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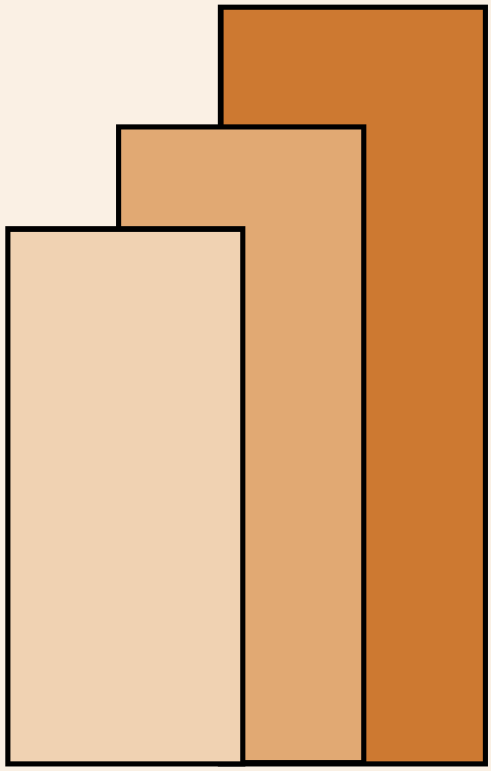
The Use of Statistics in Policy Research and Decisionmaking

Dalisay S. Maligalig

DISCUSSION PAPER SERIES NO. 94-21



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December 1994

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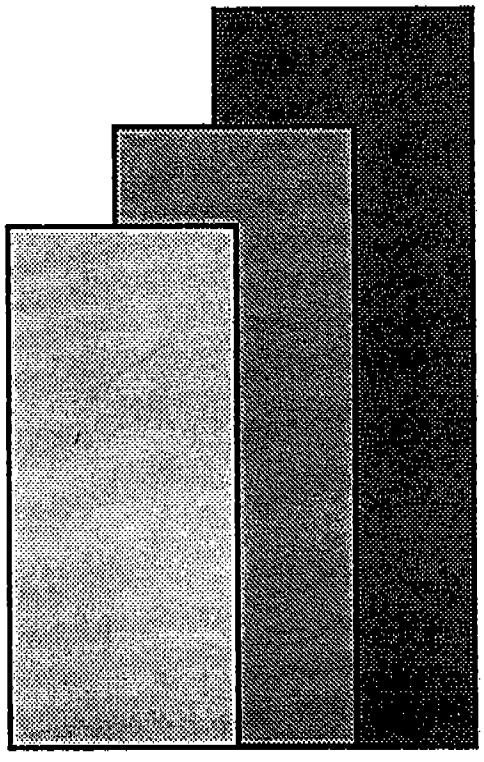

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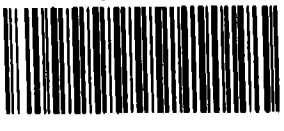

THE USE OF STATISTICS IN POLICY RESEARCH AND DECISION-MAKING*

Dalisay S. Maligalig**

1. Introduction

Reliable, relevant and timely data and appropriate statistical techniques are two ingredients necessary to produce quality policy research and sound decision-making. Data are used as basis for allocating scarce resources, evaluating and monitoring projects, validating conclusions derived from economic theories, searching inter-relationships of certain factors, identifying areas where program interventions are needed, and forecasting through the use of statistical models. Statistical techniques, meanwhile apart from their uses in the processes mentioned, are also needed in the estimation of unknown parameters and abstraction and presentation of data.

This paper investigates the uses of data and statistical methodologies in policy research and planning in the Philippine setting. The author used her experience as a statistician at the Philippine Institute for Development Studies (PIDS), interviewed leading policy researchers and studied the latest series of working and other technical papers published by PIDS in order to perform this task. The inquiries resulted in the identification of data gaps and areas for basic and applied research in statistics that may enhance policy research and planning.

