1985 Economic Censuses that, for the first time, the firm was introduced as a unit of investigation. This innovation meant that the firm is seen not only as combining inputs to maximize profits, but also as administrating financial resources.

Following this innovation, the discussion about the definition of the establishment deepens in the Brazilian Statistical Office. Since the seventies the industrial establishment is characterized as a production function. This characterization aimed mainly the calculation of technical coefficients to subsidize the elaboration of input-output tables. The main problem of this practice is to carry the surveys into intermediate processes, which are difficult to valuate.

Nowadays the focus of the discussion is on the reduction of the excessive desegregation of the local units into several establishments. This discussion points out to the revision of the classification of activities which should privilege the market concept.

The definition of the establishment should coincide with the local unit, and only in exceptional cases desegregation rules should be applied. In this sense the reduction in the number of establishments would bring the statistical unit of investigation closer to reality. This proposal, in our opinion, reinforces the view that, in a world of imperfect information, what is most relevant to be known is how firms are organized and how they identify and exploit their markets.

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