On a larger scale, this paper aims to raise the level of appreciation of statistics within and outside the Philippine Statistical Community. Perhaps, this is also a small step that can initiate the movement to bridge the gaps between what statistics is being taught, what is being investigated, and what is being used.

Section 2 of this paper presents the current major uses of data and statistical methodology in policy research and planning. The next section, Section 3, identifies the existing data gaps and flaws in statistical methodology. The areas for basic research and training that are needed to enhance the use of statistics in policy research and planning are discussed in Section 4, while the references used in this paper are listed in Section 5.

2. Major Uses of Data and Statistical Methodology

The latest series of PIDS working papers and technical papers from the Journal of Philippine Development dealt with a variety of polices and issues -- income, health, nutrition, education, environment, agriculture, money and banking,h labor and employment, poverty, gender, trade, government finance and structure and production. These research and studies

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employed datasets from various sources and at different levels of disaggregation. Administrative records from various government agencies and private banking institutions are mostly the sources of government finance, health, money and banking. Meanwhile, data on income, trade, production, agriculture, nutrition, education, labor and employment, poverty and gender are taken from surveys and censuses conducted by the National Statistics Office (NSO), the Food and Nutrition Research Institute (FNRI) and the Bureau of Agricultural Statistics (BAS). For instance, *NSO's Annual Survey of Establishment (ASE)* is the source of data for the national income accounts and the input-output table. The *Family Income and Expenditure Survey (FIES)*, conducted by NSO every three years, is the data source for household income, poverty indicators, education, gender and other social welfare indicators. FNRI's quinquinneal *National Nutrition Survey (NNS)* is the primary source of comprehensive data on nutritional status of children while NSO's quarterly *Labor Force Survey (LFS)* provides labor and employment data. BAS's quarterly *Rice and Corn Survey (RCS)* is the source of rice and corn production data, while the quarterly *Other Crop Survey* provides the production data of other agricultural crops.

Data are also taken from the censuses conducted by NSO every ten years. These censuses are the *Census of Population and Housing (CPH)* which provides that is the source of population and dwelling specifications data and the *Census of Agriculture and Fisheries (CAF)* which provides agricultural crop areas, livestock and poultry inventory, and fisheries information.

The PIDS macroeconometric model of the Philippine economy is the single, most comprehensive user of the time series data enumerated above. The model consists of various equations that describe the economy. These equations are determined through the application of statistical analysis such as solving systems of linear equations, regression and time series techniques on time series data on various sectors of the economy. In turn, the model is used for forecasting outcomes of different economic factors.

The major problems encountered by the PIDS macroeconomic modelers are the: (a) national income accounts series' shift to a more recent base year, i.e. that is from 1972 to 1985; (b) adoption of new concepts in the poverty time series; (c) and new concepts introduced in the monetization of gold. Another data-related problem that besets them is the constant revision of the national income accounts. For example, this year's publication contains revised values of the last two previous years. Every time the database changes, modelers have to revalidate affected equations. The task becomes very time-consuming and laborious when revisions trickle in every now and then.

The input-output (I-O) table produced by the National Statistical Coordination Board (NSCB) from the results of the *ASE, FIES, LFS* and other relevant surveys is another dataset often used by policy researchers. The input-output framework represents the production structure as well as the various sectors of the Philippine economy. This is primarily used by policy researchers in formulating programs for economic progress. For instance, through the

use of the agricultural sector in the input-output table, Clarete (1992) examined policies on tariff, value-added tax and other liberalization measures in agriculture. Similarly, other PIDS studies such as those on trade liberalization and other aspects were based on the I-O table.

The major data-related problem of researchers doing very specific sectoral research on the I-O is that their preferred sectors may not be well-represented in the sample, thereby rendering sectoral estimates as not very reliable. The reliability issue also crops up in the breakdown of production costs. However, since there are no readily-accessible mechanisms for validating respondents' answers, researchers have no option but to use whatever data is available. The long data-processing time of the *ASE* has also been a problem for the I-O researchers.

Factors affecting the demand for health services, on the other hand, are studied by analyzing regional socioeconomic indicators using regression techniques. Program interventions are thus proposed on a regional level basis. Other health policies are formulated by delving into administrative records of the Department of Health (DOH). This situation also applies to fiscal policy and education related studies of the PIDS. Policy issues regarding the households, however, are examined using household models and data from the *FIES* and *LFS*.

Other micro-level studies also employed household models and household level data derived from PIDS-sponsored surveys and from NSO's *FIES* and *LFS*. Apart from household surveys, projects like the Dynamics of Rural Development research of the PIDS also conducted firm-level surveys on purposively-selected regions of the country. Similarly, environment-related studies employed results from their own household surveys. Another PIDS project, the Micro Impacts of Macroeconomic Adjustment Policies (MIMAP), proposes to use a monitoring system to collect data that are not generated by NSO and BAS.

3. Issues Arising from the Use of Data and Statistical Techniques

This section discusses in the length some of the problems regarding the major surveys mentioned in the previous section. There are six major issues identified, namely: (a) unreliable data, (b) data not available at the desired level of aggregation, (c) long data-processing periods, (d) technical issues on the estimation process, (e) technical issues on the data collection process, and (f) accessibility of data.

- **Unreliable data**

A 1989 PIDS-NSCB Seminar-Workshop Series on Agricultural Statistics participated by senior and technical officials of government agencies and representatives from the private sector, pinpointed (a) the following major problems in using agriculture data: inconsistency of data due to non uniformity of concepts/terminologies and methodology, and duplication of

activities; (b) uncoordinated data gathering; and (c) unreliability of data due to non-maintenance of records and weakness in memory recall among respondents.[1]

The unreliability of data issue was also raised by Mendoza (1992) and Reyes (1992) on the results of the *ASE*, by Herrin (1992) on DOH administrative records, and by others doing household modeling and cross-tabulations on the *FIES* and *LFS*. Their common concern is founded on the inconsistent results they usually encounter in data analysis. Their common solution to this problem is to throw out the suspect observations.

David and Mendoza (1990) also noted that the BAS produces subjective estimates for coconut production with unknown accuracy. Further analysis on these estimates showed inconsistent results. This situation was attributed to the non-probability sampling design employed in the data collection. In the Workshop on the Quality of Basic Data sponsored by the Philippine Statistical Association (PSA) last year, it was gathered that this observation is also true for *other crops* production data from the BAS.

Since sampling errors, even for the most important characteristics of interest, are not at all published, there is really no objective gauge that can be used in determining the level of precision of estimates resulting from surveys[2]. Since probability surveys like the *RCS, FIES, NNS* and *LFS* are multipurpose and therefore have numerous variables and since data from these surveys are also presented in different levels of disaggregation and cross-classes, sampling error computations are very cumbersome and difficult. For non-probability surveys like the DOH Expanded Programme for Immunization (EPI) and BAS's *other crops* survey, sampling error computation is not at all technically feasible.

Since surveys do not have built-in mechanisms by which biases arising from non-sampling errors can be tracked down, the accuracy of estimates can only be evaluated through anecdotal evidence. For example, during the agricultural pilot survey conducted by the author through the sponsorship of the PSA - USAID Statistical Development and Analysis in Support of the Agribusiness Sector project, non-sampling errors were observed and determined to be the major cause of unreliable estimates. The sources of non-sampling errors in this survey are the interviewers' inability to follow simple directions, the enumerator's neglect of using the questionnaire in the interviewing process, the supervisor's use of his judgment to replace sampled parcels, non-response and weak memory recall. Unfortunately, these occurrences are not unique to this survey. During informal discussions

[1] Other problems include the dearth of data at the subregional levels delay in processing of data and ineffective data dissemination.

[2] In general, the reliability of an estimate is measured by its mean square error, MSE(), which has two components -- the variance, Var() and the square of its Bias(). The sampling error which is actually the root of Var() measures the precision of the estimator while the bias gives the indication of how far off the estimator, on the average is from its true value. Non-sampling error is one source of bias.

with NSO and BAS personnel involved in field operations, they openly admit that such situations perennially happen. Unfortunately, there is no procedure that allows the estimation of the biases arising from these errors.

- **Data not available at the desired level of disaggregation**

Although the *LFS* and *FIES* are designed with provinces *x* urban/rural areas as domains, estimates from these surveys are usually published only at the regional and national levels. Unreliable estimates and the voluminous data tabulations at the sub-regional level are perhaps the reasons for such decision. However, with the devolution of the national government's responsibilities to the local government units (LGUs), there is also a significant increase in the demand for data at these levels for planning and policy research purposes. For example, health projects require indicators at the provincial level so that the DOH can determine the areas wherein it will introduce program interventions. Decision-makers of the LGUs also need data to formulate plans and program activities. On research issues, meanwhile, Lamberte (1994) pointed out that their research on decentralization would have been further enhanced by analysis at the provincial level. He cited that their cost-benefit analyses were done on a regional level basis. Yet, he recognized that a dam, for example, would also benefit adjoining provinces that are not within the region.

Policy researchers sometimes isolate their studies to specific sectors or sub-classes of the data. For instance, Reyes (1994) required finer disaggregation of the *ASE* to generate the agribusiness sector I-O. Unfortunately, the distribution of the sampled establishments in her desired sectors was sparse. Thus, the estimates may have large variances.

- **Long data processing periods**

Researchers and planners often have to wait for a long time for the results of surveys to be published or be accessible in any form. For example, the results of the 1991 *CAF* have not yet been published at this time. The publication lag times of major surveys have been noted by Virola (1993). Usually, this situation occurs because of the long data processing period after the conduct of the survey. Reyes (1994) noted that because of the long data processing period of the *ASE*, revisions of the national income accounts are done several times which disrupt their macroeconomic modeling activities. Other researchers think that their researchwork could have had more impact had they been able to obtain timely data.

- **Technical issues on the estimation process**

David, et al. (1990) pointed out that corn estimates[3] derived from BAS' *RCS* were biased because the estimator used a chain ratio type with a built-in adjustment factor that was applicable only in the 1970s. Because of this factor, the official corn estimates (BAS) deviate widely from the Census estimates. The differences are worse at the provincial and regional levels.

Estimates derived from the *ASE* may also be biased because of the censoring done in the design process. The imposition of a limit on the number of sampled elements per stratum and the unknown stratum size support the claim that the designated survey weights may not be appropriate at all.

Major surveys like the *ASE, FIES, LFS* and *RCS* do not also incorporate weights to compensate for non-response nor do they offer adjustment procedures. Thus, when researchers decide to throw out suspect data, the estimation procedure is not altered to reflect the reduction in the respondent size. Because of this imbalance, the estimates generated may be biased and therefore may not be acceptable especially if the bias is unestimable.

David, et al. (1990) also noted that estimates may be greatly biased because of the obsolete sampling frame. Usually, the decennial censuses conducted by the NSO are used as sampling frames. If there are no mechanisms, like the updating of household listing in sampled *psus* to update these frames after several years of use, certainly, the weights of estimators could become erroneous.

- **Technical issues on the data collection process**

Most of our surveys rely heavily on the interview method with no astringent rules on the eligible respondent. In fact, any member of the household or sometimes a neighbor or somebody knowledgeable about the household may be interviewed. This method raises some doubts on the quality of the measurements collected. Problems like weak memory recall, inaccurate information from an unknowledgeable respondent and ineffective interviewing method may arise.

It is also often the case that interviewers are hired on a temporary basis and thus do not have the opportunity to develop their interviewing skills. In a pilot agricultural crops production survey conducted by the author in Laguna, the casual data collectors (CDCs) often hired by the BAS for their surveys were compared to Statistics undergraduate students of the

[3] Their paper was written based on the design of the *Rice and Corn Survey* prior to the present one. The author did not have the opportunity to scrutinize the estimation procedure of the present design.

University of the Philippines at Los Baños (UPLB) who have no prior interviewing experience. The results of their training evaluations showed that UPLB students followed directions and were able to accomplish mapping and interviewing activities better than the BAS' CDCs. In the actual field operations, the CDCs were observed to be less motivated to perform better. Oftentimes, they did not follow the enumerator's manual.

- **Accessibility of data**

Another problem of researchers and policy makers is how to access the data they need. The NSO and NSCB have greatly improved their services. In addition to its publications, NSO offers data access via its Electronic Bulletin Board (EBB), various automated databases and diskette-hand-off through special tabulation requests. The NSCB, on the other hand, has a one-stop shop in its headquarters where users can access PC-AXIS, a software developed by Statistics Sweden that stores and retrieves time series data.[4]

However, there are still gaps in providing researchers with analysis-ready data. For instance, the PIDS-DRD project requested the NSO for several summary datasets from the *CPH* in raw data format. The files given to the researchers however were in table format. Likewise instead of barangay, municipality and provincial codes being included as requested, only their corresponding names were piled in one column. To be able to analyze these files, several programs had to be written to take off the special characters caused by table formatting, to disentangle the names of barangays from municipalities and later on from the provinces, and lastly, to incorporate the numeric codes needed for analytical purposes. These steps certainly doubled the allocated time for data analysis. Unfortunately, this seems to be a common occurrence whenever the PIDS requests data in analysis-ready format from the NSO.

4. Areas for Basic Research and Training

On the basis of the above discussions, the statistical processes most often used in policy research and planning revolve around survey sampling methods. At present, this is also the field of statistics most often applied in the Philippine Statistical System. Instruction and research on this field, however, have not been given commensurate attention. At the Institute of Mathematical Sciences and Physics (IMSP) of the University of the Philippines at Los Baños (UPLB), only four credit hours are allocated to survey sampling and operations in the undergraduate level. A three-credit hour course in survey sampling theory is offered in the master's and Ph. D. level. This situation is similar to the Statistical Center at the University of the Philippines in Diliman (UP Diliman).

[4] These information have been disseminated via newspapers and magazines.

The review of the past proceedings of the annual statistical research and training conferences sponsored by the Statistical Research and Training Center (SRTC) showed that survey sampling methods were not investigated equitably. Although there were successful attempts to study survey sampling methodology, the direction of research seems to be vague. While research in survey sampling methods has progressed immensely abroad, only a few new techniques and results have been introduced in the Philippine Statistical System. Perhaps this could be attributed to the lack of available materials for such endeavors. International publications on survey sampling methods in bookstores are almost non-existent while local books are only few and not-readily accessible. The libraries of the SRTC, Statistical Center in UP Diliman and IMPS in UPLB likewise do not subscribe to the *Journal of Official Statistics* published by Statistics Sweden, or to Statistics Canada's *Survey Methodology* or to the American Statistical Association's Proceedings of *Survey Methodology Session*. These publications are the rich sources of information regarding survey sampling methods.

With the advent of **Internet** -- a global network of computer networks -- in the Philippines, however, the problem of unavailability of research materials may be solved. With electronic mail that can be sent almost anywhere in the world and survey news groups, correspondence with other survey practitioners and researchers may be facilitated. Access to research and other technical papers may be also facilitated by automated indexing system and public domain files on the **Internet**. With such, statistical research, in general, will flourish.

5. Recommedations

In this regard, I recommend the following areas of survey sampling methods for future research and training purposes are being recommended:

- **Variance Estimation for Complex Surveys**

The most known scandal among survey practitioners in the Philippines is the non-computation of sampling error. Even the national surveys such as *LFS, FIES* and *RCS* do not publish them. Without this measure, however, there is no other objective gauge of reliability. It is a prudent move for a sampling statistician to include the computations of sampling errors, even only for the most important characteristics of interest, in the data processing plan. In addition to providing the reliability measures of surveys, these sampling errors can be used in planning for the next similar survey.

There are very solid developments abroad in this area. In fact, Wolter (1985) summarized these in his book. With the advent of powerful but very accessible computers, variance estimation methods may readily be applied to our surveys. There are also computer softwares that were developed for this purpose. Some of them are the Sampling Error for Survey Data and Analysis (SESUDAAN) by the Research

Triangle Institute, OSIRIS by the University of Michigan, PC Supercarp by Iowa State University and PROC WESVAR by Westat.

- **Small Area Estimation**

This area is needed the most in the decentralization process of the government. At the same time, this field of study may be used in sectoral estimation for macroeconometric and other econometric models. Because of cost concerns, national surveys cannot be designed to provide estimates at the finer disaggregation levels needed by the LGUs and modelers. However, there are existing statistical techniques that may be used to produce such estimates. The book entitled *Small Area Statistics* edited by R. Platek, C. E. Särndal and M.P. Singh summarized major research results in this area.

The Division of Statistics and Statistical Laboratory (DSSL) of UPLB has proposed to use structure preserving estimation (SPREE) to provide provincial estimates of the *1993 National Demographic Survey* data. There were also attempts to use SPREE by NSO to provide sectoral estimates of the *ASE* results.

- **Inference from Complex Surveys**

To minimize costs, policy researchers are known to use national surveys like the *ASE*, *FIES* and *LFS* that were designed only for enumerative purposes in their analysis. Because most statistical inference methods are founded on the assumption that observations were drawn using simple random sampling and therefore have identical and independent distributions, analytical results from complex surveys may be suspect. Studies on the use of complex survey data for statistical inference have been going on since 1974 when Kish and Frankel compared the results of subclass means and regression coefficients from simple random sampling, stratified and cluster sampling surveys. They concluded that an increase in variance brought about by the complexity of survey design is often severe. Holt et al. (1980) showed that the effect of correlations among sampled elements is severe for tests of goodness-of-fit or homogeneity but less severe for tests of independence. In another study, they found that least squares methods that ignore the clustering or stratification structure of the dataset can give seriously misleading results.

Techniques for analysis of survey data have been proposed by Särndal (1980, 1982), Binder (1983), Bethlehem and Keller (1987), and others. Unfortunately, these have not been studied in the local setting nor have been made known to policy researchers doing modeling and using other analytical techniques.

- **Total Design Method (TDM) for Surveys**

Because survey design is one of the most critical requirements of achieving quality results, this area should also be investigated. In addition to advances in sampling theory and techniques, total design method (TDM) should be explored. TDM consists of two parts -- (1) designing and determining every aspect of the survey process so that the overall response rate can be optimized, and (2) coordinating the survey effort to assure that the design objectives are carried out in complete detail. Therefore, studies on TDM should include the search for more efficient data processing techniques, better data collection strategies, comprehensive and timely sampling frames and improved survey designs, among others.

Training of local survey practitioners and other interested statisticians on this method has been proposed to the SRTC by the DSSL. However, this is a rather short-term solution. In the future, a facility that can offer this type of training regularly to professionals as well as serve as the venue where professionals can discuss current methodology and share research results should be established. SRTC seems to be the most logical choice for this type of activity.

- **Control of Non-sampling Errors**

Studies on designing questionnaires, interviewing, monitoring and mapping techniques and other methods of data collection should be further investigated to control non-sampling errors. Usually, these studies are done by multi-disciplinary teams. At the Survey Research Center of the University of Michigan, questionnaire design researches are often joint ventures of statisticians, psychologists, sociologists and political scientists.

The voluminous research results on this area abroad, however, may not be applicable here because of the differences in culture, habits and other aspects of the survey population.

- **Monitoring Systems**

Apart from surveys, other methods of data collection should be investigated. Gironella et al. (1992) explored the establishment of a statistical structure at the grassroots level. Unfortunately, there were no follow-up studies to this very good beginning. This may be a very viable option. If barangay residents can be convinced to collect data for their own planning purposes and the mechanisms to build such capabilities and organization can be studied, then perhaps data collection in the Philippines may be facilitated. However, the initial costs of establishing such structure which is often referred to as a monitoring system can be very expensive.

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